



Cash Flow Forecasting and Behavioural Modelling during the Pandemic

Banks came into the COVID-19 pandemic much stronger than they went into the Global Financial Crisis (GFC). Given the regulatory push post GFC, banks now have more resilient liquidity and capital buffers. However, can banks take comfort in their capital and liquidity buffers, and expect to successfully tide over this pandemic unscathed? We cannot be sure, as the crisis is still unfolding and the full impact is yet to be ascertained. This is the second part of our “Liquidity Management during the Pandemic” series that strives to bring to the fore the relevant and best practices for liquidity management during the current crisis. You can view our previous write-up “Liquidity Management during the Pandemic” on our website at <https://www.aptivaa.com/blog/>. This piece focusses on cash flow forecasting and behavioural modelling aspects which banks should consider in their day to day cash flow management, and how these are to be adjusted during the current crisis to obtain a more realistic view of customer behaviour.

Banks play a number of crucial roles in the functioning of the economy, one of them being maturity transformation, whereby they channelize many small deposits of relatively short-term maturity into few long-term loans. Through this maturity transformation, banks take liquidity risk on their balance sheet in addition to credit risk and interest rate risk (these risks we will be discussed in separate articles). Maturity transformation is an inherent part of a bank’s business model, as a significant portion of its income is derived from the pricing differentials on the asset and liability sides. The dynamics of maturity transformation process can only be captured through the cash flow view of the Bank as it enables a bank to accurately and dynamically forecast its balance sheet compositions, maturities, rates and income. It is easier to analyse how various risks impact and modify the future expected cash flows, rather than current stock balances. The cash flow view therefore gives a clearer picture of a bank’s current state, the risks it faces and its long-term outlook. Hence, it is of utmost importance to understand precisely the nature and mechanisms that help manage these cash flows.

Management of Liquidity and Liquidity Risk

The concept of liquidity is intrinsically linked to both sides of a bank's balance sheet. It relates to the mix of assets a bank holds and the various sources of funding utilised to fund those assets. Both the assets and liabilities may give rise to liquidity risk, but it manifests in different forms as explained below:

Funding Liquidity Risk

This is the risk of a bank failing to have sufficient cash or collateral to make payments to its counterparties and customers as they fall due (or can only do so by liquidating assets at an excessive cost).

Market Liquidity Risk

This is the risk of inability of swift sale of an asset in the private market, or if its sale is executed very rapidly, then the sale being achieved at a heavily discounted price. It is primarily a function of the market for an asset, and not the circumstances of an individual bank. Market liquidity risk can soon result in the bank facing a funding liquidity crisis.

Banks mitigate the funding liquidity risk and market liquidity risk in two ways. First, they ensure maximisation of stable sources of funding that are less likely to 'run-off' in the event of stressed market conditions, such as retail demand and time deposits. And second, banks hold a buffer of high quality liquid assets (HQLA) or cash, which can be drawn down when their liabilities fall due. This buffer is particularly important if a bank is unable to roll-over (renew) its existing sources of funding, or if other assets are not easy to liquidate.

Approach to manage liquidity risk – Stock and Flow Approach

Banks follow various approaches to manage liquidity risk, which fall either under the stock approach or the flow approach for measuring liquidity risk. All the liquidity ratios, such as LCR, NSFR, LDR and others fall under stock approach of measuring liquidity risk, while cash flow statement along with behavioural study fall under the flow approach of managing liquidity risk. One advantage of the cash flow approach is that it gives a more granular picture of the cash inflows and outflows and identifies any "Cliff Effect" which most likely will not be as clear in the stock approach. For example, consider a case where the outflows are in the first part of the month and all the inflows are towards the end of the month or there is a huge outflow on a particular date. In such a scenario, LCR can still be within the regulatory requirements and the cliff effect will go unnoticed. Only a detailed cash flow statement can pick this issue and accordingly suitable action can be taken.

This article focuses on the cash flow statement and expected behaviour of assets and liabilities under the impact of COVID-19 Pandemic as well as the impact of various announcements made by the government, as a crisis situation stresses both the sides of a bank's balance sheet.

