

Clearing and settlement's power in network payments**

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Abstract

*Clearing is the basic method of settling mediated money, i.e. their transactions from account-to-account in the books of payment intermediaries. The logic of clearing is based on the symmetry of payments, expressed by the equation **sent payments = received payments** in network. The common ratio is $\text{Clearing Efficiency} = \text{Bank Clearing} / \text{Demand Deposits}$. The most comprehensive and important indicator of clearing and settlement power is the ratio of daily payment value to annual GDP.*

A possible gradation of clearing, based on the criterion of its level and scope: internal clearing, bilateral clearing, multilateral clearing, system clearing, national clearing, and international clearing. The only pure clearing is internal, at the level of an individual intermediary, i.e., a single bank. The greatest clearing and settlement power is held by the national clearing system – a comprehensive network with the central bank as the supermediator without technical limits. The clearing and settlement power is vividly illustrated by the data from the world's largest central bank—Federal Reserve Bank of New York, about the activities in Fedwire.

The effects of payments in-network are illustrated by a quantitative analysis based on BIS-BCBS practical example for intraday liquidity of banks. This practical example shows that net cumulative position (received payments minus sent payments, transaction-by-transaction), negative and positive, directs the use of available intraday liquidity. The ultimate evidence of the superiority of payments in network lies in the fact that banks without incoming payments would not survive even half a working day.

Key words: network payments, clearing, settlement, central bank reserves, credits, intraday liquidity, BIS, net cumulative position, banks, payment intermediaries (PSPs), interbank payments, RTGS, implicit transactions, CHIPS, Fedwire, CHAPS, mediated money.***

1 Introduction

Clearing is the basic method of settling mediated money, i.e. their transactions from account-to-account in the books of payment intermediaries, which represented the *internal network*. The payer sent money and the payee received money via the intermediary. The transaction was recorded in

* Central Bank Money Research.

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*** **Mediated money** exclusively circulates account-to-account in books of payment institutions. It implies that money stays in-network, i.e. in banking system (central bank and commercial banks).

intermediator's book, creating the illusion that it was executed without money, although it is clear that without payer's money there would be no payment.

The logic of clearing is based on the symmetricity of payments, expressed by the equation *sent payments* = *received payments* in network. Considering the stock of mediated money is always in the intermediary possession, he can freely use deposited money. Freely using of money in-network allows incomparably **expansive payments** than cash, but also causes illiquidity and failure of intermediaries.

The decisive feature of mediated money lies in the *power of clearing and settlement in payments*, although many well-known textbooks on monetary economics and banking do not even contain the words *clearing* and *settlement*.¹ This power has relativized the importance of money stock in modern payment system to the point of unrecognizability, so that the household sector, which holds more than half the value of all transaction accounts, makes 200 times fewer payments than wholesale transactors.

The power of clearing and settlement can be determined through its quantification. Keynes was explicit and precise in quantification: '[E]fficiency (E) [...] represents the ratio of the Bank Clearings to the Total Deposits'. (Keynes, 1930b, p. 22). A purified and modernized version of his ratio would be: *Clearings Efficiency* = *Bank Clearing* to *Demand Deposits*. The official formulation of this ratio, published in December 2023, is nearly identical, although it carries a distinctly pejorative name. '*Liquidity recycling* is the ratio between value of payments sent and liquidity usage' (BoE & PRA, p. 15). In this way, the greatest economic power has been reduced to '*the level of liquidity recycling*' (ibidem). The results of empirical research illustrate the level of bank clearing efficiency (CHIPS, Fedwire, CHAPS).

A possible gradation of clearing, based on the criterion of its level and scope: *internal* clearing, *bilateral* clearing, *multilateral* clearing, *system* clearing, *national* clearing, and *international* clearing. It is clear that the distinction of clearing cannot be strict due to overlaps – for example, multilateral with system or system with national. The only pure clearing is internal, at the level of an individual intermediary, i.e., a single bank.

The greatest clearing and settlement power is held by the national clearing system – a comprehensive network with the central bank as the supermediator without technical limits. The inflation, i.e., purchasing power of money, is the economic limit. Consequently, the most comprehensive and important indicator of clearing and settlement power is the ratio of daily payment value to annual GDP.

The effects of payments *in-network* with mediated money are illustrated by a quantitative analysis based on BIS-BCBS practical example for intraday liquidity of banks. This practical example shows that net cumulative position (received payments minus sent payments, transaction-by-transaction), negative and positive, directs the use of available intraday liquidity. The presented

analysis discovers the ‘secrets’ of deposit and credit multiplication, fractional reserve banking, commercial bank money, bank run, and lender of last resort.

