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INTERBANK LIQUIDITY AND SHORT-TERM YIELDS IN AN EMERGING MARKET ECONOMY – THE EXPERIENCE OF HUNGARY IN 2016–2020

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Abstract

Liquidity has an impact on short-term yields, which makes it a key determinant of monetary transmission. The aim of the research was to examine how the increase in the banking system's liquidity and its distribution within the banking system affects yields. To better understand this relationship, this analysis gives an econometric estimate of the interbank liquidity demand function. The research covers Hungary being a representative of small, open, emerging market economies. The analysis is based on segmented regressions, the study covers the period 2016–2020 regarding overnight interest rates. The slope of the demand function is negative, the coefficients decrease with the increase in excess reserves. The most significant breakpoints of the demand curve are detected around 0.83% and 1.53% of M2 in excess liquidity. There is a correlation between the level of excess reserves and its distribution and concentration. The distribution of liquidity became more balanced along with the increase in excess liquidity. The saturation of the banking system depends on the concentration of liquidity among banks. The results can be useful for other small and open emerging market economies with abundant liquidity, especially in the coming tightening cycle.

Keywords liquidity, monetary policy, reserves, money demand

JEL Classification E41, E44, E47, E52

INTRODUCTION[1]

Over the past decade, the amount of central banks' liquidity has risen significantly worldwide, making liquidity a key determinant of monetary transmission and drawing attention to the market for liquidity. The 2008 economic crisis showed that the 'disappearance' of liquidity can jeopardize the stability of the financial system and thus drive economic growth down from its potential, while with the return of inflation after 2020, central banks had to start tightening monetary conditions worldwide, which made also important and reasonable to strive for a fuller understanding and functioning of the market for liquidity.

Liquidity management became a crucial factor in the practice of central banks and monetary policy. After the Great Financial Crisis (GFC) of 2008, the quantity of liquidity as a monetary policy variable has become important, drawing attention to the liquidity market. The GFC showed that the "disappearance" of liquidity has the potential to threaten the stability of the financial system and thus to drive economic growth away from its potential, which means that it is appropriate to seek to understand the liquidity market as fully as possible, to ensure that it works. As the supply of liquidity – which is determined

1 This study contains the authors' views. This study analyzes the period from 2016 to 2020, so its findings can only be applied to that period.

by central banks – is infinitely inelastic by nature, this is the shape of the liquidity demand function, which determines the yields in the interbank market. For that reason, effective monetary policy implementation assumes and presupposes to know the characteristics of the liquidity demand function.

This paper investigates how the modification of the banking system's liquidity and its distribution within the banking system affects yields and how the saturation of the banking system depends on the concentration of liquidity among banks.

1. LITERATURE REVIEW

Despite the already relevant practical importance of liquidity management concerning monetary transmission and implementation, the related scientific literature about the impact of liquidity on yields is still developing.

According to Nikolaou (2009), three concepts of liquidity can be distinguished. On the one hand, one can speak of "central bank liquidity", which refers to the central bank's 'ability' to provide financial central bank's ability to meet the central bank's money needs of the financial sector. On rules concerning liquidity requirements, see Hoerova et al. (2018). On the other hand, there is "funding liquidity", which is the ability of banks to meet their payment obligations in a timely manner and to obtain funding (central bank money) at short notice, for example through the sale of their securities. Thirdly, we can talk about "market liquidity", which is a market condition where there is the possibility to sell an asset within a short period of time, at low cost and with minimal price impact. In this study, the term "liquidity" is used to refer to the central bank liquidity.

One of the main features of central banks' crisis management (concerning the traditional approach of central banks' role in crisis management see Bagehot (1873)), which has renewed economic thinking, is that central banks, once they have reached the lower interest rate bound on policy rates, have begun to use tools at levels unprecedented before the crisis. Romero (2015) outlines that Emerging liquidity shortages and the constraints of conventional interest rate policy led to quantitative easing (QE) at most major central banks, which meant a significant expansion of the central bank's price determination. On the expansion of the role of central banks, see Borio and Drehmann (2009), Blanchard (2012), and Blanchard and Summers (2019). Excess liquidity in the central bank's balance sheet had an impact on the functioning of financial markets[2], and in the short term, the key interest rate approached the central bank deposit rate, which designated the bottom of the interest rate corridor[3] (Goodhart, 2008; Bech & Klee, 2009; Rule, 2015).