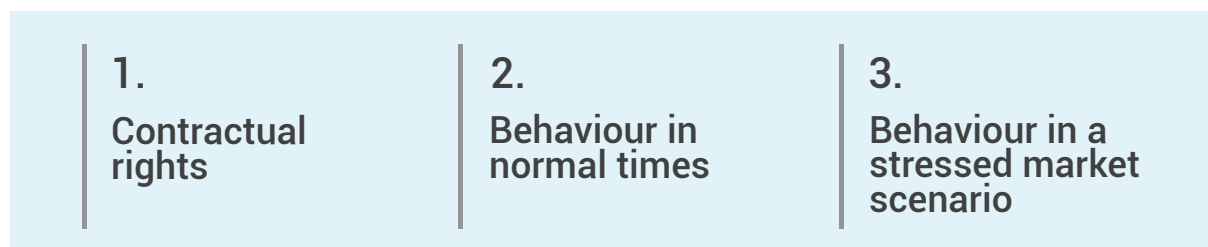
Behavioralization and Forecasting of Cash Flows

The cash flow statement buckets the inflows and outflows into various time buckets, starting with shorter time buckets in the near term and gradually increasing the length of the time bucket towards the longer term. Through cash flow statement, management can identify time buckets which are “Cash-Flow Insolvent” i.e. buckets which have higher cash outflow as compared to cash inflow. Based on this information, they can shift cash inflow and outflow through various actions, thereby closing the cash flow gap (cash outflow – cash inflow) or bring the gap to a comfortable level, so that the bank remains cash-flow solvent in all the near term buckets. One way of minimizing the cash flow gap is by raising additional funding and creating an asset of the maturity where there is a shortfall.

Cash flow statements are initially prepared based on contractual view of assets and liabilities, and later by incorporating the behaviouralized pattern of assets and liabilities. The contractual cash flow statement does not give a true picture, as most of the assets of the banks, especially the retail assets, and most liabilities show a behaviour significantly different from the contractual maturity.

For example, retail non-maturing deposits are contractually withdrawable any time but these show quite stability and remain with the bank for an extended period of time due to diversification over a large depositor base. Similarly, time deposits from retail and wholesale are generally rolled-over at their maturity and retail assets generally show prepayment behaviour. All these factors make the behavioural cash flow significantly different from the contractual cash flow statement.

Banks typically assess the behavioural pattern of their assets/liabilities in three stages:



An overview of various balance sheet products for which the cash flows are largely non-deterministic, that is they either do not have any contractual maturity or they differ materially from their contractual terms is shown in [Annexure I](#) to this article.

Stress Testing the Behavioural Assumptions in the wake of the COVID - 19 Pandemic

The current Covid-19 crisis has upended the “normal” understanding of how severe a stress scenario can be. The annual stress tests recommended by regulators so far assume a decline in global GDP by 5 to 7 percent which were seen as extremely remote. However, in the current crisis, China, US, Euro Area have all experienced negative quarter-on-quarter GDP growth of -9.8 percent, -4.8 percent and -3.8 percent respectively. ([Source: www.tradingeconomics.com](http://www.tradingeconomics.com) accessed on 13th May 2020)

Banks have so far assumed, based by empirical evidence that mortgages are generally paid earlier than their contractual maturity. Similarly, demand deposits though contractually withdrawable at any time, are assumed to be kept with the bank for an extended period of time. Time deposits are expected to stay until maturity and usually rolled over further at their maturity. But the current crisis situation will most likely change the expected behaviour in the short-term till the situation becomes normal. All these factors will put stress in the short-term liquidity buckets making these particularly more vulnerable to cash-flow insolvent situation.

Below are some factors which the management should consider in preparing their cash flow statements during this crisis period:

1. Impact of loan moratorium on loan repayment

Central banks around the world have announced a moratorium facility for retail/corporate or both borrowers for a period ranging from 3 to 6 months. This will shift the expected behaviouralized cash inflows in the up to 6 month's buckets to farther buckets (assuming there is no default or delay in the payment beyond the moratorium period, which seems unlikely).

2. Impact of lower roll-over of deposits/run-down of CASA deposits

Another effect of the pandemic is delay in payments/salaries of the customers, which in turn will lead to a lower roll-over rate of maturing deposits and a gradual reduction in customer balances. This will effectively lead to a higher outflow as estimated earlier through behaviouralized pattern. A "corona overlay" on balance decay rates needs to be assumed in the range of 5-10 percent for retail and 20-30 percent for wholesale deposit balances.

3. Lower market liquidity of securities

In a cash flow statement, the HQLA securities are bucketed as per the maturity of the underlying customer liabilities (governed by the cash reserve requirements) and the excess is bucketed as an inflow either equally in the short-term buckets based on management judgement or through a defeasance study by considering the market volume of the securities traded and the individual bank's holding portfolio. In the current crisis situation it would not be conservative if the actual market liquidity of the security is assumed to be reduced.

