

Four hours is actually how many hours? – The actual time required for intraday transfers*

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In the past, the Central bank of Hungary took measures to improve the service quality of transfers between credit institutions which enabled actual intraday transfers for the clients of payment service providers automatically and without a noticeable increase in related costs (if certain conditions are met) starting from July 2012. This study shows that transfer orders accounted in the five daily cycles of the intraday clearing module reach the beneficiary client within an average of 2 hours and 5 minutes after debiting the bank account of the payer, and 2 hours and 50 minutes in the first cycle which is considered special from several aspects. The time required for execution in the first cycle is between 58 minutes and 3 hours and 48 minutes with a confidence level of 90%, while in the rest of the cycles it ranges from 36 minutes to 2 hours and 53 minutes. The 4-hour time window defined in the regulation does not include the period when the bank accounts of beneficiary clients are credited by recipient banks. Focusing on the period within the time of execution defined in the legislation, experience shows that credit institutions of the payer were able to forward the sum of the payment order to the credit institution of the beneficiary client in an average of 1 hour and 45 minutes throughout the five cycles of the day. That amounts to 44% of the available time window, while the extent of utilisation of the time window is only 35% in cycles 2-5. The time required for execution was also examined by the various subtypes of transfer. Experiences tell us that standing orders require 1 hour more time compared to single transfers, while credit transfers initiated in batch are executed in 20 minutes less time. Efforts are made to discover the reasons behind the longer time required for transfers in the first cycle of the day, which might be attributable mainly to difference in the process of this cycle and to a lesser degree to the fact that twice the average number of transfers in other cycles are accounted in the first cycle. Finally, recommendations are given for potential means of accelerating the execution of transfers.

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1 Introduction

Two types of payment service providers can take part in the clearing of the Interbank Clearing System (ICS). Direct participants have joined the clearing system themselves and are thus eligible to create orders in the clearing system for themselves or for their clients, while indirect participants take part in clearing through another direct participant credit institution (correspondent bank). The time requirement for executing intraday transfers is the main theme presented in this study, which is based on the intraday transfer data of indirect participant credit institutions and examines this data from various aspects; however, the study also covers transfers between the clients of direct participant and indirect participant cooperative credit institutions as well. Cooperative credit institutions, as indirect participant credit institutions, currently arrange their HUF payment transactions, i.e. intraday transfers, exclusively via Magyar Takarékszövetkezeti Bank Zrt. (MTB), as correspondent bank. The time requirement for intraday transfers between the clients of indirect participants and with the clients of their correspondent bank, which are not accounted in the ICS were not subjected to analysis. The time requirement for transfers within credit institutions were also not examined. These transfers do not require clearing, since they are typically accounting items within the clearing system of the payment service provider (the vast majority of payment service providers use a single clearing system nowadays), and, except transfers requiring conversion, debiting and crediting the payment accounts of clients are carried out in real time and virtually simultaneously.

Payments of small value, which are typically residential and enterprise payment orders, have been accounted in the ICS operated by GIRO Elszámolásforgalmi Zrt. (GIRO Zrt.) as the clearing house since 1994. There are two types of clearing systems operating within this: the overnight and intraday multiple clearing module. This study measures the actual time requirement for completing payment orders accounted in the latter, i.e. intraday transfers. The study is not meant to answer if the maximum execution time (4-hour) requirement according to the legislation is met, but this will also be presented here in an indirect way. The available time window according to the legislation commences at the time of receiving the payment order (this is considered the time of debiting the payment account) and lasts until crediting of the amount on the payment account of the beneficiary client. The study covers a period longer than that, since it also includes the time requirement for the beneficiary client's credit institution arising from the crediting process. The latter is the time requirement for the process that starts when the funds of the amount specified for the payment order received by the credit institution of the beneficiary client after intraday clearing and ends when the beneficiary client may dispose of the incoming amount. The starting time of durations are theoretically different in the two approaches (time of receipt and time of debit); however, in practice these are almost always identical points of time. Therefore, starting times are more or less identical points of time, since the bank account of the payer is usually debited immediately after receiving payment orders.

2 Regulatory environment

The main responsibility of the Central bank of Hungary (MNB) according to the Central Bank Act is to ensure the uninterrupted circulation of money and the reliable and efficient operation of payment and clearing systems supporting the same. In the course of discharging these duties, the MNB

- participates in the development and operation of payment and clearing systems;
- continuously monitors (controls) their operation in order to ensure the secure and efficient operation of these systems and the uninterrupted circulation of money;
- establishes the main rules governing the circulation of money applying to credit institutions, which are set out in a decree (MNB decree¹); and
- controls the observation of these rules by credit institutions within its official competence.

2.1 Intraday transfers before July 2012

Even before July 2012, it was possible for the beneficiary client to receive the amount of the transfer order on the same day the payer initiated the order. This was only ensured between direct participant credit institutions through the Real Time Gross Settlement System (RTGS, or, in Hungarian, VIBER) launched in 1999 and operated by the MNB, where payment orders could be credited within minutes. The primary function of VIBER is to complete high-value, time-critical money and capital market transactions and other payment transactions requiring urgency, where clearing and execution (on a gross principle) occurs in the same step and in real time (*Table 1*). In addition to typical payments, the system enables the completion of low-value payment orders of residential or enterprise clients requiring urgency, but this does not account for a significant portion of the total number of transactions.

The MNB decree did not include special rules for intra-day execution before July 2012, and thus the regulation did not compel or motivate payment service providers to use the VIBER system. Accordingly, the credit institutions only executed the transfer orders of their clients within the day, if this request was indicated by them when submitting their transfer order and they accepted a significantly higher fee compared to ICS clearing. The payment regulation in effect between 1 November 2009 and 30 June 2012 only required the credit institution of the payer client to shall ensure that, after the point in time of receipt

1 Currently, Decree No 18/2009 (VIII.6.) on the circulation of money (MNB decree) is in force.

Table 1**Turnover and key figures of the VIBER system (2013)**

Number of settled transactions (thousands)	Value (Billion HUF)	Settlement agent (clearing)	Clearing house	Number of participating institutions		Typical transactions
				Direct participant	Indirect participant	
1,417	1,287,582	MNB	MNB	45	132	<ul style="list-style-type: none"> – bank-to-bank items: financial market transactions (e.g. HUF leg of HUF FX transactions, HUF cash leg of securities transactions), – intraday credit transfer and clearing of the Postal Clearing Centre's settlements; – central bank operations (e.g. cash and monetary policy operations)

Source: MNB Payment System Report 2014.

(debiting), the amount of the payment transaction is credited to the payee's payment service provider's account by the end of the next business day at the latest. However, there was a voluntary standard under an interbank agreement according to which the payment service providers undertook execution within two hours in the case of VIBER transfers. Meeting this voluntary standard could have well been expected by the payer (for a higher fee), but was unable to legally demand such according to the MNB decree setting out the rules of executing payment orders.

Before July 2012, only the overnight clearing system was operational in the ICS, which ensured the receipt of the transferred amount on the bank day following debiting. This meant a 3-day delay in the case of payment orders initiated before a bank holiday (i.e. on Friday) between debiting the payment account of the payer and crediting the payment account of the beneficiary client, which could even amount to 4-5 days in the case of multiple holidays. Direct participant credit institutions typically send payment transaction to the ICS's overnight module in late afternoon or evening; with the clearing actually performed during the night, while settlement, on the accounts of credit institutions at the MNB, and crediting the bank account of beneficiary clients are completed early in the morning on the day that follows.

