Liquidity-Driven Risks to Large Valued Payments

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Abstract

During particularly stressed financial or macroeconomic circumstances, banks' access to liquidity can become severely restricted. The recent financial crisis demonstrated this phenomenon all too plainly, when, in a climate of fear and uncertainty, both the interbank and international money markets ceased to function in a meaningful manner. Liquidity shortages can potentially create problems for a bank's ability to meet its outward intraday payments obligations on the TARGET2 real-time gross settlement system. Such a situation not only has negative implications for the respective bank but could also produce contagion effects for the TARGET2 system as a whole. In order to provide increased clarity regarding liquidity driven risks to large value payment systems, the Central Bank of Ireland has developed a 'liquidity buffer' indicator for the domestic credit institutions. The initial focus of this project centred primarily upon the development of an 'early warning' system, capable of identifying TARGET2 liquidity issues as they occurred in real time. However, during the development of such a platform, the analysis has also presented a means from which it is possible to derive a proxy for the level of risk banks detect in their environment. The analysis undertaken reveals that the Reserve Requirement (RR) plays an important role in how banks formulate their liquidity management strategies throughout the maintenance period. In times of increased uncertainty banks appear willing to hold excess liquidity, at a greater expense, in order to be guaranteed access to liquidity towards the latter half of the maintenance period. In a similar fashion, during a period of stability or relative certainty, banks do not choose to maintain excess liquidity on the TARGET2 platform, implying a degree of increased confidence in accessing liquidity when they require it later in the maintenance period. In this sense we can, to some degree, infer the degree of risk a bank perceives to be present in its immediate environment, by examining the respective institutions' liquidity management strategy over the maintenance period. In a broader fashion, the indicator also serves as a tool from which the Central Bank of Ireland can monitor banks' liquidity position with increased precision.

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1. Introduction

The objective of this article is to examine the area of funding liquidity risk and the associated implications for payment systems. The analysis aims to derive a framework that would help to calibrate the risks of liquidity constraints spilling over to payments and causing gridlock in the wholesale payments system.

The volume of transactions which interbank settlement systems handle on a daily basis is very impressive. TARGET2 processes a daily flow of transfers amounting to about 17 per cent of annual euro area nominal GDP. For the US, the equivalent figure for Fedwire and CHIPS together is about 28 per cent (see Baglioni, 2006).

A deficiency of liquidity can prevent a participant in the payment and settlement system from settling its obligations in real time as is facilitated by real-time gross settlement (RTGS) systems or at the end of the day as is typically the case in deferred net settlement (DNS) systems. Such a failure can give rise to a chain reaction in which participants depending on incoming payments, which have failed, are unable to honour their own outgoing payments obligations. Spill-over effects could cause the large-value payment system to become gridlocked. Of course, if participants held sufficient amounts of liquidity then this type of a collapse in the system would be obviated. However, as the recent financial market crisis amply demonstrated, under stressed conditions, liquidity can become both extremely scarce and expensive. In the limiting case, the market seizes up completely, an event also experienced during the recent financial crisis. Even in such extreme circumstance, there is typically still plenty of liquidity in the system in the aggregate but it simply does not circulate. It is not, therefore, just the total amount of liquidity in the system but its highly skewed distribution across market participants which is a key concern. The payments oversight function at the Central Bank of Ireland therefore needs to be in a position to assess the relative pressures of liquidity supply and demand facing individual banks.

There is therefore a trade-off between liquidity cost and availability on the one hand and settlement risk on the other and it is understandable that this trade-off is a major concern of public policy. It is a special concern for central banks since the dominant settlement instrument in large-value payments systems is issued by central banks, i.e., central bank money. Central banks have therefore been at the forefront of efforts to promote safe settlement systems.

The relationship between payments and funding liquidity risk is two way. Payments can affect funding liquidity risk in a number of ways. The degree of sophistication of payments technologies in operation can have a big effect. A transition from paper-based payments to dematerialised electronic payments has the benign effect of facilitating the compression of the time interval between a transaction being initiated and the settlement of that transaction, with finality if deemed necessary. For example, the shorter this interval of time, the smaller the funding risk is, i.e., the smaller the chances that an incoming payments obligation will not be capable of being honoured simply by virtue of the fact that the probability of an adverse event is less, the smaller the interval of time within which it can occur. In addition, RTGS has the effect of increasing the velocity of circulation of the settlement medium (central bank money). In principle, it can do so without limit. This is because the funds made available in the settlement of any one gross transaction by the payer are immediately made available again for the settlement of another transaction by the payee.

In this respect, real-time gross settlement would have ameliorated liquidity funding risk by effectively eliminating the risk arising from delay due to this time interval. However, it also, at the same time, increased liquidity funding risk by virtue of the fact that each individual payment has to be settled separately and adequate funds have to be available to meet each of these individual payments. Specifically, the payee bank must have sufficient liquidity at its disposal to honour its obligations in the payments system. Not only this, the liquidity in question has to be immediate, or zero maturity, liquidity. Although the concept of liquidity is widely used, it covers a whole array of financial assets of varying maturities. However, for liquidity to be a settlement medium it has to be

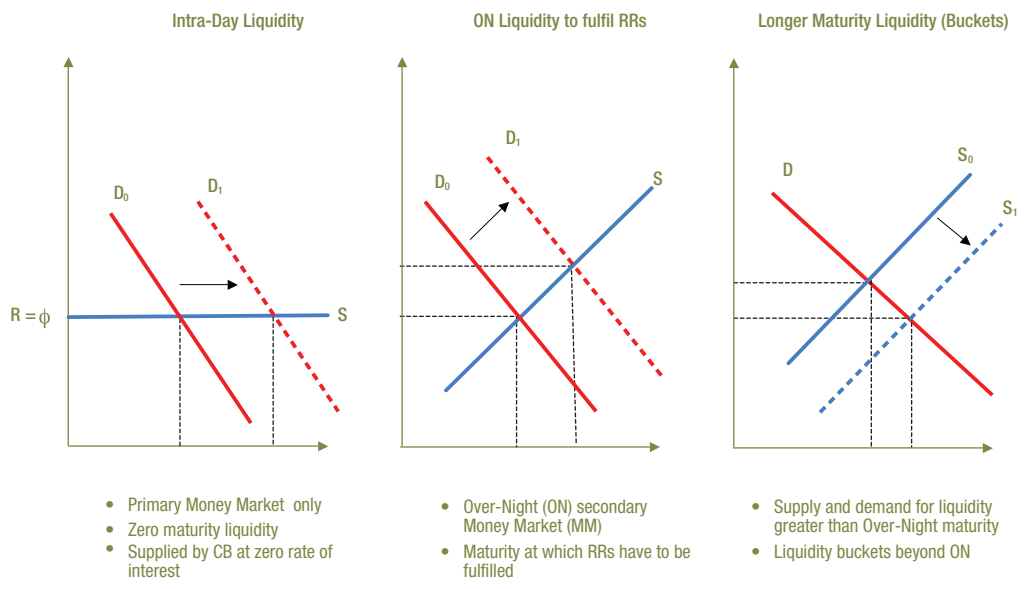
available instantly. A failure to settle is a real-time concern. A framework is therefore necessary to allow an overseer to detect if the relevant processes are, or are in danger of, going awry.

2. Liquidity Concepts

In the euro area there is no market for intra-day liquidity. This is because the ECB's operational framework is designed to supply central bank money in infinitely large amounts to bank counterparties in the money market at zero rate of interest. The only condition that needs to be respected is that counterparties have to be financially sound and have adequate collateral, which has to fulfil the eligibility criteria in the ECB's *General Documentation*. The intra-day supply and demand for liquidity are therefore likely to be as depicted in the first panel in Figure 1. If banks participating in the wholesale payments system have adequate eligible collateral then they can never be short of liquidity. The Eurosystem therefore always acts to ensure that there is a sufficient supply of the settlement medium, i.e., zero maturity central bank money, to lubricate the payments system.