As not only the central bank's marginal prices, but also the available amount of liquidity may have a significant impact on money market yields, the monetary policy significance of the market for liquidity has increased with the transformation of central banking. Analyzing the period before the quantitative easing programs, Bindseil et al. (2009) looked primarily at the specific banking and banking system characteristics that determine how much banks are willing to pay for liquidity at a given overall liquidity level. Their main conclusion was that the informal efficiency of the liquidity market was high and that the increase in interbank yield volatility did not lead to more aggressive pricing. According to Ouyang et al. (2022), the nature of volatility is of crucial importance, which can cause potential spillover effects.

Fecht et al. (2010) also examined the pre-crisis period and, based on German individual banking data from 2000 to 2001, concluded that frictions characterized the market for liquidity and that the price paid by banks for liquidity reflected both bank-specific and market-specific factors. The research focuses on the pre-crisis period, and, in particular, Nyborg and Strebulaev (2004) hypothesize that the distribution of liquidity among

2 Concerning the lesson of the great financial crisis on interbank market and its efficiency in allocating funds see Freixas et al. (2011).

3 Interbank interest rates are also influenced by central bank credibility, inflation and interest rate as well as exchange rate expectations.

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banks has a significant impact on price, i.e., the more extreme the distribution, the narrower is the market, where banks facing liquidity shortages are increasingly exposed to the supply of banks with long liquidity positions. According to the results, the price of liquidity systematically depends not only on individual banking conditions but also on market structures[4] and conditions: the more significant the heterogeneity in the distribution of liquidity, the more banks may appear on the demand side, which is consistent with higher prices.

Based on the experience of quantitative easing programs, Reis (2016) focused on how the increase in total banking system liquidity affects yields on the one hand and, of course, not independently of the former, the distribution of liquidity within the banking system. Reis's reasoning is based on the relative price of liquidity, meaning that as liquidity increases in the banking system, money market yields fall, which in relative terms makes central bank deposits more attractive than providing liquidity. Perfect flexibility is represented by the saturation phase calculated from the saturation point: prices no longer fall as supply increases; the equilibrium price approaches the bottom of the interest rate corridor.[5] Reis (2016) estimates that the US market for liquidity demand curve will become horizontal at around USD 1,000 billion. Reis concludes that with the significant increase in liquidity, many banks started to hold more central bank money than they would have needed due to the regulatory environment (reserve rules, liquidity rules). This means that with the overall increase in liquidity, more and more banks are opting to increase their central bank deposits, suggesting that more and more banks are entering the horizontal phase of their own liquidity demand function.

Afonso et al. (2019) analyze how the level of aggregate reserves affects trading in the Fed funds market and conclude that it depends on two factors: (1) the aggregate size of reserve balances, and (2) the distribution of reserves. The authors conclude that the distribution of excess reserves can shape the market, independently of the supply of reserves. The effective Fed funds rate increases above the IOR rate when reserves are around USD 800 billion. With highly concentrated reserves, the EFFR intersects the IOR rate at around USD 1,000 billion in aggregate reserves. In contrast, when the concentration is low, the EFFR reaches IOR at a lower level, according to the estimate of the authors at around USD 500 billion.

In accordance with Chang et al. (2014), Coeuré (2019) arrives to the following conclusion:

Liquidity supply may have become less elastic in both the euro area and the United States, for different reasons though: in the United States because of high concentration among banks, in the euro area because of fragmentation across countries (p. 9).

According to Ennis and Wolman (2015), "(…) reserves were widely distributed across banks and appeared to get relatively more concentrated in large banks only during periods of high growth (…) when the total level of reserves stabilized for some time, reserves became more evenly distributed among institutions" (p. 33). According to Baldo et al. (2017), "the excess liquidity holdings were found to be concentrated in specific countries and banks in a persistent way over time (…) the concentration of excess liquidity is determined by a combination of factors, while their individual relevance has changed over time" (p. 41). The authors conclude that at the bank level, the most important factor influencing the liquidity held is "the bank business model and the related liquidity management strategy, followed by regulatory requirements and risk management policies" (p. 42).