2.2 Intraday transfer since July 2012

Directing large volumes of transfers into intraday clearing brings numerous economic advantages for clients. *It leads to an improved competitiveness of economy, since the current account management of enterprises (which frequently conduct transactions) is*

made more efficient. Its advantage includes the savings of clients on interest, which is less remarkable for enterprises managing current account deposits, but represents significant savings for those using current account credit lines. Consequently, the advantages of intra-day completion of transactions are more intensive for enterprise clients, which is why the introduction of intraday transfer was more a demand of enterprises in the first place (Kovács, 2013).

In order to improve the standard of domestic payment services, the MNB already set the aim of enabling the clearing of low-value payments (or at least the majority of such) within one day in 2008. The central bank attached great importance to this, *because the overnight clearing solution introduced in 1994 (and considered modern at that time) had become outdated in the meantime. At the time, not only Western, but also Eastern European countries were making intra-day transfer part of the range of base services (Divéki et al., 2013).* Intra-day transfers were introduced along two separate, however, from the aspect of the central bank's objective, interconnected projects:

- By the adoption of an amendment to the relevant legislation,² the MNB achieved the goal of making intra-day execution of the majority transfer orders mandatory without the separate indication of clients. Significant improvement in the standard of service can only be achieved (meaning the shortening of the time required for completing transfers from client to client), if the application of intraday transfer is not dependent on the ad hoc decision of clients (which formerly resulted in high surcharges for clients), but ensured automatically and in large numbers. In the MNB decree, a set of criteria was laid down, which, if met, removed the right of the credit institution of payers to consider, and made the execution of transfer orders received in accordance with relevant conditions obligatory. In line with the then planned launch of intraday clearing, the legislation also required that the payment service provider of the payer ensure that the amount of national HUF transfer orders submitted electronically within the period of current day execution was forwarded to the beneficiary client's credit institution within 4 hours of receipt, unless their execution requires a conversion of currencies, as of 1 July 2012. This is the so-called *4-hour rule*.

This legislation was needed to enforce a change, since previously neither payment service providers nor GIRO Zrt. (then in majority bank ownership) had taken steps to provide the option of intraday transfer. The reason for this on the part of GIRO Zrt. was that *overnight clearing and the overnight clearing module were operating well (Legeza, 2013:5)*. On the side of credit institutions, the reason was that *the costs of the project were borne by the bank sector, while the negative financial consequences of its introduction, that is, current account deposits with low interest rate on the side of liabilities and the decline in the use of current credit account with high interest rate on the side of assets (Kovács, 2013).*

² Decree 15/2010 (X. 12.) (MNB decree).

– Beyond the adoption of legislation, a new clearing system was also needed, which was launched in accordance with the MNB's plans in July 2012 under the operation of GIRO Zrt. in live mode. This is actually the intraday multiple clearing module, where transfers are cleared in five cycles separate from each other.

The MNB decree does not state the clearing system, and hence the new requirement should be available using VIBER as well. The new clearing system was needed, because VIBER is not suitable for completing this volume of transactions if its capacity is considered, since the system was not developed for such scale of utilisation.³ The number of transactions specified in the legislation covered approximately half of the transactions of the former overnight clearing module (however, an even larger part if value is considered), which means several thousands of transactions in practice.

Besides obligatory execution within 4 hours as specified in the regulation, it allowed credit institutions to channel transfers not falling within the effect of the regulation, e.g. transfers submitted on paper or requiring conversion, into intraday clearing at their own discretion.

Observing the 4-hour rule is only mandatory for the credit institution of the payer. The time window does not include the time requirement for crediting the transferred amount at the credit institution of the beneficiary client on his payment account, since the payment service provider of the payer does not have oversight or information on when the transfer is actually completed. However, the credit side of the payment chain is also regulated in the MNB decree, namely in that the payment service providers of beneficiary clients must credit amounts immediately sent to their account through clearing⁴ at the payment account of their beneficiary clients.

Intraday transfers are cleared at specified times 0830, 1030, 1230, 1440 and 1630.⁵ The result of clearing is submitted by GIRO Zrt. to the direct participant payment service provider, while its financial arrangement (settlement) is carried out in VIBER (*Table 2*).

3 The theoretical daily capacity of the VIBER system is approximately 20,000 cleared transactions. This daily average number of transactions is about one quarter of this in practice.

4 Article 21 of the MNB decree specifies that the payment service provider of the beneficiary shall assign a value date to the amount of the payment transaction on its own account immediately after its crediting and shall credit it on the payment account of the beneficiary client in order to enable the client to dispose over the amount.

5 Except on Saturdays considered bank days due to a rearrangement of holidays, on which days only the first three clearing cycles are completed.

Clearing module	Number of items cleared (thousand)	Value (HUF bn)	Executing party (settlement)	Clearing house	Number of participating institutions		Typical payments
					Direct participants	Indirect participants	
Overnight clearing	158 288	15 963	MNB proprietary home account system	GIRO Zrt.	39	130	<ul style="list-style-type: none"> – transfers submitted on paper by clients; – group collection (e.g. payment of public utility bills); – items of the Hungarian State Treasury (e.g. old-age pensions, family allowance, aids)
Intraday clearing	155 326	59 278	"MNB				<ul style="list-style-type: none"> – individual, group and regular transfers set by clients on an electronic bank channel

Source: MNB Payment System Report 2014.

Clearing the majority of payment orders in the intraday multiple clearing system has some secondary advantages alongside the significant improvement in service quality. It had a positive effect on the *pricing* (Divéki et al., 2013) of payment orders, since the cost of introducing the new clearing is divided up between multiple transactions. This ultimately influenced the payment habits of clients, on the basis of a survey conducted by the MNB on VIBER transfers, since the operation of intraday transfer offers an alternative to VIBER transfer, and, moreover, at a much lower transaction cost. *Adapting to a new clearing system meant that numerous payment orders were not completed by clients in VIBER since the launch of intraday transfer, as opposed to their previous practice* (Luspay et al., 2014).

3 Methodology of data analysis

Historical payment data were used for this study, therefore, the conclusions obtained as a result are not based on expert estimations.

In the course of the analysis, the intraday transfers sent by 17 credit institutions and the intraday transfers received by 20 credit institutions between 1 July 2012 and 31 December 2013 were sampled, that is, 6,927,000 and 7,327,000 transactions respectively in total. Sampling typically meant a transaction on the sending and/or one on the receiving side. Accordingly, 2.99% of transactions on the sending side and 3.16% of transactions on the

receiving side were examined from the total volume of transactions cleared in the ICS intraday clearing module in the initial one and a half year.

Later, a detailed account is given of the effect which certain processes of the payer's credit institution have on the time requirement for transfers. The representative nature of the sample, besides the extensiveness of the sample, is also confirmed by the fact that it was taken from the transactions of credit institutions that have a high total market share in intraday transfers. Market share could be illustrated on the basis of monthly figures of volume for the months taken into consideration in the course of sampling. Instead of this, however, due to *seasonal differences between the volumes of individual months* (Pál, 2013: 516–518), market share was shown based on the annual intraday transfer sent by the credit institutions involved in the sample (Table 3). The credit institutions involved in the sample accounted for 64.7% of the total intraday transfer volume and 70.3% of the volume of direct participants (to which the 4-hour rule applies) on the basis of end-of-year figures of 2013; thus the data included in the analysis and credit institutions give a faithful representation of the volume of intraday transfers.