The middle panel of Figure 1 reflects the supply and demand for overnight money placed with the central bank. This is a normal secondary market with an upward sloping supply schedule. This market is special because it is at this overnight maturity that the bank has to meet its statutory reserve requirement obligations. We denote the amount of liquidity the bank needs to hold in its account on an end of day basis so as to satisfy the reserve requirement over the maintenance period as the target level of reserves. Note that any surplus in its account at the end of the business day automatically becomes overnight liquidity and therefore contributes to fulfilling the reserve requirement target for the day. If this would not be sufficient to meet the end-of-day target level, it would have to borrow in the overnight market at some positive rate of interest. Alternatively, it could liquidate financial assets it holds in the longer maturity buckets for cash to deposit at the central bank overnight (see right-hand panel in Figure 1). However, converting longer-term maturity financial assets into payment systems liquidity (i.e., funding) exposes the bank to micro liquidity risk. Since both of these strategies are costly, with a normally upward sloping money market yield curve, it would not (in normal circumstances) be profitable for a bank to hold liquidity in excess of the requirement with the central bank. It would also be incentivised to manage its intra-day liquidity more efficiently.

Figure 1: Liquidity Supply and Demand



It is clear from the next section of the paper that the larger Irish banks do manage their liquidity more actively and possibly more efficiently than some of the smaller Irish clearing banks. It would appear that some of the latter employ the simple strategy of just maintaining enough overnight liquidity in their account at the end of each day so as to satisfy the averaging requirement for the maintenance period.

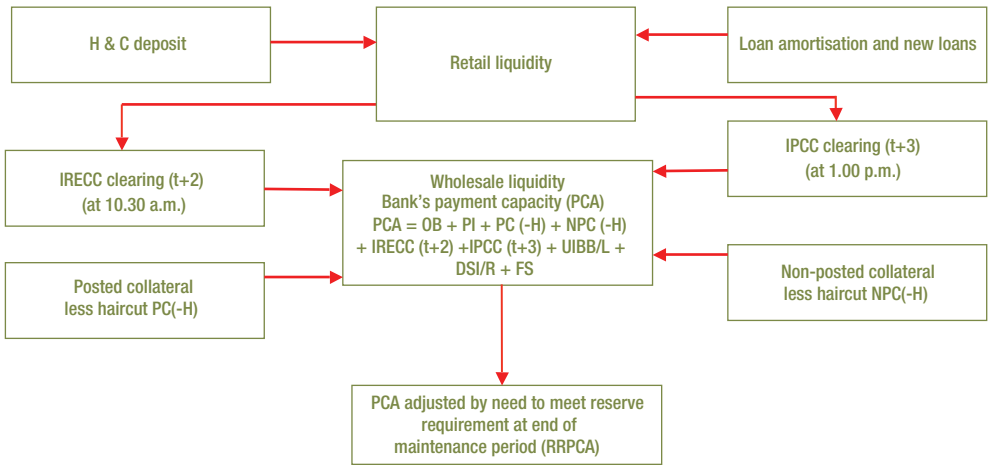
The operations of the Eurosystem have the effect of pre-empting the emergence of any secondary market in central bank money during the day. Indeed, to ensure that the system was sufficiently supplied with liquidity during the recent crisis, the ECB liberalised its definition of eligible collateral. It could be said that the Eurosystem's operational framework is well designed to minimise funding liquidity risk in the payments system.

Up until just before the start of the recent financial crisis, it was deemed highly unlikely that a bank participating in the wholesale payments system could ever encounter a shortage of the settlement medium. As just noted, this is mostly due to the way in which operational frameworks were designed, especially that of the Eurosystem. The likelihood of domino effects was considered very remote. This is no longer so. Considering euro area banks were seen to have hoarded vast amounts of central bank money, much of the limited supply of eligible collateral was already tied up in the Eurosystem. This consideration has to be added to the fact that the market value of much of the eligible collateral available to the banks participating in the euro area money market had been eroded following the collapse of financial markets. This means that banks can run out of eligible collateral and therefore may be unable to tap the central bank for funding. They may not, accordingly, be able to meet their requirements in the payments system. Domino effects cannot therefore be dismissed even in real-time gross settlement systems.

3. Intra-day Payment Capacity and Payment Obligations

Figure 2 gives a comprehensive picture of the various sources of an Irish clearing bank's payment capacity in real time. It shows the sources of retail and wholesale liquidity and how these relate to each other. In the short run, retail liquidity is determined by household and corporate (H&C) demand for money (predominantly a demand for bank deposits). New loans granted along with existing loan amortisations also play a part in determining retail liquidity availability.

Figure 2: Sources of a Bank's Payment Capacity



Electronic funds transfer (EFT) is the electronic infrastructure through which electronic payments are made. The IRECC ''Rules for Clearing'' govern the process by which payments are made and cleared. The net obligations of IRECC participants are settled via the TARGET2 system. The EFT system in Ireland operates on the basis of a two-day cycle. The settlement process is completed (with finality) when the settlement accounts of each of the participants at the Central Bank are debited or credited as appropriate. Payments via the EFT infrastructure impact on the bank's position at the Central Bank at 10.30 a.m. after a two-day delay from when the payment was initiated. The settlement process for cheques via IPCC is similar but mostly analogue with the entire process, including the correction of any errors, completed by 1.00 p.m. with a three-day lag from the day a payment was initiated.

Bringing all the sources of real-time liquidity together, we see that the overall payment capacity (see middle panel in Figure 2) available to an Irish clearing bank at any time during the day depends on:

(1) the bank's opening balance at the central bank (OB) at the start of the day; plus

(2) Payment inflows during the day (PI), reflecting high-value transactions between financial institutions arising from their involvement in financial markets; plus

(3) whatever liquidity becomes available from the retail settlement during the day [i.e., IRECC (t + 2) and IPCC (t + 3)]; plus

(4) eligible collateral posted less the appropriate haircut [PC(-H)]; plus

(5) eligible collateral not posted less the appropriate haircut [NPC(-H)]; plus

(6) unsecured wholesale (mostly interbank) borrowing/lending (UIBB/L); plus

(7) debt securities issued, minus debt securities redeemed (DSI/R); plus

(8) liquidity garnered from the sale (in extreme cases, fire sale) of financial and other assets (FS).

The bank can also borrow in the private repo market. However, the potential for this depends on the collateral available to the bank and this is already captured by the two collateral variables noted. To avoid double counting, it is not noted explicitly in the flow diagram in Figure 2. A bank can, of course in principle, borrow or lend on the unsecured inter bank market (UIBB/L) or can issue or redeem debt (DSI/R). Although, as already noted, there is no intra-day inter bank money market in the euro area, funds that are borrowed at longer maturities and added to the bank's account at the Central Bank are, in principle, available to discharge obligations arising in the wholesale payments system within the business day.

A bank's payment capacity (PCA) is therefore comprised of its position at the Central Bank at the start of the business day, payments due to it during the day, its market borrowings along with its net borrowing capacity during the day from the Central Bank. It can, therefore, come from both wholesale and retail sources. However, the volumes coming from retail sources *in real time* are likely to be small in relative terms and for any particular bank, should be close to zero in the medium term. Note also that the value of collateral has to be adjusted to take into account the haircut applied by the ECB according to the specification in the *General Documentation* — the value of the liquidity extended by the ECB is less than the face value of the collateral provided as security.

It is also likely that the headline payments capacity (PCA) as indicated in the flow chart will be comfortably in excess of the bank's payments obligations (PO, i.e., payments due from the bank and debited to its account at the Central Bank) in most circumstances. However, the final amount represented by PCA in Figure 2 does not fully represent the bank's actual payments capacity. This is because a certain amount of it may not be available for making payments since it has to be held in the TARGET2/Reserves account at the Central Bank so as to meet the statutory reserve

requirements of the ECB's operational framework. This means that PCA has to be adjusted to give a more accurate picture of funds available in real time to effect payments (i.e., RRPCA). This adjustment can only be done on the basis of a number of assumptions. The following section deals with this issue.