The paper after this Introduction (1) is organised as follows: Clearing basis (2), Clearing and settlement power (3), Evidence based on BIS-BCBS practical example (4), and Conclusion (5).

2 Clearing basis

Clearing is the basic method of settling mediated money, i.e. their transactions from *account-to-account* in the books of payment intermediaries, which represented the *internal network*. The payer sent money and the payee received money via the intermediary. The transaction was recorded in intermediary’s book, creating the illusion that it was executed without money, although it is clear that without payer’s money there would be no payment. This illusion is so strong that the Governor of BoE in 1992 emphasized *explicit transactions* in gross payment systems opposite net payment systems (Leigh-Pemberton, p. 454). Are there explicit payments vs implicit payments or explicit money vs implicit money?

London bankers were well acquainted with money transfer technology and used public deposit banks on the Continent. ‘All banks will to a certain extent economize currency, and those of Amsterdam and Hamburg have for some centuries carried on a system of transfers, the true prototype of our system’ (Jevons, p. 338). The Bankers’ Clearing House in London from **1770s** was a continuation of the evolution of mediated money, with a Copernican leap – from 1841 it performed **multilateral clearing**,² previously unknown in the world of banking.

Bank of England entered the London Clearing House in May of **1864**, technically: ‘enter the clearing’ (Clapham, II, p. 251).³ Thus, the first national clearing system was created, which no longer had spatial limits in domestic payments – main clearing bankers were in-network.

International clearing was hindered by *gold fetters* until 1932, when the newly established BIS began ‘[...] activities on the technical cooperation between central banks (including reserve management, foreign exchange transactions, international postal payments, gold deposit and swap facilities)’. Naturally, gold deposits were not removed from central bank vault, but only a portion of them was transferred to the BIS as collateral to secure international settings. With the abolition of the gold standard in 1971, the formal link between gold and international clearing and settlement systems was severed.

The logic of clearing is based on the symmetricity of payments, expressed by the equation *sent payments = received payments* in network. Considering the stock of mediated money is always in the intermediary possession, he can freely use deposited money. Freely using of money in-network allows incomparably **expansive payments** than cash, but also causes illiquidity and failure of intermediaries. Until the founding of Federal Deposit Insurance Corporation (FDIC) 1934, bankruptcy of deposit institution meant the loss of money of depositors.

The basic issuer of modern mediated money is a central bank, and it circulates between commercial banks. That central bank money is issued and circulates via commercial banks’ accounts with the central bank, the so-called **reserves**. Direct access to this non-cash money is available only to a

smaller portion of payment intermediaries – authorized commercial banks and selected financial institutions. Other intermediaries access it through correspondent banks. All of them, along with the central bank, are interconnected through retail and wholesale payment systems in a comprehensive national clearing network.

The only money that is created and circulates in national network, as well as through all other levels of clearing (internal, bilateral, multilateral, etc), is the central bank money, denominated in national currency. “Commercial bank money” is an illusion created by the very clearing of transactions in books of banks. The bank money that Adam Smith emphasized as early as 1776 was the money of public deposit banks; during the 19th century, it evolved into central bank money. Today, this is the only shape of mediated money or bank money.

Mediated money enables the multiplication of payments within the network, provided that banks can freely use deposited money their clients. The expansion of payments is effectuated through overdraft and other loans, which are *promise of money*, i.e., *promise of payment* in the form of bank liabilities – deposits. It can be noticed that this is a process of an apparent deposit and credit multiplication, which actually represents a reflection of clearing. Without clearing and monopoly of payments, the credit potential of any bank would be equal to that of any non-deposit financial institution with the same liabilities and equity.

With the suppression of cash in retail transactions, a closed payments network is being created, eliminating the limits of mediated money creation. ‘Today’s central banks have the capability of creating or destroying **unlimited** supplies of money and credit’ (Alan Greenspan).⁴ The terrifying monetary expansion during the 2010s and early 2020s unequivocally confirms this.

The national clearing system is a closed payments network. This comprehensive network is managed by the central bank,⁵ which is the sole issuer of modern mediated money and the lender of last resort. Mediated money circulates exclusively account-to-account in books of payment intermediaries – banks and other PSPs. The central bank is a supermediator – comprehensive and universal. The unlimited clearing and settlement power of central bank is the nuclear reactor of mediated money emission. Only thanks to such power of the central bank were wholesale depositors who were able to withdraw \$140 billion uninsured deposits from the illiquid Silicon Valley Bank in just two days in March 2023.⁶

Interbank settlement process has always relied on an acceptable settlement asset; without such an asset, there could be no settlements, and therefore no mediated money. Commercial banks have never accepted claims from other banks for settlement. The only settlement asset that all banks have accepted was and remains the central bank money – immediate (until the mid-19th century) and mediated. That is why central banks are the ultimate providers of interbank settlement assets.