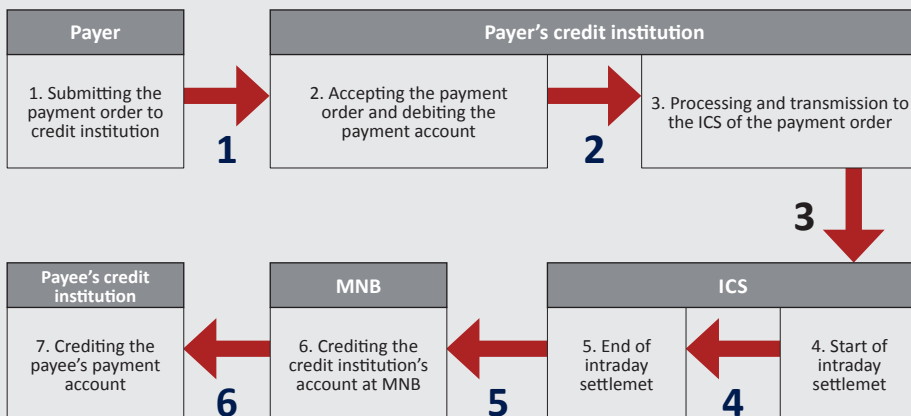
Figures of ICS daytime clearing volume in 2013	Number of items (thousand)	Market share ratio (%)	
		Total to the volume	To the volume of direct participants
Total daytime clearing volume	155 326	100,0%	
1. Sent volume of indirect participants out of this	12 368	8,0%	
2. Sent volume of direct participants out of this	142 958	92,0%	100,0%
2.1 Sent volume of credit institutions involved in the analysis	100 495	64,7%	70,3%
2.2 Volume of other credit institutions not involved in the analysis	42 462	27,3%	29,7%

Source: Own calculation based on P38 (non-public) data service to the central bank

The time requirement for transactions was not measured over the entire payment chain (Figure 1), but starting from debiting of the client's bank account (the point in time under Item 2 of Figure 1). The reason for this is that submission the payment order through an electronic bank channel can be completed by an electronic signature/approval after securing the payment order even outside opening hours of the bank. In such cases, the time of receipt according to the MNB decree falls on the beginning of the subsequent bank day, provided that there are sufficient funds for execution. Accordingly, the time of receipt of a payment order submitted in late afternoon or overnight will be the morning of the subsequent day, while a payment order submitted at the weekend will be received on Monday morning, if these days qualify as a business day at the credit institution of the payer.

The available database contains the times and dates of submission, but measuring any timeframe starting from this point of time would be of little economic use. Payment orders could be submitted outside business days as well, and their time of receipt will be later, on the subsequent business day. In such cases, credit institutions may not only debit the payment account of their client in the morning of the next business day (at receipt). For instance, if the client submits his payment order at 2315 on Friday and does not indicate a later value date, then the bank will carry out the debit automatically on the subsequent business day, that is, on Monday morning between around 0600 and 0800, depending on the opening time of their systems. After the time of submission, but until the receipt on Monday or time of debiting, the client may even decide to cancel the order or spend its funds with his bank card. Since the payment order is debited on Monday and executed in the clearing cycle of the same day, the funds of the order will yield interest at the account of the client, regardless of the time of submission. Therefore, there is no difference if the client submitted his payment order on Friday overnight or at another point of time during the weekend, or even on Monday morning at dawn: the transaction will be still forwarded to the first cycle of Monday in all three cases for the purposes of clearing. This is why measuring from the time of submission would significantly distort the actual data relating to the time required for execution, not to mention payment orders submitted weeks or months prior to the date of execution indicated in the payment order.

Figure 1
The payment process between two credit institutions as direct participants



Source: edited the flowchart by the author

The average time requirement for client-to-client transfers can be determined in several ways. The easiest and most accurate method of measuring this time is to assign the credit data of the actual client bank account to the actual bank account debiting times. In this case, the period between the two points in time would be the end result, however, this requires that data relating to the debiting and crediting of intraday transfers be available to us. However, the MNB has no database that would provide such a comprehensive set

of data, but data from individual data service were available for the period between 1 July 2012 and 31 December 2013.⁶ These typically monthly figures were used to measure the timeframe of transfers. In the course of making such measurements, the time sections marked with arrows 2-6 in *Figure 1* were determined separately.⁷ These averages weighted with the numbers of executed transfers provided the average timeframe of all credit institutions involved in the sample for each time section (marked with arrows 2-6). Adding up these time sections we get the average timeframe of transfer from the payer's credit institution to the beneficiary client.

It was considered using a weighted average calculation that the higher cash flow the credit institution had, the more important the time requirement is as set by its own processes and the payment habits of its client. For instance (measuring the time section marked by arrow 2 in *Figure 1*):

- if credit institution A received a total of 50,000 payment orders for execution in a month and forwarded them to ICS in an average of 30 minutes from debiting, while
- credit institution B did the same in 45 minutes, but its clients only submitted 10,000 payment orders, then
- these two credit institutions together would forward 60,000 payment orders into the intraday clearing in 32.5 minutes from receipt.

The time sections determined through weighting and their aggregation in itself does not distort the final result, since the calculated time requirement is determined by the features of the credit institutions' systems and processes and not the data pool where they were taken from. Naturally, there were months in the examined period when payment data from multiple credit institutions were available, and hence the actual time requirement between them could have been measured. However, measuring this would enable us to determine a very narrow sample from the entire available database, and consequently the result could not have been considered representative, that is, we would not be able to project it to the whole credit institution sector in general.

The average times of time sections marked with the arrows in *Figure 1* at credit institutions could be measured fully from the available database, since the database provided by the credit institutions contained the debiting and sending times within ISC, and hence the average time between debiting and sending within ISC could be determined for each cycle. The actual starting and ending point of the clearing time of each day and each cycle was also known from other data service from GIRO. In the latter, the point of time of settling the clearing (time of VIBER arrangement) was taken into consideration for the analysis. The data giving a picture of these special institutions generated the time sections

6 Data tables requested in the course of audits of payment services.

7 Time sections marked by arrows 4 and 5 were calculated together, because the time section marked by arrow 5 would give a very short interval in itself, however, due to the process it is illustrated separately in *Figure 1*.

of all the credit institutions involved in the analysis in a pro rata volume and weighted. The average time requirement of crediting was determined in a similar manner from the side of beneficiary credit institutions, when the time lapsed starting from the end of ISC clearing (time of clearing settlement) until the transferred amount was credited on the payment account of clients. It is important to note that the legislation sets the “4-hour rule” for the maximum timeframe of executing time sections marked with arrows 2-5, but the analysis covered the measurement of the time section indicated by arrow 6.

The receipt and debiting of payment orders is not synonymous, but in the majority of cases these two points of time coincide. The receipt and debiting of payment orders typically occurs simultaneously, when submitted within the bank's opening hours and the funds needed for execution are available. In this case, the payment order is practically received at the moment of submission and the bank account of the payer is also debited with the same amount as well. Such concurrence is present when in the morning of a business day (at opening) the credit institution commences the processing of payment orders submitted electronically between the closing of the preceding day and the opening of that day, that is, their receipt according to the legislation and also debits payment accounts at the same time. The two times of execution do not coincide in the relatively rare cases when the credit institution cannot carry out the debiting of the payment order received, even though the client has the necessary funds. This may well happen for instance (depending on the credit institution's system) for payment orders in queue, if the amount of payment order in queue is not debited immediately, but only a few minutes later on the bank account after receiving the funds (which, in this case, coincides with the time of receipt in terms of the 4-hour execution time). But the same happens when the credit institution cannot carry out the immediate debiting of the bank account with a payment order received within a time specified for execution due to some sort of technical problem.