4. Adjusting for Reserve Requirements

The amount of liquidity available to the bank for meeting payment obligations is, potentially, considerably less than that in its account at the Central Bank. This is because the bank has to meet its statutory reserve requirement specified in the *General Documentation* governing the ECB's operational framework. The ECB requires credit institutions to hold minimum reserves with the Central Bank within the framework of the Eurosystem's minimum reserve system[1]. The amount of minimum reserves to be held is determined in relation to the bank's reserve base. The minimum reserve system allows credit institutions to make use of averaging provisions. This implies that compliance with reserve requirements is determined on the basis of the average of the end-of-calendar-day balances held by the bank in its TARGET2/reserves account with the Central Bank over the relevant maintenance period. The reserve requirement is 2 per cent of the bank's reserve base (RB). Although the broad purpose of the minimum reserves system is to help stabilise money market interest rates and to create or enlarge a structural liquidity shortage, the funds held in the account can also be used for making payments provided the statutory average minimum is respected.

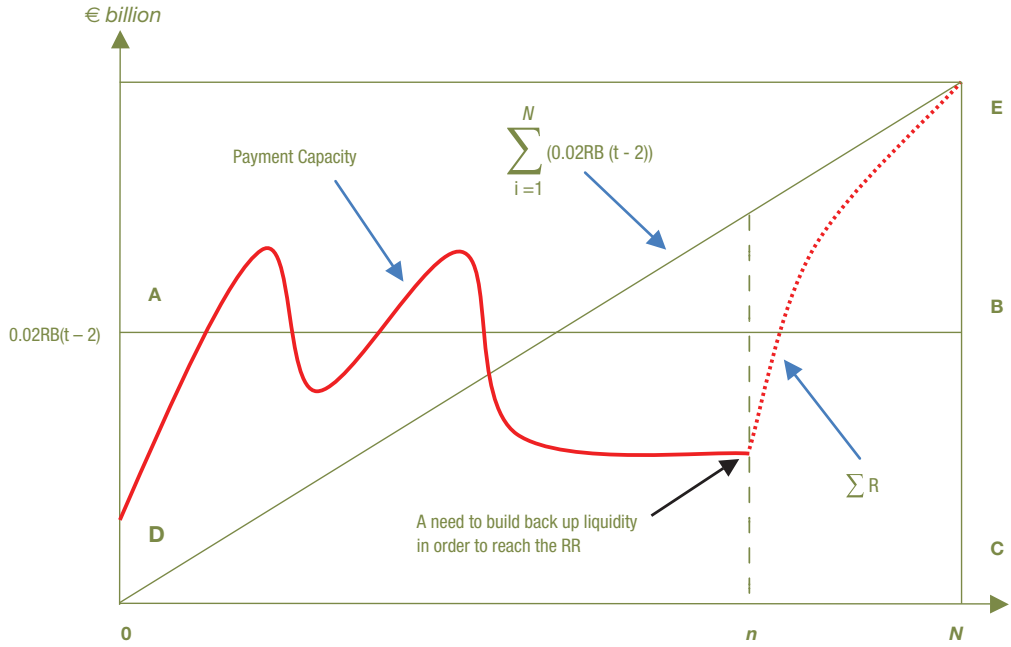
This could mean, for example, that a bank could use its reserve account to the full in the early stages of the maintenance period but in the latter half of the period it will have to start rebuilding its position with the Bank so as to fulfil its reserve requirement on average over the maintenance period. Alternatively, a bank could front-load its TARGET2 account, allowing it to run down its liquidity position over the maintenance period, whilst maintaining a sufficient average to fulfil the reserve requirement. Although 'frontloading' is clearly an option, it is more expensive for banks, relative to 'backloading' the reserve requirement. In a situation of extreme uncertainty (as in the recent crisis) frontloading over the maintenance period makes sense, as banks are willing to incur a higher cost in order to be guaranteed an ample supply of liquidity. In times of increased stability and certainty, banks can manage their liquidity needs more cost effectively, confident that required liquidity will be readily available. A risk-adverse credit institution would tend to frontload in the stressed economic environment that has prevailed since the start of the financial crisis.

The reserve base is close to those deposits of all types that qualify for inclusion in the ECB's M3 money aggregate definition. The balance sheet data referring to the end of a given calendar month are used to determine the reserve base for the maintenance period starting in the calendar month two months later. The *General Documentation* gives the example where the reserve base calculated from the balance sheet at end of February would be used to calculate the reserve requirement to be fulfilled by credit institutions in the maintenance period beginning in April.

Banks' liquidity management strategies for fulfilling their reserve requirement may differ and, accordingly, the amount of funds available for payments purposes may also differ. Indeed, the intra-maintenance period pattern of banks' accounts with the Central Bank clearly point to differences across banks in the way they manage their liquidity. Short of any knowledge of what these strategies are (however, see below for a plot of two representative banks' daily account movements which clearly indicate differences) we can only estimate when the reserve account is, and is not, usable for payments purposes. To do this, we postulate a benchmark according to which banks might fulfil the reserve requirement. We then compare this with the actual pattern of fulfilment. If the actual is above the benchmark in, say, the second half of the maintenance period then the bank would retain considerable scope for using

[1] The legal framework for this system is laid down in Article 19 of the Statute of the ESCB/ECB, Council Regulation (EC) No. 2531/98 of 23 November 1998 concerning the application of minimum reserves by the ECB and Regulation (EC) No. 1745/2003 of the ECB on the application of minimum reserves (ECB/2003/9).

Figure 3A: Fulfilling RR and Payment Capacity – *the case of backloading*



its TARGET2 account for payments. If it is equal to, or less than, the benchmark then the flexibility is less and the bank may have to build up its liquidity before the end of the maintenance period in order to meet the requirement. This means of course that the amount of funds in its Central Bank account is not a good indicator of payments capacity (PCA). It needs to be adjusted downwards. This is done using the following method.

In the benchmark we assume that the requirement is fulfilled smoothly throughout the maintenance period, i.e., that the bank adds 0.02RB(t-2) to its end-of-business-day reserve account at the Central Bank each day. The cumulative fulfilment at any point of time (i) would therefore be:

$$\sum_{i=1}^{N}[0.02RB\ (t - 2)]$$

i = 1(start),.....,n,.....N (end).

Cumulative actual reserves held at the Central Bank at the end of the business day are the sum of these for each previous day in the current maintenance period, i.e.:

$$\sum_{i=1}^{N} R\ (t + i)$$

i = 1(start),.....,n,.....N (end).

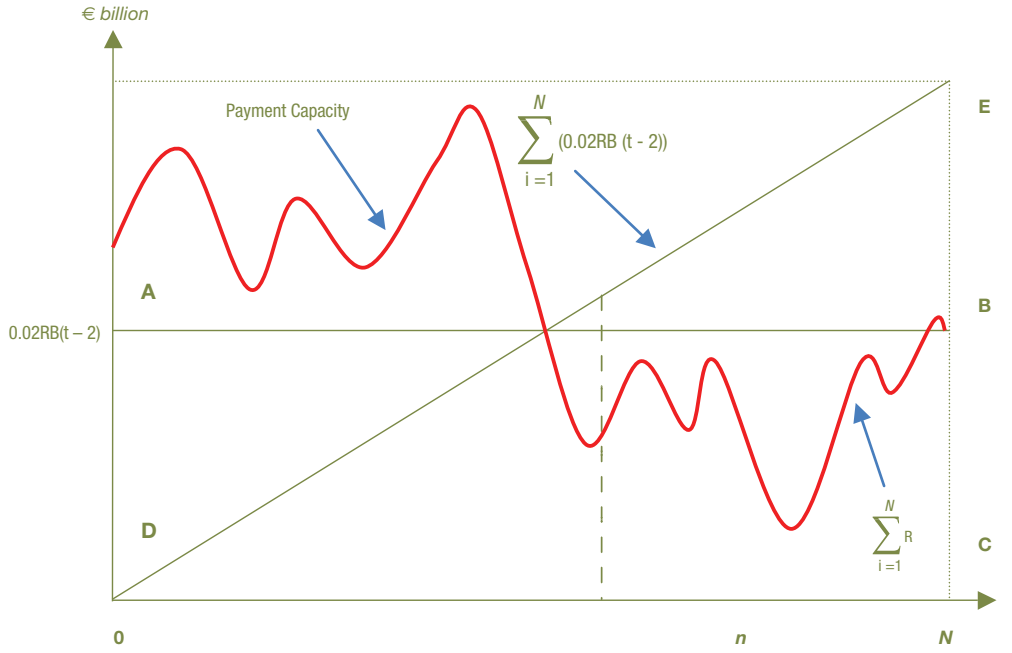
R is the actual level of the reserve balance at the end of the calendar day for every day of the maintenance period. The situation is illustrated in the accompanying Figure 3A, 3B and 3C.