The comprehensive dynamic approach explains all the diversity and peculiarity of mediated money. *Dynamic analysis* focuses on the stock-flow relationship. The stock of money is the result of flow; money flow contains a series of payment transactions; transactions occur in network between payer and payee; transaction outflow of payer = transactions inflow of payee (*symmetric*); each transaction changes the stock of money for both the payer and payee; the transaction does not change the stock of money in the overall system; transactions are *successive* and *interdependent*

– previous transactions determine the next ones; full information on money stock and flow in the network is held only by the system mediator; stock of money enables the start of flow; the difference between $Stock(t)$ and $Stock(t-1)$ does not show the total value of flow.

3 Clearing and settlement power

The power of mediated money that circulates in books of intermediaries has always been understandable and appealing to bankers, just as much as it has been misunderstood and off-putting to the general public. The true extent of that power—without banking bias and public aversion—can be determined through its quantification.

Keynes was explicit and precise in quantification. '[I] propose to employ two terms, namely *Velocity* (V) and *Efficiency* (E); of which the latter represents the ratio of the Bank Clearings to the Total Deposits. This leaves us free to use the expression 'velocity of circulation' to denote unambiguously the velocity or rate of turnover of what is truly serving the purposes of cash, namely the Cash Deposits. It follows that $E = Vw$, where w is the proportion of the Cash-deposits to the total deposits' (Keynes, 1930b, p. 22). By emphasizing *Bank Clearing*, Keynes stepped out from a static standpoint into a dynamic analysis. A purified and modernized version of his ratio would be *Clearings Efficiency = Bank Clearing to Demand Deposits*.

The official formulation of this ratio, published in December 2023, is nearly identical, although it carries a distinctly pejorative name. '*Liquidity recycling* is the ratio between value of payments sent and liquidity usage' (BoE & PRA, p. 15). For illustration, if *a gross outflow* is ten times bigger than *a liquidity usage*, then there is *a liquidity recycling factor* of 10. In this way, the greatest economic power has been reduced to '*the level of liquidity recycling*' (ibidem).

The efficiency ratio at the system level is essentially the same as the previous two: '[...] intraday liquidity efficiency Q_s to be the ratio of aggregate payment values over aggregate intraday liquidity used at the system level. $Q_s \equiv P_s / L_s$. This ratio captures the value of payments that are made for each unit of intraday liquidity used. If system participants can meet their daily payment obligations with minimal liquidity usage, the ratio takes on higher values and the system is more liquidity efficient' (Kabadjova et al, p. 11). Here, the greatest economic power is subordinated to the '*minimization of liquidity usage*'.

The results of empirical research illustrate the level of efficiency of mediated money. In the UK's CHAPS, the efficiency ratio before the GFC 2007–9 averaged 15 times, and after the crisis fell to 11 times (Benos et al, p. 166). Static (stock) indicators of in-network efficiency, such as the ratio of *reserves to banks' assets*, show a greater range of oscillations. In Fedwire, from 8% (2010 and 2019) to 19% (2014 and 2021), which is primarily the result of oscillations in the expansiveness of monetary policy (Afonso et al, 2024, p. 13). These results show that the power of payments in network has not diminished, despite *conventional wisdom*.⁷

The method for *economizing* of liquidity is the most common synonym for the power of netting transactions in bank networks (for example, see Johnson et al). This economizing of funds creates the illusion of transactions without money. Interestingly, the flow of money remains obscured in the clearing-netting process ("implicit" transactions) and becomes visible to observers only in the

settlement phase (“explicit” transactions). Despite this, it should be understandable, at least intuitively, that in every clearing transaction our money, circulating via intermediaries, not *imaginary* money, but central bank money.

Clearing and settlement power in banking practice is often perceived as the magic of money transfers in banks’ books. And magic lending of deposit money. ‘But the English money is “borrowable” money. Our people are bolder in dealing with their money than any continental nation, [...] their money is deposited in a bank makes it far it more obtainable’ (Bagehot, p. 5).