4 Timeframe of intraday transfer between direct participant credit institutions

In accordance with the methodology, the time requirement for executing payment orders is measured in sections, with 4 sections used in total, and then we obtain the time requirement for the transfer by adding up these time sections. These sections are the following in order:

Section 1: the time starting at the time of debiting payment orders and ending at the time when they are forwarded to ICS;

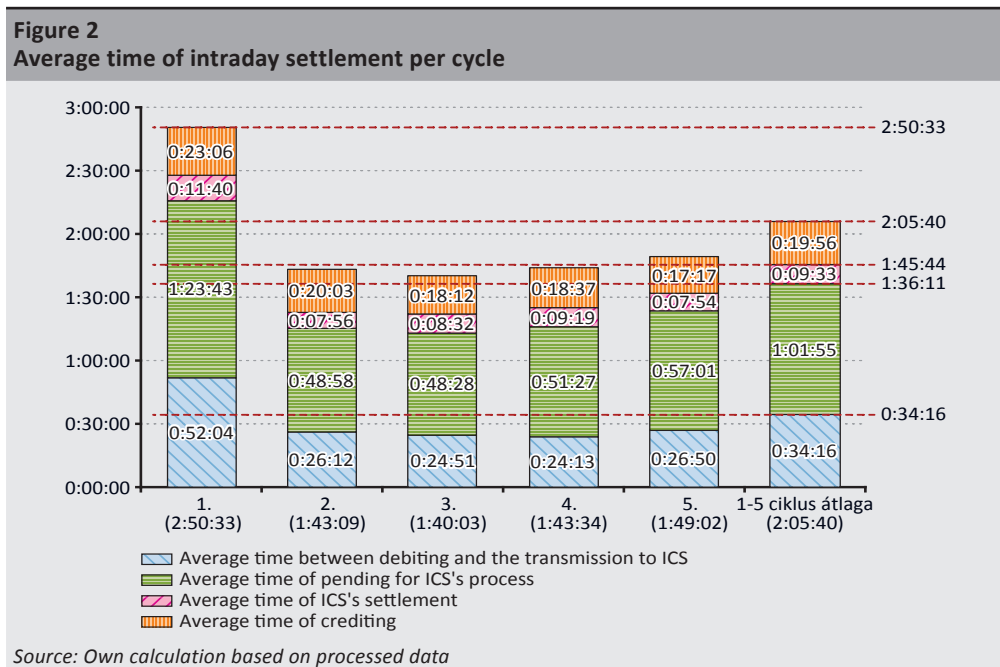
Section 2: the time of waiting for clearing in the ICS, which starts at the closing time of section 1 and ends at the actual starting time of ICS clearing. As an initial time, the “closing time of receipt for ICS clearing” of the actual clearing cycle was taken into consideration. This time section occurs when the payer’s credit institution has completed all of its tasks arising from the execution of the payment order, however, the ICS has not started clearing the subsequent cycle;

Section 3: time section of ICS clearing, which starts at the time of closing time section 2 and ends at the time of crediting the bank account of the credit institutions at MNB. In this time section not only the time requirement of the clearing itself was taken into account, but also the time required for settling the result of clearing;

Section 4: The time requirement of crediting, which start at the time of closing time section 3 and ends at the time of crediting the bank account of the beneficiary client. This time section essentially starts at the point of time, when the beneficiary credit institutions’ “immediate obligation of crediting” commences according to the law and ends when the operation was carried out.

4.1 Average time required for intraday transfers

The lengths of time sections indicated in sections 1-4 are illustrated in *Figure 2* in a breakdown to cycles and also in total (average of cycles 1-5).



On the basis of processed data, 2 hours and 5 minutes is required on average for a transfer to reach the bank account of the beneficiary client from the time of debiting the payer's bank account. Of this, 34 minutes is required for time section 1 (27.3%), and 1 hour and 2 minutes for time section 2 (49.3%) on average. Both time sections depend on the sending credit institution, since it not only determines the timeframe between debiting and sending into ICS needed for the credit institution of the payer, but also, due to the initial times that are essentially fixed points in time, it depends on the sending credit institution how much time the transfer it forwards will be waiting in queue.

The ratio of the two first time sections has an effect on the type of sending process which the credit institution of the payer chooses for forwarding to ICS. In Hungary, essentially two sending processes can be found. In the case of the first one, the credit institution always starts processing transactions and sending them to ICS at a point in time fixed to the initial time of clearing (e.g. 0815, 1015 or 1215, etc.), while in case of the second process, the transaction is processed and sent continuously and is sent independent of whether processed transactions reach a predetermined number (e.g. 500, 1,000, 1,500, etc.). Sending at a fixed time is primarily typical of credit institutions with a small cash flow, while continuous processing and sending is frequently used in the case of larger entities.

After measuring time section 3, it can be observed that the average time requirement of clearing and settlement (depending on ICS and MNB) is less than 10 minutes, that is, 7.6% of the entire time requirement. The crediting time of beneficiary credit institutions is around 20 minutes, which is 15.6% of the entire time requirement measured.

As we noted on several occasions earlier, the process of crediting by the beneficiary credit institution is not part of the 4-hour time window set out in the legislation. Accordingly, if we disregard this time section, then payment transactions reach the credit institution of beneficiary clients in 1 hour and 45 minutes from the time of debiting, i.e. in the course of executing intraday transfers credit institutions do not use up even half of the maximum time window of 4 hours (44%) provided for in the legislation. After assessing cycles 2-5 within the daily average, we get an average execution time of 1 hour and 25 minutes, which is only 35% of the available time window.

4.2 Distribution of time required for intraday transfers

The time when clients submit their payment order compared to the fixed time of the ICS cycle has an effect on the time required for executing transfer orders. *The distribution of payment transactions shows significant differences not only on annual, monthly and weekly, but also on a daily basis (Pál, 2013: 532–533).* It is obvious that a transfer order

submitted at 0700 in the morning (and debited on the payment account) will have a longer time requirement of execution than an order submitted at 0800, since it will have to wait longer until the fixed time of starting clearing (in our case at 0830). The four time sections of transfers could complete even within 20 minutes in extreme cases. This could happen, if the client submits its transfer order a few minutes before the end of the ICS clearing cycle, but at a point of time when its credit institution can send it to the next ICS clearing cycle. This however is not a sufficient condition, as the beneficiary must be the client of a credit institution that credits the amount on the payment account of its client within a few minutes after settling the ICS clearing through VIBER. Naturally, the time requirement for execution can significantly exceed the average time of 2 hours and 5 minutes which is typical of the four time sections in general.

Accordingly, in practice, the timeframe of transfers cleared in one cycle can vary along a very wide scale on the level of the transaction. The question of the amount of time in which transactions are executed was examined in two steps, since an estimation separated for time sections could not be performed for the 4 time sections used in calculating the average. As shown in Section 4.1, the lengths of the first two time sections were independent from each other, since the length of time section 1 is more dominant in the case of credit institutions sending transactions into the ICS at predetermined and fixed points in time, while in the case of credit institutions using a limit number the length of time section 2 was more dominant. In the first step, the distribution of the combined timeframe of the first three time sections (essentially covering the 4-hour rule) was examined, and then the timeframe distribution of the crediting process of the beneficiary credit institution (*Table 4*). The time intervals defined in the two steps are independent from each other, and thus their resulting timeframe data can be added up.

The distribution was defined using a smaller sample from transactions taken into consideration in the course of average calculation at a confidence level of 90%, which shows the time interval in which 90% of transactions were executed. In the course of narrowed sampling, an effort was made to match the average time requirement of the sample with the average time requirement of the total number of transactions processed (6,927,000 sent and 7,327,000 received transactions). The distribution of the first three time sections was measured on the basis of 1,610,000 transfers, where the average run-through time requirement was only 1 minute shorter than the sent transfer specified in Section 4.1. The distribution of time used for crediting by beneficiary credit institutions was measured using a sample of 1,574,000 transaction, where the average crediting time requirement was identical to the average time requirement of all processed credit transactions. In addition, due to the special nature of the first cycle, the distribution of the time requirement of transactions cleared in the first cycle and cycles 2-5 were differentiated.