The purpose of this study is to determine the relationship between liquidity and short-term yields with the outline of the liquidity demand function of the Hungarian banking system, applying Reis's (2016) approach on Hungarian data. The hypotheses of the study are the following:

H1: *The slope of the liquidity demand function is negative, the coefficients decrease with the increase in excess reserves, with potential breakpoints.*

4 Concerning the structure of the interbank market see: Craig et al (2015), Castiglionesi and Eboli (2018), Denbee et al. (2021).

5 As Reis (2016) puts it, the price and the amount of central bank reserves have become two separate regulatory instruments.

H2: *The liquidity increases make the distribution of liquidity more balanced, thereby reducing the price of liquidity and reducing interbank market flows, indicating that banks are more inclined to hold a portion of their liquid assets in central bank deposits due to a decline in interest rates on alternative assets and liquidity trading.*

At the end of the analysis, the results concerning the Hungarian banking sector are put into an international context. As data are available only for the US, the Hungarian and the US banking sector is compared, with an emphasis on the difference in the distribution of excess liquidity around saturation levels.

2. METHOD

Below the data used to estimate the aggregate liquidity demand function of the Hungarian banking system and the methodology applied to estimate it are described.[6] Most of the data used are public and available on the Magyar Nemzeti Bank's (Central Bank of Hungary, from now on MNB) website (one-day outstanding volumes, interbank liquidity market HUFONIA rates and turnover, Hungarian money market fixings – BUBOR). Non-public individual bank data were obtained from the MNB and used only for calculating anonym concentration ratios.

- **The examined period:** The period between November 15, 2016 and February 28, 2020, because MNB monetary policy operation framework used a targeted floor system[7] driving excess liquidity into an end-of-day instrument (overnight deposits) priced to the bottom of the interest rate corridor.
- **Examined banks:** 37 banks belonging to the monetary policy counterparties of MNB – this is the total number of credit institutions in Hungary with required reserves and access to MNB's balance sheet and monetary policy instruments.
- **Net excess liquidity (excess reserves):** the daily value of overnight (from now on O/N) deposits less O/N central bank loans and same-day O/N repos of the Debt Management Agency (ÁKK) as a lender of near-last resort. The O/N deposit data are end-of-day[8] and business day data. Nominal values are used in the analysis, but for international comparison, GDP proportionate, as well as the ratios taken with banking sector total assets and M2 monetary aggregate data are used.
- **Evenness of liquidity distribution:**[9]
  - The number of banks placing at least HUF 1 billion O/N deposits at the end of the day at the MNB.[10]
  - Calculation of the Herfindahl–Hirschman index for the concentration of excess liquidity.
- **Relative price:** The opportunity cost of depositing central bank liquidity, i.e. the difference between the interbank one-day depo market transaction volume-weighted interest rates (HUFONIA) and the O/N deposit rate (floor of the interest rate corridor).

In this study, based on Kolozsi and Horváth (2019), the sample included 826 observations (Table 1). The HUFONIA interest rates and the related total HUFONIA daily turnover are synchronized to the available excess liquidity data (net O/N deposit

6 The domestic antecedent of this estimation includes Erhart (2004), who explained the position of the O/N interbank interest rate within the interest corridor with net O/N deposits and the average free reserve, using a logistic function, and Csávás and Kollarik (2016), who analysed the relationship between the net O/N deposit and the relative HUFONIA with a logistics function, by examining the Hungarian self-financing program from 2014.

7 Concerning the conceptual pillars of Hungarian economic policy see Matolcsy (2015); concerning the monetary policy framework in Hungary see Lehmann et al. (ed.) (2017), Matolcsy and Palotai (2016).

8 As the MNB charges penalty interest on excess reserves, it is not in the banks' interest to maintain a higher balance on their reserve accounts than the mandatory monthly average, and although this occurs, it was not typical during the study period, so it was excluded from the analysis.

9 Gross end-of-day values were calculated to qualitatively evaluate asset usage and to map non-aggregated demand conditions.

10 This definition does not exactly match the definition used in the article by Fecht et al. (2010), which defined the distribution unevenness by the standard deviation of net excess liquidity before the individual bank auction. However, the conclusions drawn from the two different definitions are comparable.

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instrument outstandings). End of quarter observations sometimes showed significant deviations from the values observed on neighboring days due to balance sheet arrangements by foreign banks and clientele. Outlier days were not eliminated though, instead an average of rates was input from neighboring days.