In the economic literature, clearing and settlement power is defined as multiplication of deposits and loans. Monetary collapse during the Great Depression exposed and discredited this power as an uncontrolled multiplication of deposit money. Irving Fisher, a pioneer of modern monetary analysis, considered that the instability of demand deposits is the primary cause of booms and depressions, which is why he advocated a full cash reserves or 100% money (Fisher, p. 119–120). ‘The destruction of check-book money was not something natural and inevitable; it was due to a faulty system’ (ibid, p. 7). Similarly, Hayek saw clearing and settlement power as the ‘perverse elasticity of bank deposits’ and ‘the seat of the trouble’.⁸

Obviously, it is widely known that bank deposit business led to cyclical recessions and depressions, but it is also indisputable that it was the driving force behind the leading economies—from Venice and Amsterdam to London and New York.

The clearing and settlement power is vividly illustrated by the data from the world’s largest central bank—Federal Reserve Bank of New York, about the activities in Fedwire of the top 15 banks during the first 100 business days in 2020. These 15 banks were sending 76% of the dollar value of all payments sent by the top 100 entities. The same 15 banks held approximately 45% of the reserves held from the same 100 entities during the same period (Afonso et al, 2022, p. 7). By comparing the share of sent payments (76%) and reserves (45%), we get a coefficient of 1.69, meaning that the top 15 banks used reserves 69% more efficiently than the top 100 banks! Or conversely, to send the same value of payments, they required 40% less reserves compared to the top 100 banks. Clearly, a higher clearing level and scope induces even greater power of payments. A possible gradation of clearing, based on the criterion of its level and scope, is given below.

CLEARING LEVEL AND SCOPE

INTERNAL clearing

BILATERAL clearing

MULTILATERAL clearing

SYSTEM clearing

NATIONAL clearing

INTERNATIONAL clearing

It is clear that the distinction of clearing cannot be strict due to overlaps – for example, multilateral with system or system with national. The only pure clearing is internal, at the level of an individual

intermediary, i.e., a single bank. This basic clearing is characterized by the absence of other intermediaries and independence from the liquidity level of the intermediary itself, described by their stock-flow identities: $\sum \text{Inflow} = \sum \text{Outflow} \Rightarrow \text{Stock}(t) = \text{Stock}(t-1)$. These two characteristics eliminate settlement risk and make internal set-off the safest clearing after national clearing under the control of the central bank. As previously explained, the greatest clearing and settlement power is held by the national clearing system – a comprehensive network with the central bank as the supermediator without technical limits. The inflation, i.e., purchasing power of money, is the economic limit.

Consequently, the most comprehensive and important indicator of clearing and settlement power is the ratio of daily payment value to annual GDP. ‘In 2020, the Fedwire Funds Service handled a daily payment value of over \$3.3 trillion dollars, meaning that a sum equivalent to the (annual) GDP of the United States was turned over every 7 days or so’ (Afonso et al, 2022, p. 1). Although already hypertrophied relative to the needs of the real sector, this monetary power continues to grow unstoppably.

The evidence of the absence of technical limits in the expansion of clearing transactions using mediated money is provided below. For this purpose, a bilateral clearing model was developed, based on the BIS – BCBS practical example.

4 Evidence based on BIS – BCBS practical example

The Basel Committee on Banking Supervision (BCBS) at the Bank for International Settlements (BIS), ‘has developed a set of **quantitative tools** to enable banking supervisors to monitor banks’ intraday liquidity risk’ (BIS, 2013b, p. 1). To illustrate the use of these tools, the Basel Committee also provided *Practical example*, which served as the basis for the construction of our interbank payments model – the main proof of clearing and settlement power.

‘*Practical example* of the monitoring tools would operate for a bank on a particular business day’ BIS-BCBS was designed for two types of banks: 1. direct participant, and 2. bank that uses a correspondent bank. Substantially and numerically, both examples are identical (ibid, p. 13–14). For the description of clearing and settlement effects, it is also irrelevant to distinguish between payments for time-specific obligations and regular payments (ibid, p. 13). All details from the *BIS – BCBS practical example*, which were also used in our analysis of payments in the interbanking network, are listed below.

‘Details of the bank’s payment profile are as following: The bank has **300 units** of central bank **reserves** and **500 units** of eligible **collateral**. A(i) Daily maximum **liquidity usage**: largest **negative net** cumulative positions: **550 units**; largest **positive net** cumulative positions: **200 units**. A(ii) **Available intraday liquidity** at the start of the business day: 300 units of central bank reserves + 500 units of eligible collateral (routinely transferred to the central bank) = **800 units**. A(iii) **Total payments**: Gross payments **sent**: $450+100+200+300+250+100 = 1400$ **units**. Gross payments **received**: $200+400+300+350+150 = 1400$ **units**’ (ibid).