Figure 3A illustrates a stylised version of the case in which the bank backloads the build up of its account to meet the requirement. In this case the bank has to build up its account in the latter half of the period to meet the averaging requirement. Since the funds have to stay in the account overnight to qualify as required reserves, some of these funds may not be usable to meet incoming payment obligations. The account has therefore to be adjusted downwards to take account of this fact and to get the true payment capacity for the bank.

For the bank to meet the average of 0.02 RB (t—2) for each end of day in the maintenance period, it would have to accumulate at a rate [0.02 RB (t—2)] each end of day over the full maintenance period (i.e., triangle DEC, which is the same as the rectangle ABCD).

In order to estimate the part of the reserve balance which is available for payments purposes we also have to make some assumption about when in the maintenance period banks are likely to start adjusting their

Figure 3B: Fulfilling RR and Payment Capacity - *the case of frontloading*



reserve balance to meet the average reserve requirement for the full period. The assumption we are making is the following: banks only start adjusting when they know the reserve base from the previous period [RB (t — 2)], i.e., mid-way through the current maintenance period. Before this banks are assumed to use the reserve base freely to meet payment commitments.

After the mid-point of the maintenance period, it is assumed that banks start making the correction to the account balance (AB) required to meet the averaging over the full period. The part of the account balance available to the bank for payments (ABA) is therefore:

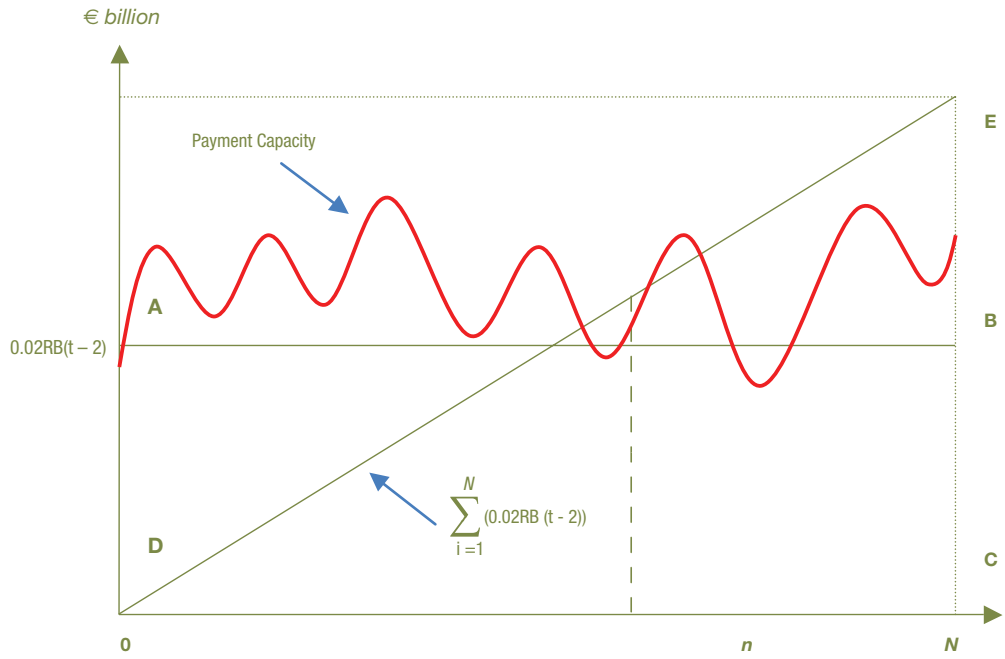
$$ABA = \sum_{i=1}^{N} R - \left(\sum_{i=1}^{N} (0.02RB\ (t - 2))\right)$$

This is for all i time periods where i = N/2, where N is the total number of days in the maintenance period. The need to fulfil the reserve requirement in the latter half of the maintenance period starts to be a drain on payment capacity. So, in the first half of the maintenance period, it is assumed that the total account (AB) is available for payments while in the second half the amount available is given by the right-hand of the above equation. If this is negative, as is likely, then not only is none of the account available for payments but the bank has to borrow to build up the account to meet the reserve requirement.

It is notable that all payments made during the day have, as we have noted already, to be made with zero maturity liquidity. However, the liquidity needed to fulfil the reserve requirement has to be a minimum of overnight maturity. Of course, intra-day liquidity that is still in the TARGET2/reserve account at the end of the calendar day, after all intra-day borrowings from the Central Bank have been repaid, becomes overnight if not used. So, as illustrated in Figure 2 above, there is a clear link between intra-day liquidity and overnight liquidity. A bank may have to refrain from using its intra-day liquidity for payments so that it can reach its target overnight liquidity so as to be able, in turn, to respect the statutory average requirement at the end of the maintenance period.

Figure 3B displays a stylised representation of the case in which a bank fulfils the reserve requirement by frontloading its TARGET2 account at the Central Bank. Fluctuations in the account are well in excess of the required average in the early part of the maintenance

Figure 3C: Fulfilling RR and Payment Capacity - *the case of consistent over fullfilment*



period and even more in excess of what would be required by a perfectly smooth fulfilment on a daily basis. This allows the bank considerable scope for running down its account in the latter part of the maintenance period. The bank's payment capacity would therefore be ample going into the second half of the period. Of course it has to be recognised that its payment capacity in the early part of the maintenance period may have been compromised by the bank daily targeting of an ambitious level of reserves. Therefore, the TARGET2 account has to be adjusted downwards to obtain the bank's true payment capacity in the large-value payment system. Without this adjustment the account gives a misleading impression of the bank's payment capacity.

This frontloading pattern of fulfilment may be specific to recent financial crisis. Against a background of pronounced financial instability and dysfunctional money markets, banks were not confident of being able to fulfil their reserve requirement if they left it to the end, or towards the end, of the maintenance period. They ran the risk of being sanctioned by the Eurosystem. They may therefore be inclined to fulfil the reserve requirement early in the maintenance period. This is what Figure 5 now seems to be illustrating. It is therefore supportive of the idea that in an uncertain financial markets environment banks will tend to frontload their reserve holdings.

Moreover, in a situation whereby Irish banks are heavily reliant on ECB funding, it is highly unlikely that they would do anything (such as not respecting the ECB's own operational framework) to jeopardise the continuation of this support.

Finally, Figure 3C shows the stylised case in which the bank over-fulfils consistently the reserve requirement. This situation is fairly straightforward. The headline figure may not need to be adjusted since the bank has a surplus after fulfilling its reserve requirement and is therefore unlikely to be constrained in its use of the TARGET2 account for payments purposes.

5. Payment Capacity, Payment Obligations and Development of a Liquidity Buffer Indicator

This section outlines the development of a 'liquidity buffer' indicator for domestic credit institutions active on the TARGET2 real-time

gross settlement system. An intra-day analysis utilising real-time hourly payments data has been conducted by the Central Bank for all six domestic Irish credit institutions. The end product of this analysis is to define the liquidity buffers available to Irish banks on the TARGET2 platform at a given point in time (hourly time brackets). The indicator developed may prove useful as part of an early warning system, in the event that liquidity buffers held on the TARGET2 system fall below an assigned threshold limit on an intra-day basis. In addition, examination of the liquidity indicator over time represents a valuable tangential tool in gauging the relative health and resilience of domestic credit institutions.