Table 4
Distribution of credit transfer’s time length

	Cycle	Time slot 1-3			Time slot 4			Time slot 1-4		
		number of sample	lower bound of estimation	upper bound of estimation	number of sample	lower bound of estimation	upper bound of estimation	lower bound of estimation	upper bound of estimation	length of time period
		(number of transactions)	(hour:min)	(hour:min)	(number of transactions)	(hour:min)	(hour:min)	(hour:min)	(hour:min)	(hour:min)
Confidence level 90%	1.	578,398	0:49	2:56	542,730	0:09	0:45	0:58	3:41	2:43
	2–5.	1,031,695	0:29	2:20	1,030,804	0:07	0:33	0:36	2:53	2:17

Source: Own calculation based on processed data

The average time requirement for the first three time sections was 2 hours and 27 minutes as shown in Section 4.1, while in the case of the rest of the cycles it was 1 hour and 25 minutes. The run-through time was between 49 minutes and 2 hours and 56 minutes in 90% of transactions, while in the rest of the cycles it was between 29 minutes and 2 hours and 20 minutes. In the first cycle the distribution of run-through times was tending towards the left side, and hence was not symmetric, as opposed to the other cycles, where the distribution of run-through times followed a single-modus symmetric distribution.

Overall, we can establish that the run-through time of transactions in the first cycle in time section 4 falls within a time interval of 2 hours and 43 minutes (with a confidence level of 90%), between the extreme values of 58 minutes and 3 hours and 41 minutes. This is half an hour shorter in the case of time sections 2-5, and occurs with time interval of 2 hours and 17 minutes, between the extreme values of 36 minutes and 2 hours and 53 minutes.

5 Intraday transfers between direct and indirect participant credit institutions

The legislation sets different execution deadlines for indirect ICS participants, since instead of 4 hours, they had 6 hours to ensure that the amount of the payment order reaches the credit institution of the beneficiary client. The reason for this distinction is that indirect participant credit institutions connect to the ICS through an indirect member (correspondent bank), and thus the additional time requirement is taken into consideration by the regulation, which provides a maximum of 2 hours of additional time to execute the transfer order.

Indirect ICS participants are currently integrated cooperative credit institutions, credit institutions separated from an integrated cooperative credit institution and transformed into a bank as well as mortgage banks.⁸ The common feature of integrated cooperative credit institutions is that their payment account is not managed by the MNB, but rather by the MTB, and consequently they are not in direct contact with ICS, so both overnight and intraday clearing is done via the MTB. The MTB not only performs an intermediary activity (data forwarder), but rather a 'quasi' clearing activity (first processing within the integration). In the course of sending, it first processes the payment orders received from the credit institutions whose accounts it manages (corresponds), then forwards the results of processing to the ICS, or, if the bank account of the beneficiary client is also managed by the MTB, then directly to the beneficiary credit institution. Payment orders falling within the latter group are not forwarded to the ICS's intraday multiple clearing, and consequently those are not subject to analysis in this study.

5.1 Timeframe of a transfer initiated by the client of an indirect participant and credited at a direct participant

We do not have reliable data for the purposes of analysis on intraday transfers initiated by clients of indirect participants. Although we have some databases containing transactions initiated by such credit institutions which include the debiting times of outbound intraday transfers and their sending time to the MTB, there is no accurate information to know the ICS cycle in which the transactions were actually cleared after the MTB has discharged its duties as a correspondent bank. Lacking this however, we cannot precisely determine when these payment transactions reach the credit institution of the beneficiary client.

The MTB announces points in time for the correspondent credit institution until which it undertakes to ensure forwarding to the current clearing cycle. At the start of intraday transfer, the MTB undertook to forward intraday transfers it received by 0730 to the first cycle in case of normal operations. In this analysis, an average time requirement of 2 hours and 16 minutes was measured using the points in time published by the MTB.⁹ Accordingly, the timeframe measured on the basis of processed data was only 11 minutes longer than the time requirement observed for intraday transfers between indirect participants. This is possible because the time requirement of MTB's activity as a correspondent bank is not fully added to the total time requirement. The time section spanning from debiting to forwarding to the MTB was only 15 minutes on average, which is 19 minutes shorter than the period measured from debiting to sending into the ICS in

⁸ Mortgage banks manage special accounts for their clients and transfers initiated from the client account are also special transactions; hence these are not subjects of study.

⁹ The measurement was calculated for a total of 50 outbound transactions of 5 indirect participant credit institutions.

the case of indirect participants. However, in the case of indirect participants, 1 hour and 31 minutes passed from forwarding to the MTB until the commencement of ICS clearing (this joint figure includes the time of waiting at the MTB for clearing in ICS and the internal clearing time of the MTB), while it was 30 minutes shorter in case of direct participants. It is true however that the 1 hour and 2 minutes long period was made up of the time waiting for ICS clearing in its entirety.

The measured data is considered informative, because we had no information on whether intraday transfers forwarded to the MTB a few minutes after specified deadlines were actually cleared before the ICS clearing specified by the MTB. It could not be established explicitly if there were intraday transfers among the processed data which were sent to the MTB in a period between 0731 and 0735 for instance, but made it to the first clearing cycle of ICS nonetheless. But there could have been transfers forwarded to MTB between 0725 and 0729, but were eventually only cleared in cycle 2.

5.2 Timeframe of a transfer initiated by the client of a direct participant and received by an indirect participant

In the case of an intraday transfer initiated by a direct participant and credited at the MTB or the client of any correspondent credit institution, 3 hours and 7 minutes was required on average to have the amount credited at the beneficiary client. This time is 49% longer than the time measure for direct ICS participant credit institutions.

The average time requirement for the transfer is the same shown for time sections 1-3 in Section 4.1, that is, 1 hour and 45 minute in terms of the credit institution of the payer and the ICS clearing, since it does not matter for the credit institution of the paying party at which domestic credit institution the beneficiary client is registered as a client. The process basically differs after ICS clearing, since the result of clearing and its funds is received by the MTB directly from the ICS. The correspondent credit institution then receives this result after an internal clearing operation, which makes the time requirement of intraday transfers much longer as compared to direct participants. On the basis of the data subjected to assessment, an average of 1 hour and 22 minutes lapsed after settling the clearings in VIBER until the payment orders were credited at the clients of the correspondent bank. A significant portion of this time was taken up with the clearing activity of the MTB, and a smaller part was used by the crediting time of corresponded credit institution.¹⁰

¹⁰ The measurement was calculated for a total of 72 inbound transactions of 4 indirect participant credit institutions.

6 Certain features of intraday transfers

The processed data were used to examine how the number of intraday transfers are distributed between each clearing cycle and whether this is in alignment with the distribution compared to the entire volume of transactions. The potential reasons for the lengthening of the first cycle was assessed separately, and the longest time section from the measurement in a breakdown of time sections was examined in detail.

6.1 Number and distribution per cycle of processed transfers

As mentioned before, a total number of 6,927,000 and 7,327,000 intraday transfers sent into the ICS and received from the ICS respectively were examined. There was no significant difference between the number of sent and credited transfers per cycle measured (the two bottom trend lines of *Figure 3*).