This *BIS – BCBS practical example* is schematic focused on an individual bank (**Bank A**), thus neglecting the nature of network payments. Therefore, our analysis introduces an additional bank (**Bank B**), taking into account the fundamental equation: *sent payment A = received payment B*, and vice versa. The result of such an extension of this simple model is presented below (Table 1).

Table 1 - Bank A (initial reserves 300 units) vs Bank B (initial reserves 300 units)

<i>Time</i>	<i>Sent</i>	<i>Received</i>	<i>Reserves</i>	<i>Credit</i>	<i>Sent</i>	<i>Received</i>	<i>Reserves</i>	<i>Credit</i>
07:00	450			150		450	750	
08:00		200	50		200		550	
09:00	100			50		100	650	
10:00	200			250		200	850	
11:00		400	150		400		450	
12:00		300	450		300		150	
13:00	300		150			300	450	
14:00		350	500		350		100	
15:00	250		250			250	350	
16:00	100		150			100	450	
17:00		150	300		150		300	
Total:	1,400	1,400			1,400	1,400		

Sources: BIS (2013b), p. 13-14, and author's calculation.

Both banks have the same *payment profile*: identical initial reserves (300 units), identical available intraday liquidity (800 units), and identical total payments (1,400 units). Only the payment dynamics throughout the business day differ, hence the usage of central bank reserves and intraday credit differs. Their *net cumulative positions*, negative and positive, are also different. More precisely, their signs differ: minus or plus (Table 1). 'For the calculation of the net cumulative position, 'payments received' do not include funds obtained through central bank intraday liquidity facilities' (ibid, p. 5).

The *BIS – BCBS practical example* is extremely simplified, and this derived model of bilateral intraday payments shares that trait. For instance, the assumed equality of sent payments and received payments within a single business day is an extremely rare occurrence, while typically there is some difference between them. The good side of this simple model of interbank payments is that it highlights the interdependence between the payer bank and payee bank and the fundamental principles of payments in network.

The initial distribution of available intraday liquidity is ideal: fifty-fifty. For certain reasons, Bank A sends more than half of the total intraday payments already by 10:00 (the first and largest payment of 450 units is not explained), while its received payments are almost four times smaller. For such early payments, it had to use intraday credit from the central bank. On the other hand, Bank B nearly tripled its initial reserves, achieving a noticeable concentration of liquidity. By the end of the business day, total payments were equalized, so reserves returned to the initial level. The beauty of this example is that it clearly shows how, in an RTGS system, early payment is penalized, while late payment is rewarded: Bank A had to use intraday credit, Bank B did not!

The most important proof is that all payments remained within the network, i.e., in bank books. Simply put, received payments are used by the bank for sent payments (so-called ‘liquidity recycling’), the missing amount is covered by intraday credit, while excess reserves are offered to other banks through the money market. All payments were executed with short-term credit support from the central bank, and both banks retained the same reserves as at the beginning of the day. This is not the alchemy of payments, but the clearing and settlement power held by all payment intermediaries. The power of mediated money.

Table 2 – Net cumulative positions – negative and positive (Bank A vs Bank B)

<i>Time</i>	<i>Sent</i>	<i>Received</i>	<i>Net</i>	<i>Sent</i>	<i>Received</i>	<i>Net</i>
07:00	450		-450		450	+450
08:00		200	-250	200		+250
09:00	100		-350		100	+350
10:00	200		-550		200	+550
11:00		400	-150	400		+150
12:00		300	+150	300		-150
13:00	300		-150		300	+150
14:00		350	+200	350		-200
15:00	250		-50		250	+50
16:00	100		-150		100	+150
17:00		150	0	150		0
Total:	1,400	1,400		1,400	1,400	

Sources: BIS (2013b), p. 13-14, and author’s calculation.

Net cumulative position (received payments minus sent payments, transaction-by-transaction), negative and positive, directs the use of available intraday liquidity. ‘The largest net negative position during the business day on the account(s), (i.e. the largest net cumulative balance between payments made and received), will determine a bank’s maximum daily intraday liquidity usage.’ Maximal net negative position Bank A (-550 units) and Bank B (-200 units) are within their available intraday liquidity, which means there is no liquidity risk. Conversely, if the largest net negative position were to exceed available intraday liquidity, there would be a danger of gridlock in payments. In such a case, it would be necessary to seek additional intraday liquidity sources. That is why banking supervisors continuously monitor any intraday liquidity shortfall.