4. Increased online transactions

Increased use of online transactions and reduction of branch based transactions have been observed, primarily due to the lockdown imposed in many countries. This will definitely move the customers to digital channels permanently and we expect a lower level of branch based transactions once the situation returns to normal. Banks need to collect and analyse the data separately for customers based on their preferred way of transacting to have a better understanding of different customer segments.

Management Action Plan

Management needs to analyse the cash flow statement and the expected behaviouralized cash flows in detail. A simple base cash flow with behaviouralized numbers will not be sufficient to manage the cash flows in the current crisis, which is still unfolding. Banks should do multiple scenario analyses and stress testing based on the expected cash inflow and outflow pattern, as a relatively small change in one factor would lead to a big impact on the overall cash flow statement and might lead to a cash-flow insolvent situation.

To illustrate the point, a sample monthly cash flow statement is prepared for the first six months on a monthly basis, first on a base case basis with behaviouralized assumption and then after including the stressed behaviour due to this COVID-19 crisis:

Base Case (CUR MM)	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Outflows						
Retail Term Deposits	62.5	62.5	75.0	75.0	75.0	75.0
Current Account	7.5	9.4	11.3	11.3	11.3	7.5
Savings Deposits	5.2	6.5	7.8	7.8	7.8	5.2
Wholesale Deposits	41.3	41.3	48.8	48.8	48.8	48.8
Total outflow	116.4	119.6	142.8	142.8	142.8	136.4

Inflows						
Mortgages	35.0	35.0	35.0	35.0	35.0	35.0
Wholesale Loans	47.3	47.3	47.3	47.3	47.3	47.3
Other Inflows	150.0	150.0	150.0	150.0	150.0	150.0
Total inflow	232.3	232.3	232.3	232.3	232.3	232.3

Net Gap	115.8	112.7	89.5	89.5	89.5	95.8
Cumulative Gap	115.8	228.5	318.0	407.5	496.9	592.8

With only slight modifications in the expected cash flow pattern for the first six months, the cash flow statement will change drastically.

Outflow for retail deposits, current account, savings account and wholesale deposits have been increased by 0.25 percent, 0.50 percent, 0.25 percent and 1.0 percent respectively only for the first six months. Similarly, the scheduled inflows have been decreased by 1 percent for both the mortgages and wholesale loans due to the moratorium facility availed by the customers, only for the first six months. These percentage changes are to be applied on a portfolio basis. For example, if earlier in the first month, 5 percent of the total retail deposits portfolio was expected to mature, in the stressed scenario this number will increase to 5.25 percent of the total deposit portfolio.

The revised cash flow statement with these adjustments will look like below:

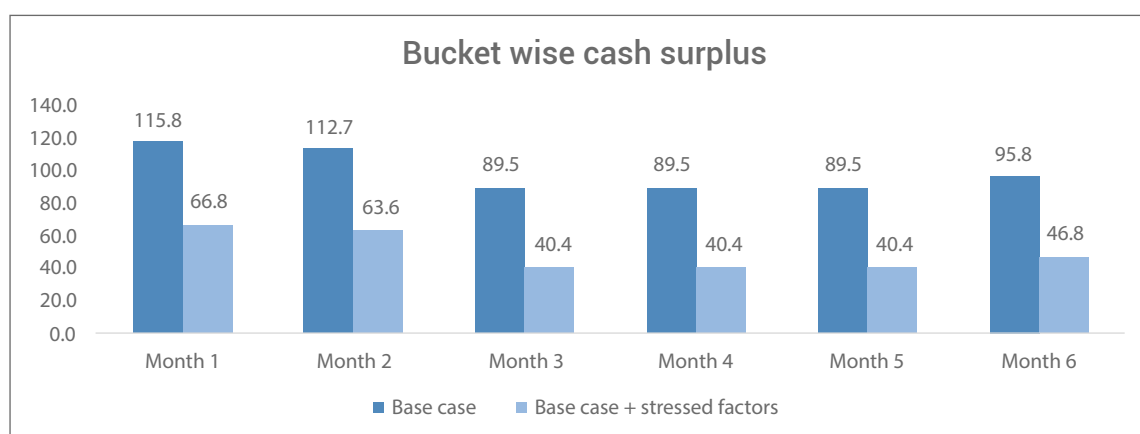
Base Case + stressed factors	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Outflows						
Retail deposits	65.6	65.6	78.1	78.1	78.1	78.1
Current account	11.3	13.1	15.0	15.0	15.0	11.3
Savings deposits	6.6	7.9	9.2	9.2	9.2	6.6
Wholesale deposits	48.8	48.8	56.3	56.3	56.3	56.3
Total outflow	132.2	135.4	158.6	158.6	158.6	152.2