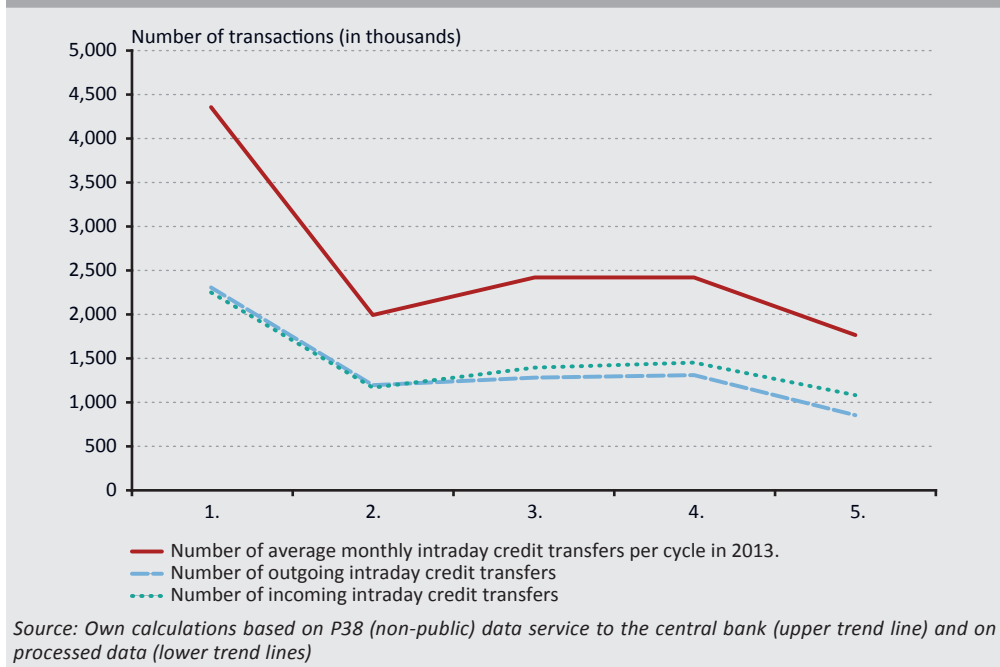
The situation is completely different, however, if the distribution per cycle of the number of intraday transfers is analysed, as the majority of transfers is cleared in the first cycle. This partly due to the fact that the timeframe is the longest before the first cycle, when the clients submit payment orders (from the closing of the previous business day to the opening of the current business day, that is, from approximately 1500-1600 to 0800-0830 in the morning). Furthermore, the length of this period can significantly increase in the event of intermediary business day(s). Moreover, the number of transactions in the first cycle might be increased by transfer orders debited in the morning for which an execution on a later date is indicated by the client and standing orders are also cleared at this time. As a result, on the basis of processed data it can be established that twice as many transactions were cleared in the first cycle as in the rest of the cycles; to be more precise the number of transactions of the first cycle was 199% of the average number in cycles 2-5.

It should also be examined if the volume of transactions of credit institutions involved in the measurement show any significant difference compared to intraday transfer volume. In the case of a significant difference, the confidence level of average time requirement data in Section 4.1 would be lower, since if the volume of the first cycle (with the longest time requirement) is higher in terms of total volume of intraday transfers, then that would mean that the measured data is assumed to show a smaller average time requirement than what is realistic. If the increase of volume in the first cycle is one and a half times the average of the rest of the cycles in the total volume, then the time requirement typical of the total volume is assumed to be shorter than what was observed in the measurement. The top trend line of *Figure 3* shows the share of volume per cycle on a monthly basis in relation to

the total volume of intraday transfers in 2013. Based on the data of all participants (direct and indirect), the volume in the first cycle was double (202%) the average of cycles 2-5.

Consequently, it can be established that the processed intraday transfers involved in the analysis show the same distribution per cycle (trend lines of Figure 3) that is typical of the total volume of intraday transfer, and, ratio of measured and real volume of the first cycle differ to the same extent from the volume of the rest of the clearing cycles, and thus no distortion in the measured time requirement data can be presumed.

Figure 3
Number of intraday credit transfers per cycle



6.2 The reason for extending the timeframe of the first clearing cycle

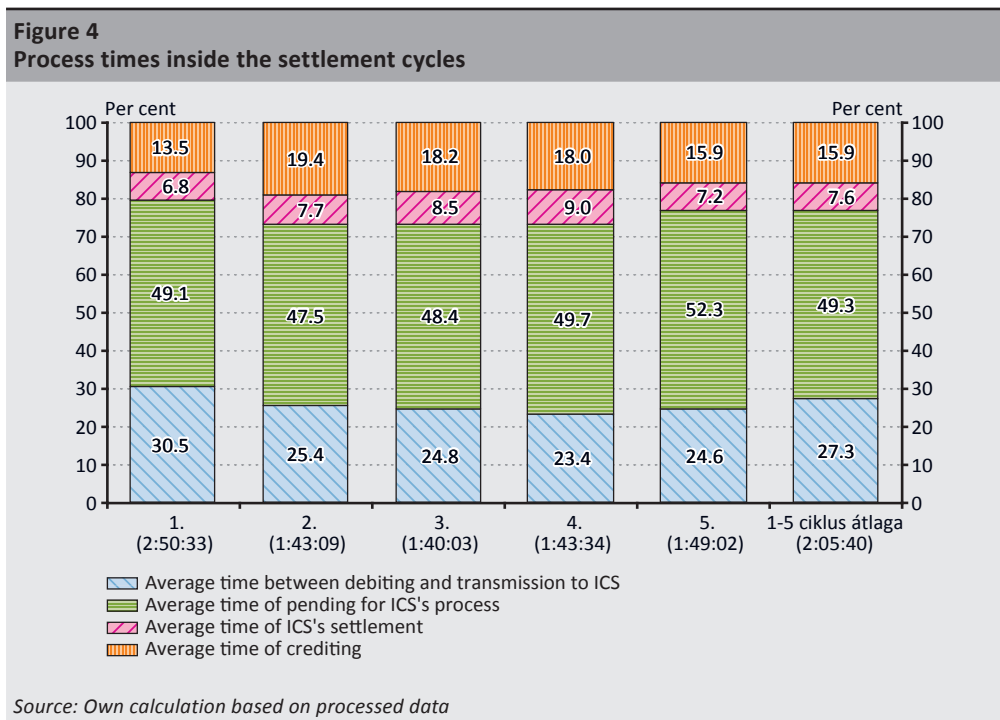
Considering that the length of the first cycle showed a significant difference from the rest, it was important to examine what was behind this. The extension of the timeframe cannot be traced back to issues of infrastructure, since credit institutions use the same IT infrastructure in all cycles, and it does not matter from the aspect of account management systems if a transaction of debiting or crediting of a given number is running on them. If the automated debiting or crediting process was initiated, then there is no significant time difference between the time requirement of debiting or crediting 100 transfers.

Accordingly, two reasons could be identified which might be behind the first cycle's extension:

- a higher number of transactions showed in Figure 3 and typical of the first cycle, or
- a process feature that primarily influences the first cycle.

If the extremely high number of payment orders were to lead to such difference, then its effect should present itself in all 4 time sections shown in Figure 2, and in a nearly equal proportion. The measured data show that the period from debiting to sending into ICS is 27 minutes (105%), the average waiting time for clearing at ICS is 33 minutes (64%), while the average time of ICS clearing is 3 minutes (38%) and the crediting process of beneficiary credit institutions was only 4 minutes (25%) longer on average in the first cycle. In line with measured data, all time sections were longer in the first cycle, however, the degree of extending the time section showed great differences. This leads us to the conclusion that although an extremely high volume of transactions has an effect on the extension of time, but it is not a sufficient explanation in itself.