The model sketched in Table 2 also clearly demonstrates the interdependence of sent and received payments in a bilateral interbank network and two fundamental rules:

Gross payments sent A = Gross payments received B, and vice versa and

Net negative cumulative position A = Net positive cumulative position B and vice versa.

The previously emphasized **the largest net negative** cumulative position (LNNCP) of Bank A necessarily creates **the largest net positive** cumulative position (LNPCP) of Bank B (abbreviations according to ECB, 2024). More precisely, ***LNNCP Bank A = LNPCP Bank B***, and vice versa. The conclusion is obvious: liquidity has not disappeared, but its distribution has significantly changed, with reserves concentrated in Bank B’s account. Therefore, the BIS-BCBS view of deposit outflows and similar phenomena is too narrow. The real question is where the

deposits flowed—specifically, which portion was transferred to other banks, and which portion left the banking sector (e.g., by purchasing government bonds and central bank securities in primary markets, or through tax payments). Most often, the majority of deposits remain within the banking sector; only the deposit-holding bank changes. This phenomenon results from the systematic suppression of cash from payment flows, which escalated dramatically in the 2010s. Consequently, an analysis of payments and settlement processes in the banking sector becomes not only as important as the investigation of the intraday liquidity of individual banks, but even more important.

The banking sector (B) is a set of banks (b). According to set theory, it follows that $b \in B$, and $\in$ is referred to as *the membership relation*. Mathematically, ‘all relevant facts about sets can be expressed in terms of the membership relation.’⁹ The BIS–BCBS practical example is presented without the membership relation—i.e., without relevant facts about the banking sector! By focusing on the intraday liquidity of an individual bank, the practical example neglects the essential membership relation within the banking sector.

Introducing a larger number of banks into the model does not alter the aforementioned principles of bilateral payments. Assuming there are no inflows or outflows of reserves into or out of the **banking sector (BS)**, and that intraday credit from the central bank is repaid by the end of the business day, the rules remain the same:

$$\text{Gross payments } \underline{\text{sent}} \text{ BS} = \text{Gross payments } \underline{\text{received}} \text{ BS},$$

$$\text{Net } \underline{\text{negative}} \text{ cumulative position BS} = \text{Net } \underline{\text{positive}} \text{ cumulative position BS}.$$

For the sake of analytical precision, *the net **negative** cumulative position* of the banking sector represents the aggregate of such positions across all individual banks, whereas *the net **positive** cumulative position* reflects the sum of all positive positions held by banks at a given point in time. While the absolute magnitudes of these positions fluctuate continuously throughout the business day, they remain perfectly offsetting in value, differing solely by sign—negative or positive. The same rule applies to **the largest net negative** cumulative position of the banking sector: $\text{LN}\underline{\text{NCP}} \text{ BS} = \text{LN}\underline{\text{PCP}} \text{ BS}$. By definition, their resultant is zero, providing further empirical validation of the inherent network effects of payment systems. This also reinforces the argument regarding the strong dependence between interbank payments.

In the presented model of interbank payments (Table 3), the banking sector is composed of Bank A and Bank B. The sector’s transactional relationship with the central bank during the payment process is primarily represented through two key variables: *reserves* and intraday *credit* for liquidity. Within this framework, the principal indicator of sectoral payment transfers is the volume of sent payments, which—by definition in this model—corresponds precisely to the volume of received payments. Table 3 below outlines the projected changes in these variables under three scenarios: initial sector reserves of **600 units** (as in Table 1), then reduced initial reserves of **300 units** (Bank A = 150 units + Bank B = 150 units), and finally, a scenario with no initial reserves - **0 units**. All projections are derived from data presented in the Basel Committee Practical example.

Table 3 - Banking sector: total initial reserves 600 units vs 300 units vs 0 units

<i>Time</i>	<i>Sent</i>	<i>Reserves</i>	<i>Credit</i>	<i>Reserves</i>	<i>Credit</i>	<i>Reserves</i>	<i>Credit</i>
07:00	450	750	150	600	300	450	450
08:00	200	600		400	100	250	250
09:00	100	650	50	500	200	350	350
10:00	200	850	250	700	400	550	550
11:00	400	600		300		150	150
12:00	300	600		300		150	150
13:00	300	600		300		150	150
14:00	350	600		350	50	200	200
15:00	250	600		300		50	50
16:00	100	600		300		150	150
17:00	150	600		300		0	0
Total:	2,800						

Sources: BIS (2013b), p. 13-14, and author's calculation.