Inflows						
Mortgages	17.5	17.5	17.5	17.5	17.5	17.5
Wholesale loans	31.5	31.5	31.5	31.5	31.5	31.5
Other inflows	150.0	150.0	150.0	150.0	150.0	150.0
Total inflow	199.0	199.0	199.0	199.0	199.0	199.0

Net Gap	66.8	63.6	40.4	40.4	40.4	46.8
Cumulative Gap	66.8	130.4	170.8	211.2	251.6	298.4

Individual impact	- 182.6	- 176.3	- 129.9	- 129.9	- 129.9	- 142.6
Cumulative impact	- 182.6	- 358.8	- 488.8	- 618.7	- 748.6	- 891.2

The above cash flow statement incorporating stress factors shows a significant reduction in the surplus cash situation in the first six months, illustrating that a relatively small change in the behavioural pattern has the potential to significantly alter the overall cash flow situation.



The above graph shows the cash surplus position in the first six months before and after the application of stress factors. There is a drastic reduction in the cash surplus position only by small changes in the behaviouralized inflow and outflow numbers, signifying the importance of close monitoring of cash flow behaviour.

We suggest that banks should enhance their cash flow statement process by including additional statement and risk metrics till the situation becomes normal. These enhanced risk metrics will definitely help the bank to give a clearer picture of the situation and all probable scenarios, helping to manage the crisis better. The cash flow statement should be modified based on the following aspects:

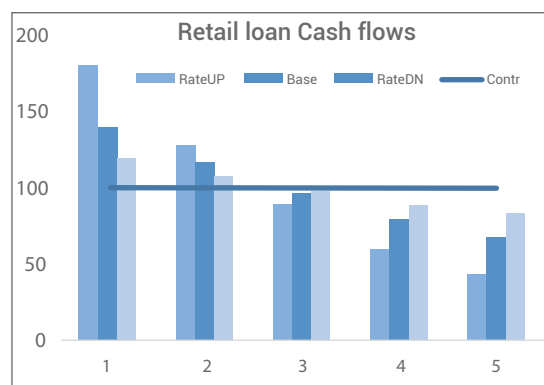
1. Base case cash flow forecasts using standardised assumptions;
2. Cash flow forecast with stressed assumptions for multiple scenarios (as shown in the above illustration);
3. 12 month rolling base case and stress forecasts;
4. Reviewing liquidity threshold for each time bucket, that is maximum negative cash flow gap and close monitoring and timely action to manage the gaps within the limit;
5. And finally, creating a liquidity contingency plan with realistic parameters factoring in the availability of funding during the crisis, increased cash outflows and decreased cash inflows.

Annexure I - A. Assets

Retail loans:

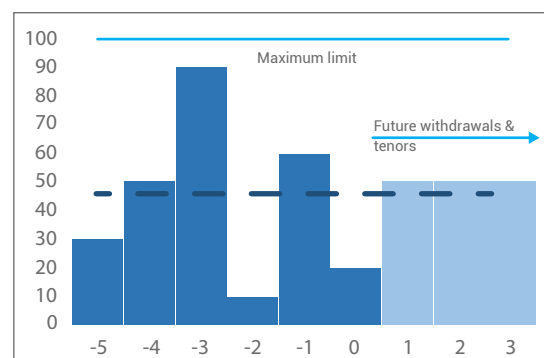
Retail loans tend to see repayments earlier than the expected schedule, due to various market and customer related factors. For fixed rate loans and to a certain extent floating rate loans, the rate environment has a control effect on the level of prepayments. This behaviour has implications from both rate and liquidity perspectives.

The cash flow chart on the right shows a simple repayment schedule of a retail loan. The repayments are always higher than the contractual schedule and repayments are highest under increasing rate (Rate UP) scenario.



Corporate working capital facilities:

Revolving facilities are typically approved on an annual basis and the facilities tend to get rolled over at its facility maturity date and become evergreen. Such products need to be assessed for core portion that will remain outstanding during the shorter tenors.