Since a significant extension of time (79% in total comparison) was observed in the time requirement for the first two time sections, which are time sections depending on the credit institution of the payer as mentioned before, the relevance of a reason beyond the number of transactions was examined (process characteristics).



The conclusion was that the difference in the process could be the timing of the day-opening process. Also, the compliant behaviour of credit institutions should be taken into consideration, since the credit institution must consider several aspects in the course of day opening as a result of the regulation.

One such an aspect may be that many payment orders are considered received at the time of day opening (e.g. transfers submitted previously with the debiting date, payment orders submitted after the closing time of the previous day, standing orders due on the current day), and thus these must reach the credit institution of the beneficiary within 4 hours from opening of the day.

The other aspect is that, in order to observe the order of execution, payment service providers had to develop a process that can ensure that payment orders submitted at an earlier time are received (and debited) earlier than those submitted later. Observing this rule is especially important, if there is not enough funds for all the payment orders of the client. Thus, the process typically means that standing orders (that were submitted long before by the client), or even orders submitted several weeks or months ago, but due on the current day, and payment orders submitted after closing the previous day or before opening the current business day (e.g. early in the morning), are debited in the morning of the business day in separate processing schemes.

By contrast, the processing of payment accounts is continuous at the receipt of the payment order or, in the case of payment orders waiting in queue, at the time of receiving the funds, and processes are not separated as in the first cycle. As a result of the above, debiting takes place 2 hours and 15 minutes on average before starting ICS clearing in the first cycle, while in cycles 2-5 this is only 1 hour and 16 minutes, that is, 59 minutes less (*Table 5*).

Daytime transfer	Number of ICS cycles		Time difference (hour:minute)
	1.	2–5.	
Total	2:15	1:16	0:59
single transfers out of this	2:15	1:17	0:57
regular transfers out of this	2:37	1:17	1:19
group transfers out of this	1:23	1:12	0:11

Source: Own calculation based on processed data

Therefore, a time requirement longer than average at credit institutions in the case of transfers cleared in the first cycle of the day is primarily due to the longer processing time typical of credit institutions and an earlier time of sending into ICS compared to the

rest of the cycles, and the extremely high volume compared to other cycles can only be marginally responsible for that.

6.3 The longest time requirement – the time section of waiting

This study also examined which the station in the payment order the payment order spends the most time in.

If the time interval between debiting the client's bank account and crediting the client's bank account is considered, then half of the entire time requirement (49.3% according to the last column of *Figure 4*) was taken up by the time of waiting for clearing. The length of the time interval of waiting for clearing is even more salient, if it is only assessed from the side of the legal requirement, that is, in how much time the payment order reaches the credit institution of the beneficiary from debiting the bank account of the payer (receipt). Here, waiting time could amount to 58.6% of the entire time requirement in each cycle, in the course of which period essentially nothing happens with the payment order.

Cycles 2-5 can be considered quite homogeneous, not only in terms of total time requirement of execution, but also for each measured time section. The difference (however, not significant) was only observed in one place, namely in the last cycle, where waiting time for ICS clearing was 7 minutes longer than in case of cycles 2-4 and had the same effect on the average execution time of the last cycle as well. It should be noted that the lowest number of transfer orders was cleared in this cycle, which also confirms the argument that the correlation between the number of transactions executed and the length of transfer time is not as close as if a difference in process is present. This difference in process can be traced back to the fact that credit institutions send payment orders into ICS earlier on average in the last cycle compared to the starting of other ICS clearing cycles, in order to avoid risks. This is necessary because if any technical problem occurs in the course of sending in, then the sending credit institution has more time to restore normal business. This risk is lower during the day, since even in the worst case, the clearing of the transfer is postponed to the next cycle, but will be executed within the current day (and does not lead to violation of the 4-hour rule). The last cycle is special in this regard, because if payment orders received on the current day are not forwarded in that cycle, the clearing will be postponed to the first cycle of the subsequent day, leading to violation of the 4-hour rule.

On the basis of the above, we can draw the conclusion that the most time is taken up in the execution of an average transfer when the payment order was received in the ICS and is waiting for the initiation of the clearing process.

7 Differences in time for each subtypes of credit transfer

The aggregate intraday transfer volume is worth assessing for each payment method subtype, and separating single credit transfers, standing orders and credit transfers initiated in batch.

7.1 Single credit transfers

In terms of the number of items, single credit transfer orders are the most frequent ones in intraday clearing, with 79% of processed intraday transfers submitted this way. Although, this ratio is naturally different for each credit institution, these payment orders account for the majority of total intraday transfers at most credit institutions.

The time section and time requirement in each cycle experienced in the case of single credit transfers is very similar to the time requirement of aggregate intraday transfer volume, for which the explanation is that 4/5 of the examined volume was made up of these payment orders if the number of transactions is considered. Of course, due to this high ratio, the features of this payment subtype were heavily influenced by the whole intraday process.

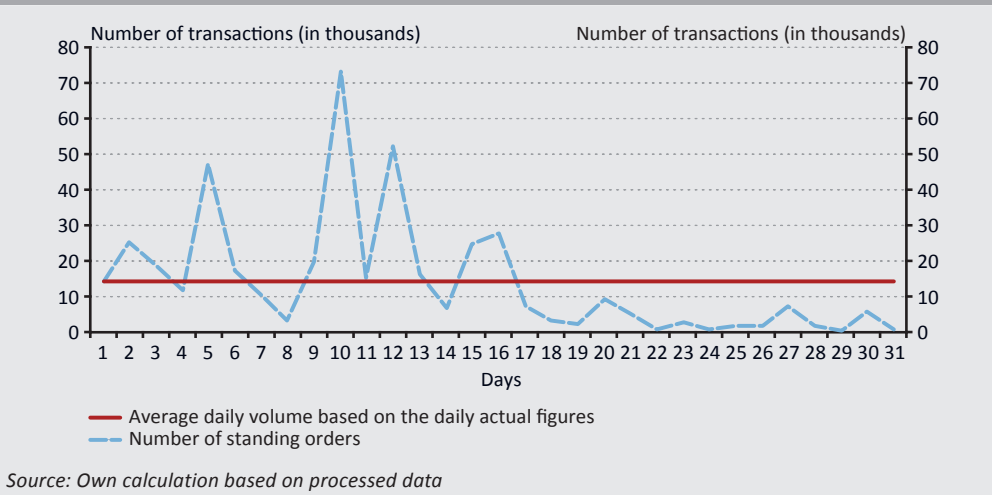
7.2 Standing orders

The average time requirement of standing orders is the highest among the subtypes of intraday transfer (3 hours and 8 minutes on average). 97% of standing were cleared in the first cycle according to processed data. This cycle becomes longer due to this payment subtype, because these payment orders are debited first even within the first cycle (see Section 6.2). The debiting of these in the day-opening process is prioritised on a process level to keep the order of receipt. At large banks (initiating the most standing orders) these processing operations start very early; experiences show that they even start between 0530 and 0600.

Standing orders were only 6.3% of the total intraday clearing volume of the examined credit institutions, however, their share in the transactions of the first cycle was 18.3%.

Standing orders are distributed unevenly not only within the day, but also on a monthly basis (*Figure 5*).