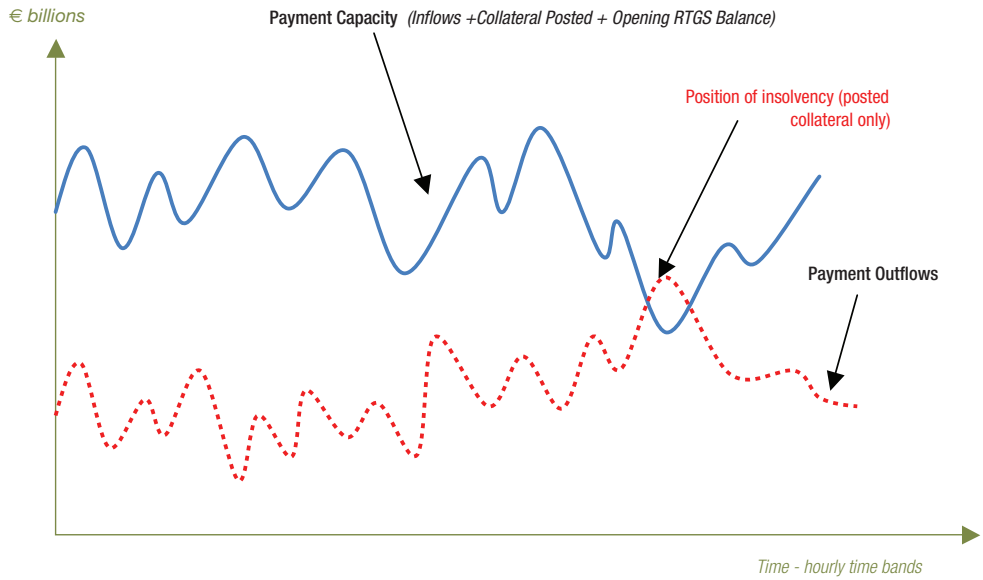
5.1 Intra-day Payment Capacity/Development of an Indicator

In terms of creating a TARGET2 liquidity buffer indicator, domestic credit institutions' payment capacity at any specific point in time is assumed to be comprised of the following four elements:

1. the bank's opening balance at the Central Bank at the start of the day. This equates to the opening balance of an institution's TARGET2 RTGS account;
2. eligible collateral posted to the TARGET2 platform;
3. payment inflows executed during the day; and
4. available eligible collateral not already allocated to TARGET2 or elsewhere.

For the purposes of this exercise, we consider only three elements of an institution's payment capacity in order to construct the 'liquidity buffer' indicator (partially equating to the 'wholesale liquidity' box in Figure 2). Owing to significant data limitations and recognised problems with existing data, available eligible collateral not already allocated to TARGET2 is not considered in the formulation of the liquidity buffer. This restriction implies that the liquidity indicator measures liquidity buffers on the TARGET2 platform in isolation. For example, at the point of insolvency in Figure 4, an institution may have the capacity to post additional collateral to the payments system in order to boost its payment capacity. Nevertheless, the need to post additional collateral in order to meet daily payment obligations can only be viewed as a significant liquidity management failure at a large domestic credit institution.

Figure 4: Intraday Payment Capacity



In order to obviate any possibility of the bank not being able to meet any debits to its account at the Central Bank, the sum of the above four items comprising the bank's payment capacity (PC) has to be strictly greater than payment outflows (PO) at all times throughout the day. Therefore what we need to know is whether this payment capacity would ever be likely to be a constraint on a bank's ability to honour payment outflow instruction as they are submitted via TARGET2. (See Figure 4 which illustrates the case.)

There are two aspects to this. The first issue is the average level of the bank's payment capacity relative to the average payment outflow instructions. It is likely that the above inequality would be invariably respected. However, when the second issue of volatility is added to the picture, it is not inconceivable that PO could exceed PC.

Internationally, commentators have argued that banks typically hold only a small amount of cash and reserves in order to meet their payments' needs. Instead banks rely heavily on incoming payments to meet outward obligations, implying a very high velocity of circulation amongst credit institutions. If the velocity of circulation were to slow down, as it has done in the recent financial crisis, then banks may become increasingly vulnerable to defaulting on payment obligations. Therefore, during a time of financial crisis the payments system may become more fragile, increasing the likelihood that banks may suffer impairments emanating from the payments system.

5.2 TARGET2 'High Frequency' Intra-day Analysis[2]

A specific credit institution's TARGET2 liquidity buffer is defined as the difference between the total inflow series (payment capacity) and the cumulative payment outflow series from the beginning to the close of business. Total inflows are calculated as the sum of the opening RTGS account balance, the value of collateral posted to TARGET2 and the cumulative payment inflows received throughout the day. Payment inflows and outflows are aggregated to an hourly frequency, ranging in hourly brackets from before 7.00 a.m.-8.00 a.m. to 5.00 p.m.-6.00 p.m. at the close of business. During each hourly segment, the total inflow series must be greater than the cumulative payment outflow series to facilitate a positive liquidity buffer.

[2] For illustrative purposes the analysis presented relates solely to a large domestic bank, the indicator has also been created for all six domestic credit institutions active on TARGET2.

Chart 1: Intraday Payment Capacity & Cumulative Outflows – Large Domestic Bank (One Day Sample: 3rd June 2009)

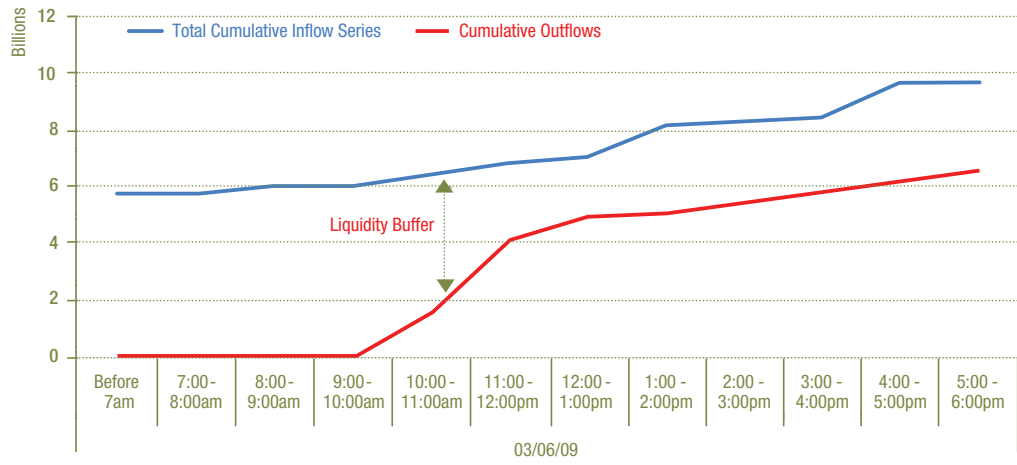


Chart 2: Liquidity Buffer Indicator — Large Domestic Bank (One Day Sample: 3rd June 2009)

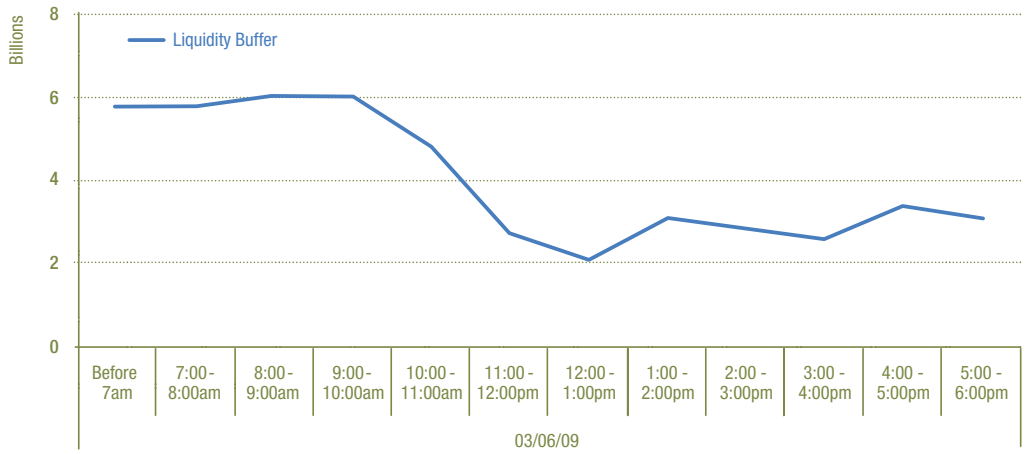
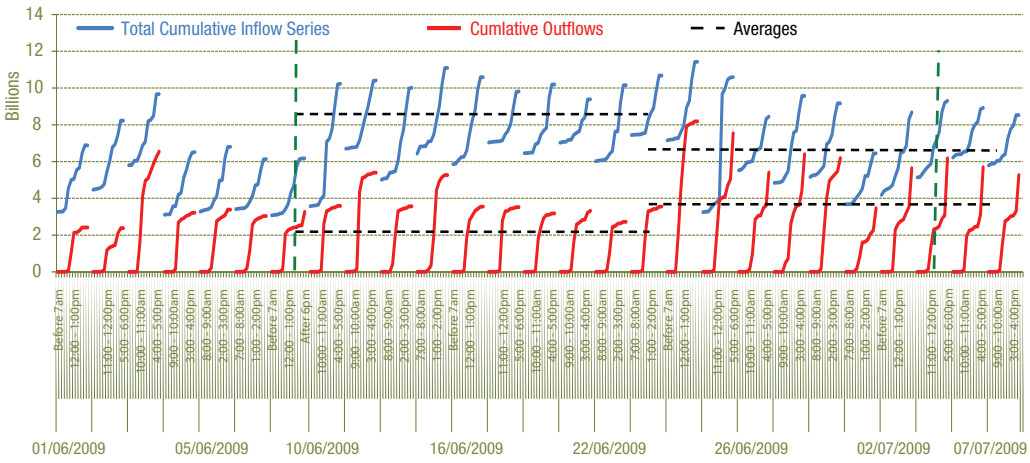