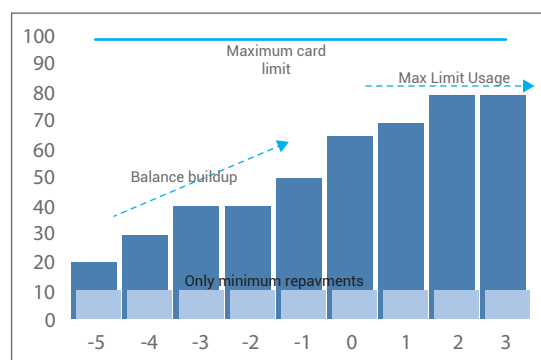
This behavioural analysis is largely required from a liquidity perspective. Additionally such analysis helps with pricing decisions as well.

The infographic shows historical limit utilisation and repayments done by the customer based on which a core portion and the tenor it is expected to be on books is estimated.

Credit Cards:

Limit usage and repayment behaviour needs to be analysed to understand cash flow of credit cards. Not all customers repay the entire outstanding during every billing cycle. Some typically revolve the balances and only repay the minimum amount due or amount less than the total outstanding and carry over the remaining amount to the next billing cycle.

First, a Transactor-Revolver analysis is needed to assess repayment behaviour of the customer and then a limit usage analysis is needed to understand balance build-up. This analysis is largely from a liquidity perspective as credit card pricing is policy driven and is not changed often.

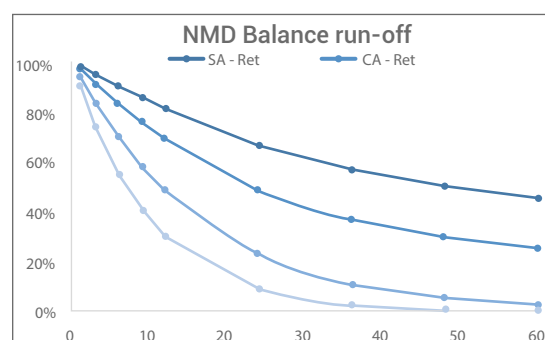


The infographic shows balance build-up and minimum repayments made by a “revolver” type customer.

Annexure I - B. Liabilities

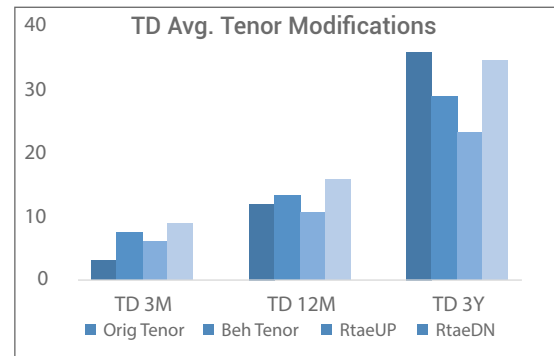
Non-maturity deposits:

Non maturing deposits need to be assessed for vintage balance run-off behaviour from a liquidity perspective first to identify the stable portion. Then the sensitivity of the run-offs to rate movements needs to be assessed to identify the core portion. In addition, a rate-pass-through analysis needs to be performed to understand how closely the offer rates on these products have tracked the market. For non-interest bearing accounts, a volume-rate analysis needs to be performed to understand rate sensitivity.



Term deposits:

Retail term deposits need to be assessed for early termination and rollover behaviour to understand behavioural maturities. Similar to loans, rate environment plays a central role that drives early terminations. While the early terminations and rollovers have liquidity implications, only the early terminations have rate implications as rollovers typically get priced at prevailing rates.



The infographic shows that in shorter terms, rollovers dominate early terminations and average tenors are always extended, however in longer tenors, early terminations dominate rollovers and tenors are shortened. Tenors are always shorter in upward rate environment.

Annexure I - C. Off-Balance Sheet Items

Product	Description
Trade related	Products typically include Letters of Credit and Letters of Guarantee. These products have liquidity implications in case customers intend to convert the liability into a loan rather than maintain a cash margin with the bank.
Credit commitments	Undrawn committed credit lines – Revocable & Irrevocable. Assumptions regarding utilisation and time will need to be made in cases where the drawdown schedule is not known.
Liquidity facilities	Other fee based liquidity facilities offered to corporates. They are mostly revocable in nature

Contact Us

Feel free to send your queries to:

Satya Vemireddy

Author | Director

Email : satya.vemireddy@aptivaa.com

Phone : +91- 99899 - 43649

Gaurav Gupta



Author | Associate Director

Email : gaurav.gupta@aptivaa.com

Phone : +91- 74833 - 24025

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