Figure 5
Distribution of standing orders within a month

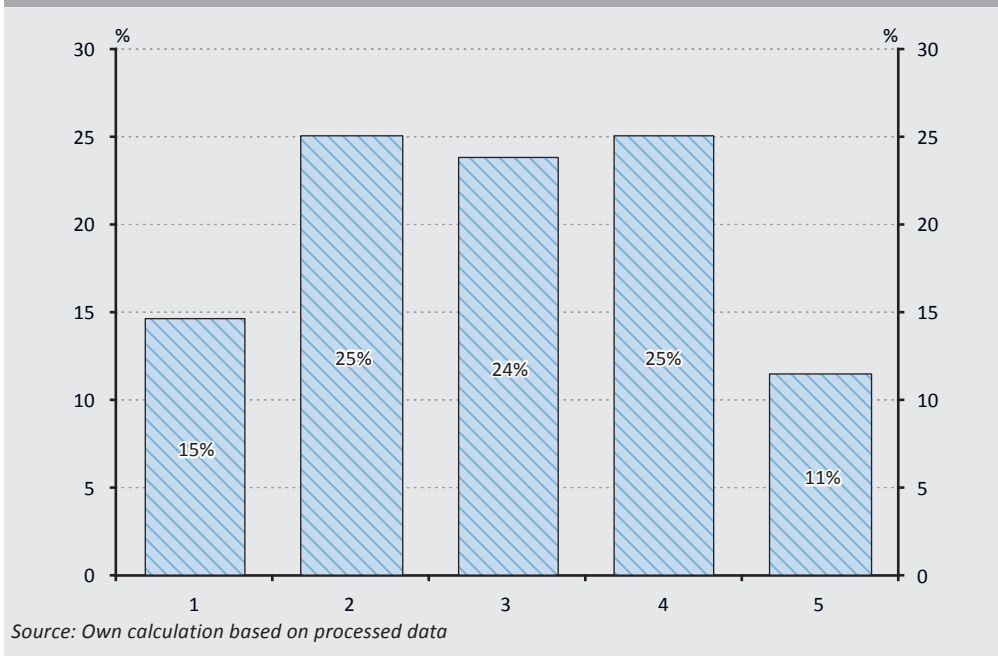


The horizontal line in the *Figure 5* indicates the daily number of transactions according to the even distribution. According to the database, there are days with extreme volumes, e.g. the 5th, 10th and 12th days of the month, when 11.2%, 17.3% and 12.4% of the average monthly transfer volume respectively became due. If periods within the month are considered, the experience was that 73% of transfers were due in the first 12 days of the month and only 6.9% took place after the 20th day, according to the sample. This can primarily be attributed to the fact that the execution time of standing orders of clients are tied to the payment of their salary, that is, clients try to specify a point of time as debiting date when their monthly salary provides funds for the transactions. However, uneven distribution (peak days) has a relatively small effect on average execution times, due to reasons mentioned above, since the number of transactions generally showed a relatively low correlation between the elongation of time (in case of crediting a doubled volume in the first cycle only increased the average crediting time by one quarter of the former average).

7.3 Credit transfers initiated in batch

The average time requirement of credit transfers initiated in batches is the highest among the subtypes of intraday transfer (1 hours and 44 minutes on average). 14.7% of processed intraday transfers was submitted as credit transfers initiated in batch. As shown before, most transactions in the intraday clearing volume were cleared in the first cycle. However, this cannot be said of credit transfers initiated in batch (*Figure 6*), since the majority of volume is concentrated in cycles 2-4.

Figure 6
Volume of credit transfers initiated in batch by settlement cycles



In the background of a distribution differing from other payment subtypes is the fact that this payment subtype is used by companies, local governments and other (non-residential) clients, who submit their credit transfers initiated in batch for execution continuously, typically in the course of the business day. Accordingly, submission occurs at a point in time that is considered working time both for the client and for the credit institution of the payer. Furthermore, clients supposedly pay attention to having the necessary funds at the time of submission, since for instance salaries are typically transferred this way; hence, the receipt and debiting of the bank account can occur immediately at the time of submission. Accordingly, it is less typical that credit transfers initiated in batch are submitted after the closing time of the credit institution or submitted for a later debiting date, in which case these would be received in the morning of the next bank day and executed in the first cycle.

8 Main conclusions and suggestions

Intraday transfers between direct ICS participant credit institutions are executed well within the 4-hour timeframe provided for by the legislation, and, in fact, the average time between debiting the bank account of beneficiary clients and crediting on the bank account just surpasses 2 hours. A little longer time was measured when the payment order was submitted at an indirect participant. According to the examined data, intraday transfers initiated by indirect credit institutions actually do not require or take up the 2-hour additional time provided by the regulation, since transfer orders are forwarded to the credit institution of the beneficiary client well within 4 hours even in case of indirect participants.

It was a well-known fact from previous MNB publications that many more intraday transfers were cleared in the first cycle of the day than in any other cycle. The study also highlighted that the time requirement for execution in the first cycle is much longer than in the rest of the cycles. This is not mainly due to the high number of transactions (although it contributes to it to some extent), but the time requirement of the day-opening process of the bank and, ultimately, to an early time of opening the day at banks.

Analysis of the execution time of transactions within the time sections showed that nearly half of the total transfer time is some sort of wasted time, a waiting time, when the payment order is no longer managed by the credit institution of the payer, but the clearing house has done nothing with it. This leads us to the conclusion that by increasing (concentrating) the number of intraday clearing cycles considerable time savings and an improvement of efficiency could be achieved, since the time spent waiting for clearing could be reduced.

Through the breakdown of transfer transactions by payment method subtypes, the study established that the time required for the execution of single customer transfers making up a large portion of intraday transfer volume is essentially the same as the time requirement of all other measured intraday transfers. In the case of standing orders this time was approximately 1 hour longer, while it means an average execution time 20 minutes shorter in the case of credit transfers initiated in batch.

The focus of the analysis was not the effect the introduction of a new 'zero' clearing cycle would have on bank processes; consequently, this was not covered in the study. Nevertheless, it can be established that if a cycle of this kind was introduced, it would have a beneficial effect on the average time requirement of transfers, if we assume that the current debiting and sending practice of payment orders are not changing. Bringing the first clearing cycle earlier in the day would have a secondary effect; among others, the extremely high number of payment orders observed in the first cycle would be distributed over two cycles, thus making the number of payment orders forwarded in each cycle more even.

References

BALLA, GERGELY PATRIK – BODNÁR, LÁSZLÓ – DIVÉKI, ÉVA – FENYVESI, MIKLÓS – ILYÉS, TAMÁS – LUSPAY, MIKLÓS – MADARÁSZ, ANNAMÁRIA – OLASZ, HENRIETTA – PAPPNÉ KOVÁCS, BEÁTA – PINTÉR, CECÍLIA – TAKÁCS, KRISTÓF – VARGA, LÓRÁNT (2014): Fizetési Rendszer Jelentés. MNB.

DIVÉKI, ÉVA – HELMECZI, ISTVÁN (2013.): A napközbeni átutalás bevezetésének hatásai. *MNB-szemle*, January.

KOVÁCS, LEVENTE (2013): A napon belüli elszámolás hatása a gazdaságra. In PRÁGAY, ISTVÁN (ed.): Napközbeni átutalás projekt (2010–2012). Tanulmánykötet. Budapest: GIRO Zrt., pp. 31–38.

LEGEZA, PÉTER (2013.): Ötlettől a megvalósulásig. In PRÁGAY ISTVÁN (szerk.): Napközbeni átutalás projekt (2010–2012) tanulmánykötet. Budapest: GIRO Zrt., pp. 5-10.

LUSPAY, MIKLÓS – MADARÁSZ, ANNAMÁRIA (2014): A napközbeni elszámolás bevezetésének hatásai a hazai fizetési rendszerek forgalmára. *MNB-szemle*, March.

PÁL, ZSOLT (2013): A bankközi klíringforgalom időbeli megoszlása. *Hitelintézeti Szemle* 12 (6), pp. 515–534.