Table 1. Descriptive statistics of excess liquidity and its relative price

Indicator	Excess liquidity	Relative price
Mean	476.2798	0.128332
Median	445.0151	0.112000
Maximum	1325.097	0.628000
Minimum	–165.9500	0.009000
Std. dev	266.0458	0.063003
Skewness	0.344879	2.696873
Kurtosis	2.789461	15.02155
Jarque-Bera	17.89985	5975.086
Probability	0.000130	0.000000
Observations	826	826

To estimate segmented OLS for cross-sectional data, EViews 11 sequential determination is used based on Bai (1997) and Bai and Perron (2003). The procedure involves sequential application of breakpoint tests. It goes by a first breakpoint test on full sample and perform a test of parameter constancy with an unknown break. Wherever a subsample null is rejected, it adds a breakpoint. Iterating the procedure until all the subsamples do not reject the null hypothesis, while performing refinement so that breakpoints are re-estimated if they were obtained from a subsample containing more than one break, gives the breakpoint estimation the same limiting distribution as obtained from global optimization. A maximum number of 5 breakpoints are given leeway for. As a pooled dataset is used, observations are ordered not by date but by increasing net liquidity supply. This way breakpoints given by observations are easily matched with the saturation levels in question. As the aggregate supply of central bank liquidity is given for all dates, the paired observations of relative price of excess liquidity depicts the aggregate liquidity demand by banks as Figure 1 shows theoretically.

Bank-level data was used to identify liquidity concentration in the Hungarian banking system, using the conventional Herfindahl-Hirschman index and top shares by banks with central bank deposits, as well as the number of banks with at least a significant HUF 1 bln of central bank deposits.

3. RESULTS

The non-breaking linear liquidity demand function of the Hungarian banking system is outlined from daily data (Figure 1) serving as a benchmark

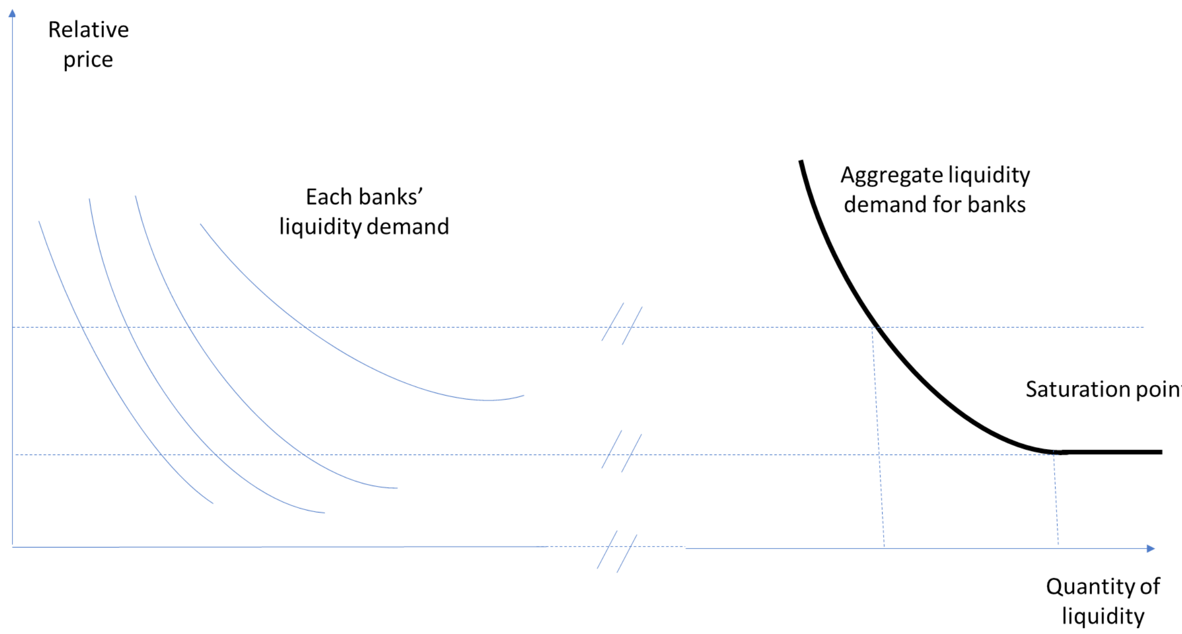
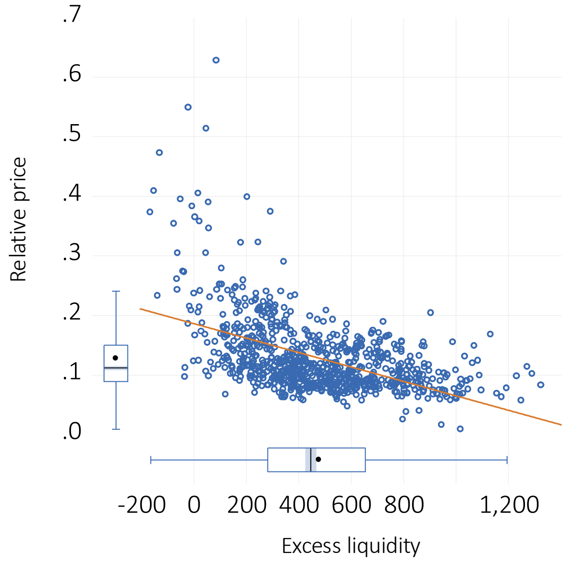