A comparison of reserves and credit reveals that the sum of intraday credit determines the level of aggregate reserves, thereby confirming that these credits represent the most important source of external liquidity for the banking sector. This is most clearly demonstrated in the third scenario with zero initial reserves, where the relationship aggregate reserves = total credit holds true. This final example illustrates the extent of clearing and settlement power even in the absence of initial reserves.

The ultimate evidence of the superiority of payments in network lies in the fact that banks can sustain operations for several days, or even weeks, without borrowing from the central bank or accessing the money market, without sale of assets, and with minimal reserves. However, without incoming payments, they would not survive even half a working day. Put simply, incoming payments cover approximately 85–95% of a bank's outgoing payments.

5 Conclusion

The logic of clearing is based on the symmetry of payments, expressed as the equation: *sent payments* = *received payments* in network. The flow of money remains obscured in the clearing-netting process ('implicit' transactions) and becomes visible to observers only in the settlement phase ('explicit' transactions).

The only money that is created and circulated within a national network, as well as on all other levels of clearing (internal, bilateral, multilateral, etc.), is central bank money, denominated in national currency. The national clearing system is a closed payments network. The central bank is the supermediator – comprehensive and universal. Only thanks to such power was it possible for wholesale depositors to withdraw \$140 billion in uninsured deposits from the illiquidity-stricken Silicon Valley Bank in just two days in March 2023.

The clearing and settlement power is vividly illustrated by the data about the activities in Fedwire. 'In 2020, the Fedwire Funds Service handled a daily payment value of over \$3.3 trillion dollars,

meaning that a sum equivalent to the (annual) GDP of the United States was turned over every 7 days or so' (Afonso et al, 2022, p. 1).

Interbank settlement process has always relied on an acceptable settlement asset. The only settlement asset that all banks have accepted was and remains the central bank money or government money.

The most important proof from the *BIS – BCBS practical example* is that all payments remained within the network, i.e., in bank books. Simply put, received payments are used by the bank for sent payments (so-called 'liquidity recycling'), the missing amount is covered by intraday credit, while excess reserves are offered to other banks through the money market. This is not the alchemy of payments, but the clearing and settlement power held by all payment intermediaries.

Net cumulative position (received payments minus sent payments, transaction-by-transaction), negative and positive, directs the use of available intraday liquidity. The largest net *negative* cumulative position of Bank A necessarily creates the largest net *positive* cumulative position of Bank B. The conclusion is obvious: liquidity has not disappeared, but its distribution has significantly changed. Therefore, the BIS-BCBS view of deposit outflows and similar phenomena is too narrow. The real question is where the deposits flowed—specifically, which portion was transferred to other banks, and which portion left the banking sector. Most often, the majority of deposits remain within the banking sector; only the deposit-holding bank changes. By focusing on the intraday liquidity of an individual bank, the practical example neglects the essential membership relation within the banking sector.

A comparison of reserves and credit reveals that the sum of intraday credit determines the level of aggregate reserves, thereby confirming that these credits represent the most important source of external liquidity for the banking sector. This is most clearly demonstrated in the third scenario with zero initial reserves, where the relationship $\text{aggregate reserves} = \text{total credit}$ holds true.

The ultimate evidence of the superiority of payments in network lies in the fact that banks can sustain operations for several days, or even weeks, without borrowing from the central bank or accessing the money market, without sale of assets, and with minimal reserves. However, without incoming payments, they would not survive even half a working day. Put simply, incoming payments cover approximately 85–95% of a bank's outgoing payments.

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References

Afonso, Gara, Darrell Duffie, Lorenzo Rigon, and Hyun Song Shin (2022), How Abundant Are Reserves? Evidence from the Wholesale Payment System, *Staff Reports no. 1040*, FRB of New York, November 2022.

Afonso, Gara, Domenico Giannone, Gabriele La Spada, and John Williams (2024), Scarce, Abundant, or Ample? A Tyme-Varying Model of the Reserve Demand Curve, *Staff Reports no. 1019*, FRB of New York, Revised April 2024.

Bagehot, Walter (1896), *Lombard Street: A Description of the Money Market*, London: Kegan, Paul, Trench & CO. Ltd.

Benos, Evangelos, Rodney Garratt, and Peter Zimmerman (2014), The role of counterparty risk in CHAPS following the collapse of Lehman Brothers, *International Journal of Central Banking*, Vol. 10, No. 4, December 2014.

BIS (2013b), Monitoring tools for intraday liquidity management, Basel Committee on Banking Supervision, Bank for International Settlements, April 2013.