Chart 1 illustrates a large domestic bank's hourly liquidity buffer throughout the 3rd June 2009 as an example. At each hourly segment the liquidity buffer maintains a positive balance, demonstrating no operational difficulties in issuing outward payment instructions. The difference between this bank's total inflows and cumulative payment outflows for the 3 June 2009 are depicted in Chart 2.

In effect, this series represents the credit institution's 'liquidity buffer' indicator. Noticeably, the liquidity buffer weakens significantly towards the latter half of the day, falling from over €6 billion in the morning to just €2 billion at 1 p.m., demonstrating the relatively high volatility typically observed in banks' liquidity buffer levels.

Chart 3: Intraday Payment Capacity & Cumulative Outflows — Large Domestic Bank (1st June 2009 - 7th July 2009)



Considering a wider time horizon, Chart 3 illustrates both the payment capacity and cumulative outflow series for a large domestic bank over the period: 1 June 2009 — 7 July 2009. It is evident from the chart that liquidity buffer levels may change due to a fall in the total inflow series, a rise in cumulative payment outflows or some combination of both. The green 'average' lines in Chart 3 show how a bank's TARGET2 liquidity buffer may be sharply restricted as a result of a decrease in the total inflows series or a corresponding rise in the payment outflows series. The trend observed in Chart 3 clearly illustrate that the liquidity buffer levels available to domestic banks are quite volatile over time, owing to sharp innovations in both the cumulative payment outflow and the total cumulative inflow series.

Owing to the fact that liquidity buffers are calculated using cumulative payment inflows and outflows during the day, the indicator series created is not continuous over time. However, plotting consecutive daily liquidity developments reveals the long-term trend in buffer levels quite clearly (Chart 4). Two obvious liquidity buffer characteristics emanate from Chart 4. First, intra-day volatility in available TARGET2 liquidity from the morning to the latter half of the day is quite pronounced. Second, notwithstanding daily fluctuations in liquidity buffer levels, the longer-term trend in available liquidity can be derived from the series. This longer-term trend ultimately reflects the overall health of a bank's liquidity position to some degree. However, it may also be derivative of the maintenance period schedule relating to the credit institution's minimum reserve requirement (see Figure 5).

An intra-day liquidity analysis allows one to pinpoint specific points during the day when liquidity buffers may become negative. However, if we have observed the event it is already too late. The liquidity buffer indicator needs to act as a warning signal and allow overseers to prevent the failure of outward payment instructions. This may be achieved in part by setting a lower bound threshold limit below which the liquidity buffer may not fall.

Manually monitoring liquidity buffer trends may help to forewarn of an imminent position of insolvency and prevent the resulting fallout within the payments system. However, this would be quite a slow and labour intensive process that would not, for example, capture a sudden fall in liquidity during one isolated day. In addition, the liquidity buffer indicator is created with a one day lag, meaning that any major developments would not be identified on the day they unfold. Accordingly, an automated system that would signal any drop below an assigned threshold level in real time represents the optimal framework from which to monitor the liquidity buffer indicator on an ongoing basis (see Section 5.3).

Chart 4: Liquidity Buffer Indicator — Large Domestic Bank (1st June 2009 - 7th July 2009)

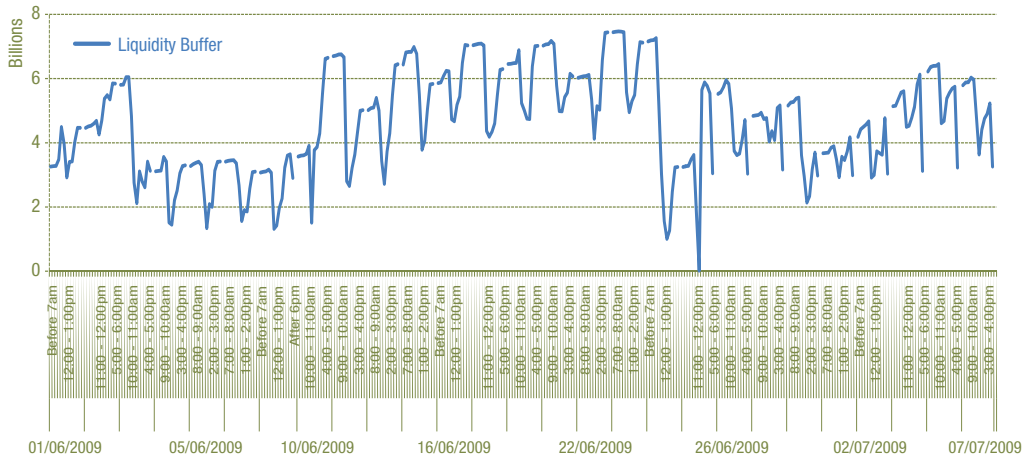
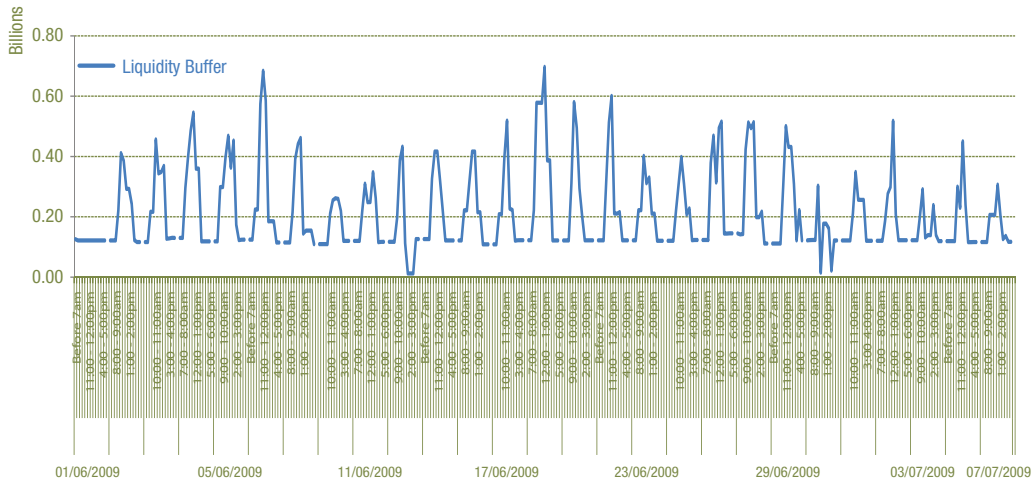


Chart 5: Liquidity Buffer Indicator — Small Domestic Bank (1st June 2009 - 7th July 2009)