Figure 1. Theoretical derivation of the aggregate liquidity demand



Note: Above the axis, box plots of descriptive stats can be found.

Figure 2. Relative price of liquidity subject to net excess liquidity

equation with an $R^2 = 26.12\%$ and a significantly negative coefficient (t-statistic: –17.07). This is derived from a simple undated scatter, in which the daily relative price of liquidity was assigned to the end-of-day net excess liquidity values.

Subsequently, it is investigated where the liquidity saturation point of the Hungarian banking system could be based on the Hungarian data (Figure 2). To determine the saturation point(s), it is necessary to estimate from what point the slope of the liquidity demand curve can be considered as 'infinitely elastic', i.e. above what level of excess liquidity it is true that the slope of the aggregate demand curve is not significantly different from zero. To answer the above question, the above demand function was segmented according to different levels of excess reserves to improve the fit of the structured regression using Bai-Perron's sequential segmentation model with a 15 percent trimming level and only 1 per cent of significance level.

As Table 2 shows, Bai-Perron tests first found a saturation point at Obs.274 (net liquidity level of HUF 344 bln), but repartitioning yielded two significant breakpoints at Obs.150 (level of 230 bln)

Table 2. Sequential segmentation of net aggregate demand for liquidity in Hungary

Multiple breakpoint tests			
Bai-Perron tests of L+1 vs. L sequentially determined breaks			
Date: 08/18/21 Time: 13:30			
Sample: 1 826			
Included observations: 826			
Breaking variables: C ONREPO			
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.01			
Sequential F-statistic determined breaks: 2			
Break Test	**F-statistic**	**Scaled F-statistic**	**Critical Value****
0 vs. 1 *	81.72615	163.4523	15.37
1 vs. 2 *	11.07539	22.15079	16.84
2 vs. 3	2.238004	4.476008	17.72
Break dates	**Sequential**	**Repartition**	**–**
1	274	150	–
2	150	390	–

Note: * Significant at the 0.01 level; ** Bai-Perron (2003) critical values.

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Table 3. Segmented regression output of relative price subject to net excess liquidity

Dependent variable: PRIXREL				
Method: Least Squares with Breaks				
Date: 08/18/21 Time: 13:36				
Sample: 1 826				
Included observations: 826				
Break type: Bai–Perron tests of L+1 vs. L sequentially determined breaks				
Breaks: 150, 390				
Selection: Trimming 0.15, Sig. level 0.01				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
1-149 – 149 obs				
C	0.256649	0.006556	39.14742	0.0000
ONREPO	–0.000545	4.38E–05	–12.45034	0.0000
150-389 – 240 obs				
C	0.242816	0.018886	12.85679	0.0000
ONREPO	–0.000336	5.60E–05	–5.997732	0.0000
390-826 – 437 obs				
C	0.133020	0.008930	14.89509	0.0000
ONREPO	–4.12E–05	1.27E–05	–3.239242	0.0012
R-squared	0.403428	Mean dependent variable		0.128332
Adjusted R-squared	0.399791	S.D. dependent variable		0.063003
S.E. of regression	0.048811	Akaike info criterion		–3.194495
Sum squared resid	1.953641	Schwarz criterion		–3.160234
Log likelihood	1325.326	Hannan–Quinn criterion		–3.181353
F-statistic	110.9040	Durbin–Watson stat		2.121478
Prob. (F-statistic)	0.000000		–	

and Obs.390 (level of 421.7bln). The corresponding regression output with implementing the break-points regime shows significant improvement in the explanatory power of the model, with gradually decreasing significant coefficients regarding the price effect of aggregate liquidity supply levels in the demand function (Table 3).