BIS (2023), Report on the 2023 banking turmoil, Basel Committee on Banking Supervision, Bank for International Settlements, October 2023.

BoE & PRA (2023), Pillar 2 liquidity, *Statement of Policy*, Bank of England and Prudential Regulation Authority, December 2023.

Clapham, John (1970), *The Bank of England: A History, 1694-1914*, Volume I - II, Cambridge University Press.

Fisher, Irving (1936), *100% Money*, New York: Adelphi Company.

Hayek, Friedrich (1937), Monetary nationalism and international stability, London: Lognmans.

Jevons, Stanley (1875/1896), *Money and the Mechanism of Exchange*, New York: D. Appelton and Company.

Johnson, Kurt, James McAndrews and Kimmo Soramaki (2004), Economizing on liquidity with Deferred Settlement Mechanisms, *FRBNY Economic Policy Review*, FRB of New York, December 2004, pp. 51-72.

Kabadjova, Biliana, Anton Badev et al (2023), Intraday liquidity around the world, *Working paper No 1089*, Bank for International Settlements, April 2023.

Keynes, John Maynard (1930b), *A Treatise on Money – Volume II – The Applied Theory of Money*, London: Macmillan and Co.

Leigh-Pemberton, Robert (1992), Developments in wholesale payments systems, *Quarterly Bulletin*, Volume 32, Number 4 (November), Bank of England, pp. 449-457.

Norman, Ben, Rachel Shaw and George Speight (2011), The history of interbank settlement arrangements: exploring central banks' role in the payment system, *Working Paper* No. 412, Bank of England, June 2011.

¹ For instance: Peter Rose and Sylvia Hudgins (2005), *Bank Management and Financial Services*, Seventh Edition, McGraw – Hill; Frederic Mishkin (2007), *The Economics of Money, Banking and Financial Markets*, Eighth Edition, Pearson; or Pierre Siklos (2002), *The Changing Face of Central Banking – Evolutionary Trends Since World War II*, Cambridge University Press.

² ‘In time, the formal processes put in place by clearing house allowed for the introduction of multilateral netting, whereby all the banks that were short overall for the day would pay in their net position and the clearing house would pay out to each long bank. [...] Thus, the Bankers’ Clearing House in London settled on a multilateral basis from 1841 onwards’ (Norman et al, p. 12).

³ ‘At last, in May of 1864, the Governor approached the Bankers’ Committee through John Lubbock its Secretary, with a proposal that the Bank should “enter the clearing”. Delegates met and the business was settled promptly. “Articles on the Bank” in bankers’ hands were to be paid in as at present, and credited at once; the Bank, that is, was in the clearing “on one side only”. Cheques on clearing bankers in the Bank’s hands were to be passed through the clearing. “Transfer cheques” – that is, cheques drawn on a banker’s account at the Bank – were to be considered as paid, unless they were returned on presentation” (Clapham, II, p. 251).

⁴ Alan Greenspan (1998), The globalization of finance, *Cato Journal*, Vol. 17, No. 3, p. 247.

⁵ ‘[S]ettlement in modern-day monetary systems ultimately occurs in central bank money, so that central banks stand at the centre of the network of clearing and settlement arrangements in their currency’ (Norman et al, p. 19).

⁶ ‘On 9 March, SVB lost over \$40 billion in deposits, and SVBFG management expected to lose over \$100 billion more on March 10. This deposit outflow was remarkable in terms of scale and scope when compared with other episodes of banking stress (see Box A). In response to these actual and expected deposit outflows, SVB failed on 10 March, which in turn led to the later bankruptcy of SVBFG’ (BIS, 2023, p. 7).

⁷ ‘In the era of large central bank balance sheets, it has been conventional wisdom that the reliance of banks on their incoming payments to make outgoing payments would no longer apply because banks hold abundant reserves at their central banks. However, we find that, even in the era of “ample” reserves, the amount of payments that a bank makes in a given minute depends significantly on the amount of payments that it has received over preceding minutes, indicating a high degree of dependence between incoming payments and outgoing payments’ (Afonso et al, 2024, p. 1).

⁸ ‘The seat of trouble is what has been very appropriately been called the perverse elasticity of bank deposits (L. Currie, 1934, p. 130) as a medium of circulation, and the cause of this is that deposits, like other forms of “credit money”, [...]’ (Hayek, p. 130).

⁹ Just, Winfried and Martin Weese (1995), *Discovering modern set theory. I – The Basics*, American Mathematical Society, p. 1.