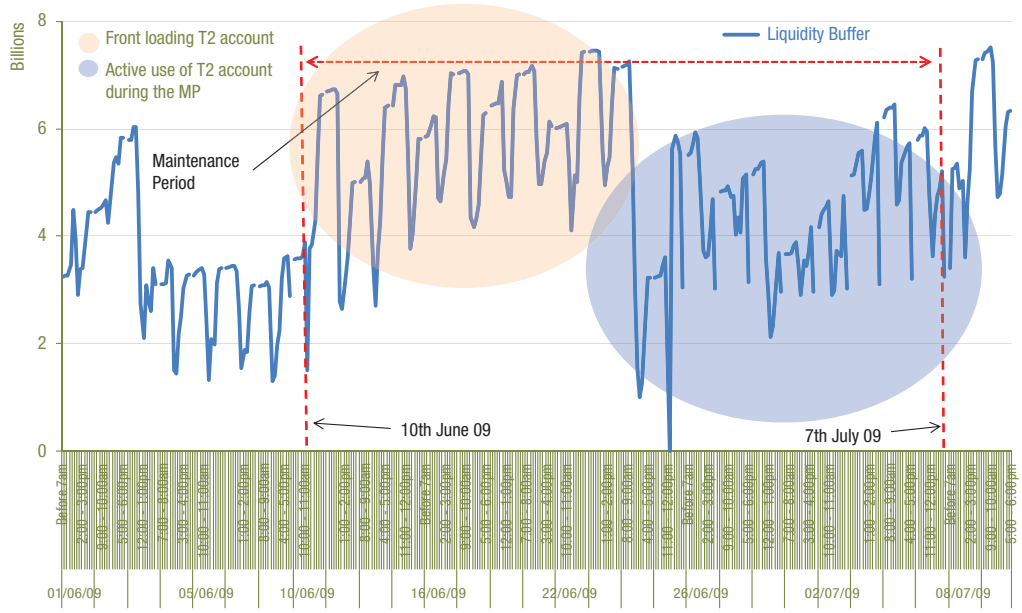
5.2.1 Liquidity Management — Large-v-Small Domestic Credit Institutions

Large domestic Irish banks appear to manage their liquidity more actively and possibly more efficiently than smaller Irish clearing credit institutions. This may be due to the fact that larger banks operate on a much larger scale, meaning there are substantial gains or savings to be had in efficiently managing liquidity flows over the maintenance period. Chart 5 depicts the liquidity buffer indicator for a representative small domestic bank.

In comparison to the large domestic bank in Chart 4, smaller clearing banks do not seem to actively manage their liquidity to the same degree as large banks. Instead they employ a simple strategy of maintaining enough overnight liquidity in their account at the end of the day to satisfy the averaging requirement for the maintenance period. The liquidity management strategy employed by large domestic banks appears to be largely derivative of the maintenance period schedule. This hypothesis is illustrated in Figure 5. Domestic banks are free to manage their liquidity requirements in any manner they wish. A large bank may choose to run down its TARGET2 account during the early stages of the maintenance period, requiring the institution to restore the account balance in the latter half of the maintenance period in order to fulfil the reserve requirement average.

However, more recently (considering the pronounced stresses in the financial environment) we typically observe large domestic banks 'frontloading' their TARGET2 accounts at the beginning of the maintenance period. Frontloading the account allows a credit institution to fully utilise available TARGET2 liquidity for payment purposes in the latter part of the maintenance period, subject to fulfilling the reserve requirement. This type of behaviour implies that banks are somewhat fearful of employing a more cost effective liquidity strategy over the maintenance period. If for example, a bank were to backload its TARGET2 account it would be exposed to the risk of encountering a liquidity constraint in the latter stages of the maintenance period, should sufficient liquidity not be readily available. In such an event, the bank would be heavily sanctioned for not fulfilling its reserve requirement average. Therefore, in an environment of stressed financial conditions, credit institutions are willing to pay an additional cost in order to maintain a degree of certainty that they have access to ample liquidity, to fulfil their needs over the maintenance period.

Figure 5: Maintenance Period — Large Bank Liquidity Management



5.3 Comparison with Euro Area Developments

Having established that domestic Irish credit institutions predominately frontloaded their payment accounts during the recent turmoil raises the question as to the corresponding developments within the wider euro area. Evidence from the euro zone indicates that on aggregate, credit institutions typically frontloaded their current accounts at the beginning of the maintenance period during the most pronounced stages of the recent financial crisis (see Figure 6A). Banks fulfilling the reserve requirement with this type of 'frontloading' approach appears to be characteristic of periods of uncertainty or financial stress. In a similar fashion to Irish banks, euro area credit institutions also appeared to accept the higher cost of maintaining increased levels of liquidity in order to be certain that they could fulfil the reserve requirement at the end of the maintenance period.

However, when one examines the behaviour of euro area banks during a period following the worst of the crisis, it is clear that banks regained a certain degree of confidence. This is evident by the fact that credit institutions appear to have reduced the level of liquidity they hold, following the ECB's decision to make vast amounts of liquidity available to the euro area banking system (see Figure 6B).

5.4 Optimal Surveillance Framework

Threshold Limit — Real Time Automatic Alarm Trigger

In an ideal liquidity surveillance framework, the 'liquidity buffer indicator' must have the ability to act as an early warning indicator in real time. In theory this may be achieved by setting an arbitrary threshold level, say, €2 billion (Chart 6). In the event that an institution's liquidity buffer fell below €2 billion, a real-time alarm would be triggered, sending a message to an overseer indicating that the threshold level has been breached. The real-time element of this system would involve a software based algorithm that monitors real-time TARGET2 data for domestic credit institutions.

An automated alarm such as this would facilitate the timely identification of liquidity based disturbances for the domestic banking sector. The early warning of a potential liquidity shortage would afford regulatory authorities the maximum amount of time possible to remedy the problem before it got out of hand. Additionally, knowing such an alarm is in place, banks would have an increased incentive to monitor their liquidity profile more carefully in order to avoid coming to the attention of authorities.

Figure 6A: Eurozone RR Fulfilment (key turmoil period)
Maintenance Period (Turmoil) — 8th August - 11th September 2007

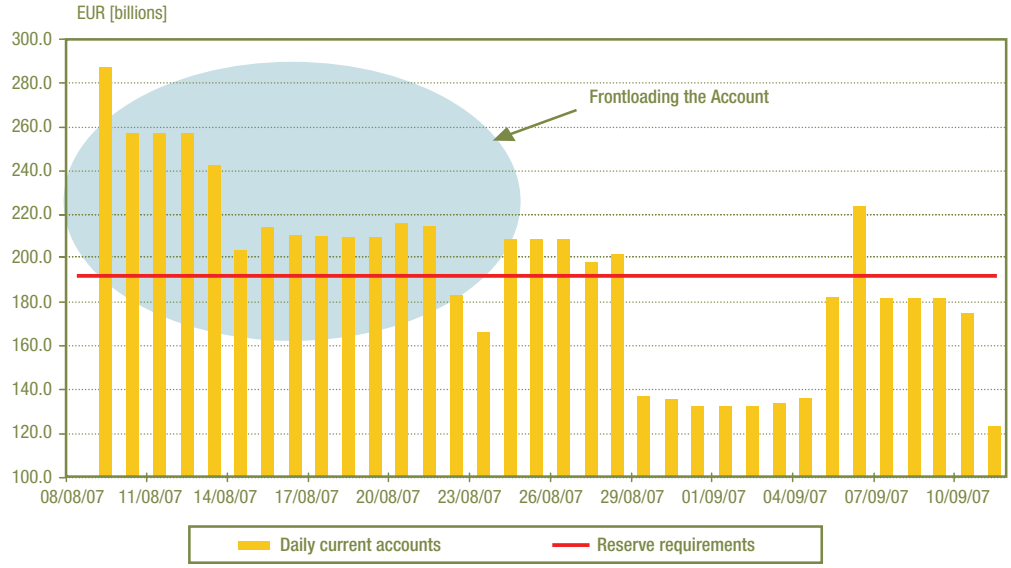
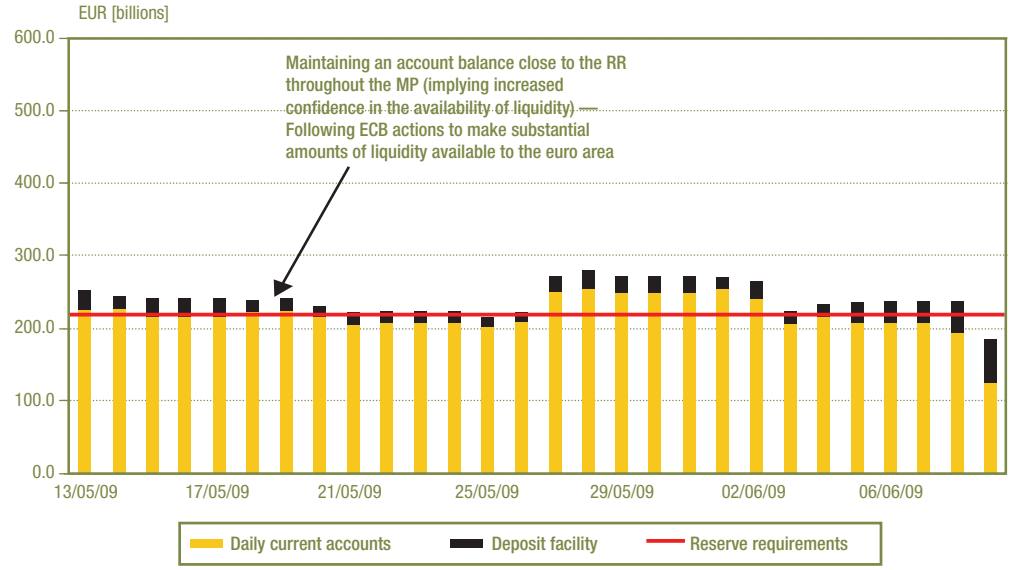