When evaluating Hungarian data, the number of banks with O/N deposits of at least HUF 1 billion were used, as the correlation index was the highest among the concentration ratios. The number of banks with O/N deposits of at least HUF 1 billion only slightly explained the evolution of the relative price of liquidity (R^2 = 17.32%), but in its

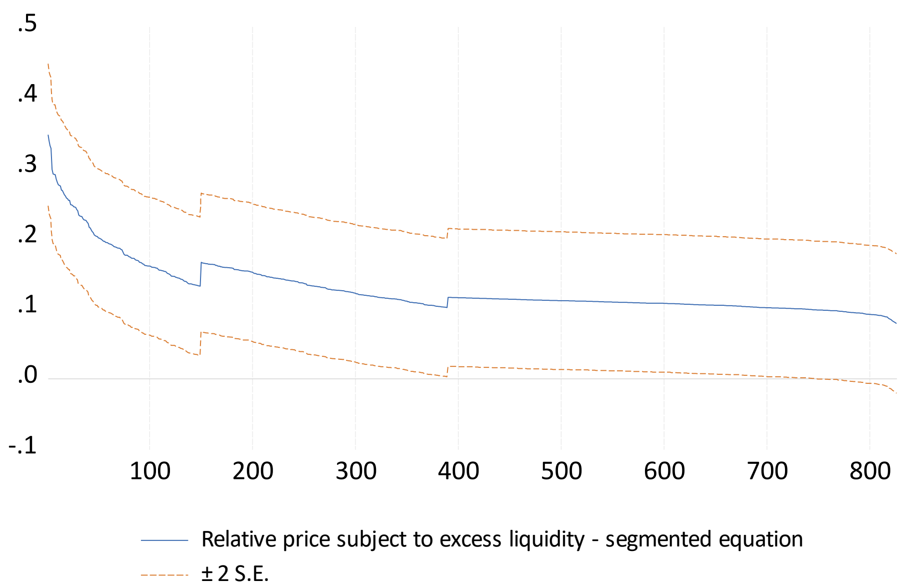
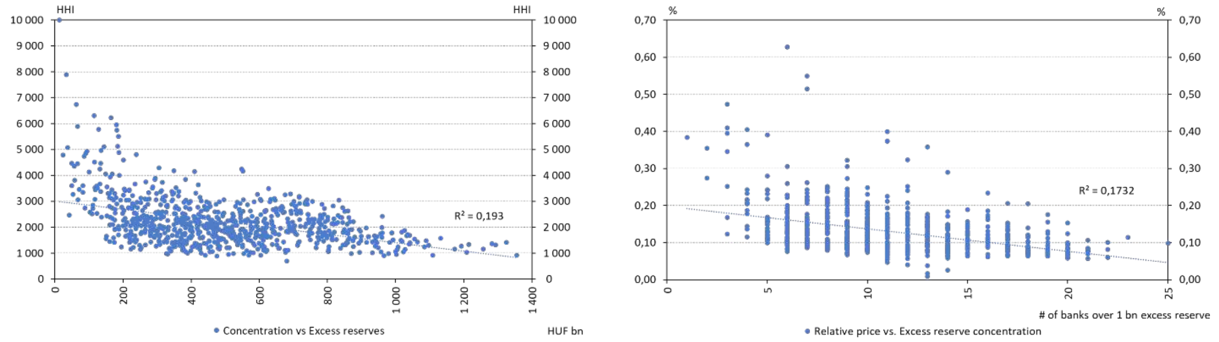


Figure 3. The segmented liquidity demand function of the Hungarian banking system



Note: Herfindahl-Hirschman index for the concentration of excess liquidity and number of banks placing at least HUF 1 billion O/N deposits at the end of the day.

Figure 4. Evolution of the relative price of liquidity subject to the concentration of excess reserves

orientation, the linear estimator gave a coefficient with an appropriate prefix, and the coefficient was significant. However, it is also evident that high relative prices can only be encountered when liquidity is concentrated at relatively few banks (for example, relative prices above 40 basis points were only observed on days when less than ten banks had O/N deposits) (Figure 4).

Results van be summarized in a context ready for international comparison (Table 4).

Internationally comparable data are rarely accessible, but in case of the US, different estimates concerning the saturation point are available. For that reason, a comparison of the Hungarian and US data are made.

According to Afonso et al. (2019), the saturation point depends on the concentration of reserves: if reserves are highly concentrated, the saturation point will be higher. In contrast, if reserves are more evenly distributed across banks, less aggregate reserves are necessary for the banking sector to get saturated with liquidity. One possibility to test this hypothesis can be the comparison of different banking sectors with different concentration patterns. According to

Table 4. Comparable statistics of the Hungarian aggregate liquidity demand curve

Excess reserves (nominal)	Excess reserves/ GDP (2019)	Excess reserves/ BS total of the banking sector (01.01.2020)	Excess reserves/ M2 (Dec. 2019)	Steepness	T-statistics
Up to HUF 230 bln	0.48%	0.53%	0.83%	–5.5 basis points/ HUF 100 bln	–12.45
HUF 230-422 bln	0.48%-0.89%	0.53%-0.98%	0.83%-1.53%	–3.4 basis points/ HUF 100 bln	–5.99
From HUF 422 bln	0.89%	0.98%	1.53%	–0.41 basis points/ HUF 100 bln	–3.24

Table 5. Comparative data of the Hungarian and the US banking system and market for liquidity

Indicator	Hungary	US
Number of depository institutions	37	5,500
GDP (2019)	HUF 47,514 bln	USD 21,430 bln
BS total of the banking sector (2020.01.01)	HUF 43,250 bln	USD 17,750 bln
M2 monetary aggregate (Dec. 2019)	HUF 27,609 bln	USD 15,346 bln
Saturation of excess liquidity, nominal value in local currency	HUF 422 bln	USD 1,000 bln (Reis, 2016) USD 800 bln (Afonso et al., 2019)
Saturation of excess liquidity, compared to GDP	0.89%	4.6% 3.7%
Saturation of excess liquidity, compared to BS total of the banking sector	0.98%	5.6% 4.5%
Saturation of excess liquidity, compared to M2	1.53%	6.5% 5.2%

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Reis (2016), the saturation point in the US banking system is 1,000 bln USD, which can be compared to the Hungarian data. The causes of the difference in the concentration patterns are not examined, but it was tested whether a banking sector with a higher concentration of excess reserves is associated with higher liquidity saturation. For US data, statistics available in the related literature are used, for Hungary, the data of the Central Bank of Hungary is used concerning the period 2016–2020 (Table 5).

4. DISCUSSION

The results of the study show that the slope of the liquidity demand function of the Hungarian banking sector is negative, and the coefficients of the curve decrease with the increase in excess reserves. Segmentation significantly improved the explanatory power of the model (adjusted R^2 = 40%), compared to the linear approach taken as a benchmark. The most significant breakpoints were around HUF 230 billion (0.83% of M2) and HUF 422 billion (1.53% of M2) of deposited interbank liquidity. The related slopes are all significantly negative and show a downward trend in magnitude, with the t-statistic of the last segment close to the rejection limit, which, in the present analysis, allows it to be defined as the real saturation point. The results of the robustness tests (different breakpoint specifications) outlined the applicability of the estimate above. These results confirm the hypothesis *H1*.

Concerning the hypothesis *H2*, results show that the distribution of liquidity became more balanced along with the increase in excess liquidity. According to Fecht et al. (2010), the price of liquidity decreased as the distribution of liquidity became more even. The results of this study also suggest that there was a correlation between the level of excess reserves and its distribution (concentration) as well as with its price.