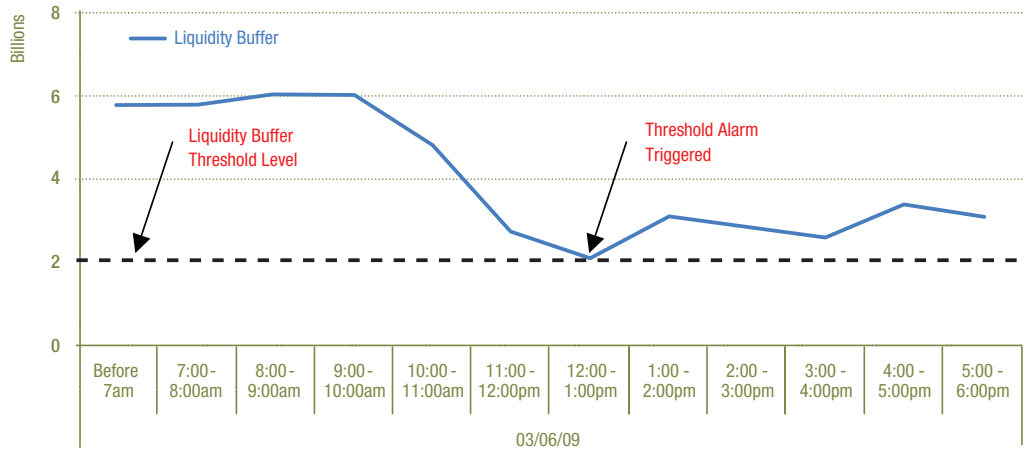
Figure 6B: Eurozone RR Fulfilment (post key turmoil period)
Maintenance Period — 13th May - 9th June 2009



Source(s): European Central Bank

[4] Presentation by Paul Mercier at the 9th ECB Seminar on Payments & Settlement Issues for Central Banks, 8th September 2009, Frankfurt am Main.

Chart 6: Liquidity Buffer Indicator — Alarm Trigger



5.5 Caveats to the Approach/Ongoing Issues

While the exercise undertaken has ultimately been successful in creating a means to provide oversight for the Irish component of the TARGET2 platform, there are a number of caveats that require attention.

1. Total Collateral Data

As already indicated, the liquidity buffer levels calculated do not incorporate additional eligible collateral that credit institutions may possess but have not allocated to TARGET2. In the event that a bank's liquidity buffer may be in danger of becoming negative, the bank is free to post additional collateral to the system. In such a scenario, the liquidity buffer indicator would essentially under represent the liquidity available to meet payment instructions.

2. Emergency Liquidity Assistance

In the event that a domestic credit institution's liquidity buffer became dangerously low (i.e. close to the assigned threshold limit) the bank may request Emergency Liquidity Assistance from the Central Bank. In this scenario, 'non-eligible collateral' may be accepted by the Central Bank to boost the credit institution's liquidity position. In order to incorporate this element into the liquidity buffer indicator, an estimate of domestic banks' 'non-eligible' collateral would be required.

3. Reserve Requirement

Owing to the fact that a bank's liquidity buffer series is at least partially derivative of the maintenance period schedule, the total stock of liquidity available to a bank on the TARGET2 platform (i.e., the payment capacity) may not be used solely for payment instruction purposes. Accordingly, the liquidity buffer indicator may need to be revised downwards in order to take account of the minimum reserve requirement as explained earlier in the paper.

4. Contingency Funding Lines/Agreements

Typically, credit institutions possess a number of contingency funding lines/agreements with other financial institutions and/or intermediaries. In the event of a liquidity shortage a bank may choose to call in these contingency agreements, thereby boosting its liquidity position in the short term. An estimate as to the volume and indeed conditions attached to these agreements would be required to integrate this element into a holistic measure of an institutions available liquidity buffer.

5.6 Outcome of the 'Liquidity Buffer Indicator' Development

In order to provide a means of conducting oversight of the Irish component of the

TARGET2 system, the Central Bank has developed a 'liquidity buffer indicator' relating to domestic credit institutions. Using data from the TARGET2 real-time gross settlement system, a liquidity buffer indicator may now be created and monitored over time for each Irish bank active on the settlement system. For the future, the framework could be adapted to include a number of additional elements, such as a 'real time alarm trigger'. This would represent the establishment of a worthwhile framework from which to monitor intra-day liquidity risks.

6. Conclusions

A bank encountering a deficiency of liquidity or reserves in its account at the central bank will not be able to settle incoming debit payments to its account. Such a failure can give rise to a systemic chain reaction in which participants depending on incoming payments, which have failed, are unable to honour their own outgoing payments obligations. This type of spill-over effect could cause the large-value-payment system to become gridlocked. Such a threat to the system as a whole can be obviated by banks holding sufficient buffers of liquidity. The recent crisis has amply demonstrated, however, that liquidity supply can become strained in periods of heightened uncertainty. The interbank money market which, in normal times, does a very efficient job of redistributing liquidity, from surplus to deficit banks in the system, can seize up completely. Even in such extreme circumstances, there is still typically ample liquidity in the system as a whole but it does not circulate. To obviate gridlock, therefore, the payments oversight function in the Central Bank and Financial Services Authority of Ireland needs to be in a position to assess the relative pressures of liquidity supply and demand facing individual banks.

The paper notes all the sources of wholesale liquidity available to a bank in real time for mediating wholesale payments. It discusses the various ways in which this total amount can be adjusted to take account of the fact that banks have to comply with the statutory reserve requirement of the ECB's operational framework for monetary policy.

A bank can choose to frontload or backload the fulfilment of the reserve requirement, or it can fulfil it evenly throughout the maintenance period. A risk-averse bank would tend to pursue a frontloading strategy and this has tended to happen to a greater extent in the uncertain financial environment that has prevailed since the start of the crisis.

An operational framework for monetary policy that allows required reserves to be used as intra-day liquidity for payments purposes, as in the Eurosystem, has considerable merit. The decision of the ECB Governing Council to pay a competitive interest rate on required reserves was also an important step in supporting the large-value-payments system in the euro area. This had the effect of greatly diminishing, if not eliminating entirely, the net opportunity cost of holding reserves and has accordingly helped to keep the large-value-payment system in the euro area well liquified. Furthermore, it has also helped to ensure that banks are not deterred from using the Eurosystem's real time gross settlement system which is systemically much sounder than the alternative of a deferred net settlement system but which is more demanding on liquidity.

However, the success of such a system is not guaranteed and has to be monitored on an ongoing basis. The failure of a single participant to respect an incoming payment obligation because of a liquidity constraint can give rise to a systemic chain reaction in which other participants, dependent on incoming payments, are unable to honour their own outgoing payment obligations. The purpose of this paper is to propose a mechanism to address this risk. Its aim is to derive a framework that would help to identify and calibrate the risk of liquidity constraints being encountered by an individual bank from spilling over to payments and causing gridlock in the domestic part of the wholesale payments system. To this end, it has developed a monitoring framework in the form of a ''liquidity buffer'' indicator for domestic credit institutions.

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