Table 5 shows that the US banking sector is much bigger than the Hungarian, not only in size but also concerning the number of depository institutions. The liquidity saturation point is higher in the US than in Hungary compared to the GDP, to the balance sheet total of the banking sector, and to M2 as well. This difference can be explained by the significant structural differences between the two banking and financial systems. In the Hungarian financial system – similarly to other CEE financial systems – the share of money market funds is low, the repo market is underdeveloped, the share of the foreign banks is significant (and thus access to euro liquidity), all of which results in a smaller market for liquidity (Bethlendi & Mérő, 2020).

In line with Afonso et al. (2019), it can be concluded that the higher saturation point is compatible with a more concentrated banking sector (Figure 5). According to Afonso et al. (2019), in the US in 2015–2016, "5 percent of banks with the largest balances hold more than 90 percent of the aggregate supply of total reserves" (p. 195). In the period under review of the present study, the 2 largest depositors representing 5-6 percent of banks in Hungary held 36.92 percent of excess reserves (O/N deposits), which is far below the US data. According to Coeuré (2019), "86% of excess reserves are held by just 1% of US banks (…), four banks alone account for 40% of aggregate excess reserve holdings in the United States" (p. 4). In Hungary, given the size of the banking sector, 1% of the banks cannot be interpreted, but the largest bank representing almost 3 percent of the sector held only 22.62 percent of excess reserves (O/N deposits), which is also far below the comparable US data.

There are several directions in which the analysis can be taken further and deepened. A particularly important research direction could be a deeper understanding of the demand factors and motivations of banks, including the impact of possible changes in the regulatory environment, the reasons for differences in liquidity preferences, and the factors behind the behavior of banks that are passive in financial markets. A better understanding of the frictions of the liquidity market can also be of value added, in particular with regard to specific dates concerning regulatory purposes (end of quarter, end of year). In a tightening monetary policy environment, the importance of liquidity management concerning monetary transmission is of crucial importance, which can also be a specific future prospect of research.

CONCLUSION

The aim of this study was to examine how the increase in the banking system's liquidity and its distribution within the banking system affects yields. The analysis covers Hungary, which can be considered as a representative of small, open, emerging market economies. The segmented liquidity demand function of the Hungarian banking system was outlined. Through segmentation, the explanatory power of the model became significantly higher than that of the linear approximation without the breakpoint. The present analysis examined the period from 2016 to 2020.

The results are compatible with the relevant international literature and show that the steepness of the liquidity demand function is significantly negative and decreases with increasing liquidity. The most significant breakpoints in the observed 3,5 years were around HUF 230 billion or 0.83% of M2 and HUF 422 billion or 1.53% of M2 in excess liquidity, which can be considered to be the liquidity saturation point of the Hungarian banking system from where on an interest floor regime can be considered active, separating the quantity of liquidity and interest rate floor as two distinct monetary policy instruments.

This analysis confirms that the gradual saturation of liquidity was reflected in money market yields and the smoothing of the distribution of liquidity. The distribution of liquidity explained only to a limited extent the evolution of interbank yields and thus the relative price of liquidity; however, it was noticeable that high relative prices were seen only when liquidity was concentrated at relatively few banks. Based on the comparison of the Hungarian data with US data from the relevant literature, the results show that the saturation point depends on the concentration of reserves.

According to the above, it can be concluded that central banks can influence monetary conditions – in respect of the interest rate corridor – through an active management of liquidity as the liquidity demand of banks and the related yields depend significantly on the supply of central bank money. The results of this study can be useful from the point of view of monetary transmission and the efficiency and effectiveness of monetary policy for small and open emerging market economies with abundant liquidity.

Central bank operations have undergone significant changes in the last decade, one of the signs of which is the proliferation of unconventional monetary policy solutions and instruments. This change has led to an appreciation of the monetary policy relevance of the liquidity market for central banks. The increase of the central bank's balance sheets makes it increasingly important to understand to what extent reserves and the related regulation matter for monetary policy implementation and through monetary channels for the general economic outcomes. The objective of this work was to contribute to that process. The present results can be useful for other small and open emerging market economies with abundant liquidity, especially in the coming tightening cycle.

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Formal analysis: Pál Péter Kolozsi.
Funding acquisition: Pál Péter Kolozsi.
Investigation: Pál Péter Kolozsi.
Methodology: Gábor Horváth.
Project administration: Csaba Lentner.
Software: Gábor Horváth.
Supervision: Pál Péter Kolozsi, Csaba Lentner.
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