Counter-Balancing Capacity

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A 5 page abstract of the CBC Technique

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After the recent banking crisis (which continues into 2010), regulators correctly identified risky business models as the cause of many bank's failures. Using massive mismatches between assets and liabilities relied on systemic abundance of liquidity and this has proved unsustainable.

As a result, the bank is exposed to a massive liquidity deficit in the short end of the refinancing curve. The use of active strategies, as predicted by the CBC technique, provides an elegant and powerful technique to calculate the necessary holdings of what regulators term 'Liquidity Buffer' - a buffer is used to safeguard against a short term liquidity problem.

A. Future Liquidity Situation and Scenarios

Assume a bank today forecasts its future liquidity situation by modelling the 'expected' cash flows of all on and off balance sheet transactions (deals). We call the resulting cash flow forecast Forward Liquidity Exposure, (FLE).

In order to paint a realistic picture of the bank's future liquidity situation, different scenarios should be applied to the entire range of the bank's balance sheet items.

B. Exposure and Strategy Scenarios

Consequently, we firstly look at 'passive' exposure scenarios and then apply 'active' scenarios (strategies), simulating the bank's response to the exposure.

In a passive scenario (an exposure), the bank is exposed to events, e.g. a change of market rates, a client's exercise of an option having a negative effect on the bank's liquidity (e.g. withdrawal of savings deposits or drawing of an advance under a credit facility) or a breach of a contract (credit and operational risk).

In an active scenario (a strategy), the bank uses its ability to shape its future liquidity situation to achieve a target, for example, that "at end of day, its central bank account has a small surplus".

Exposure scenarios model the uncertainties that a bank might encounter which arise from deals where the bank has no option or is short an option including:

- scheduled cash flows, which can either be (a) fixed (they are "certain" - unless we integrate a possible contractual breach) or (b) variable (they depend unequivocally on yet unknown market parameters and therefore bear uncertainty but no optionality);
- contingent cash flows from contractual options where the bank is short; and
- anticipated deals the bank might encounter or is not able to reject might generate hypothetical cash flows.

C. CounterBalancing Capacity - The Idea

The most important strategy, the CounterBalancing Capacity, (CBC) subsumes all liquidity-generating activities that the bank can perform in order to avert liquidity shortages.

If the target of an active strategy is just to be square on the central bank account, all 'realistic' scenarios will produce this very result (FLE + CBC = 0) – unless a scenario occurs where the bank fails to generate sufficient cash inflows. As a result, we will only know whether the headroom is sufficient to square the central bank account - whereas we would like to know, how much headroom is available in each particular scenario.

For that reason, the target of the strategy is to calculate the headroom and thus generate as much additional cash as early as possible. We, therefore, consider:

- where the bank is long a contractual option (e.g. a credit line is taken) which can be exercised to generate beneficial contingent cash flows; and
- deals that the bank might try to generate in the future to improve its liquidity situation (e.g. attract new deposits, restrict generating new loans or sell or repo assets).

The bank has two means of generating additional liquidity:

- the acquisition of additional liabilities (secured or unsecured); and
- the sale of assets in order to move future inflows (e.g. the redemption of a bond) nearer to today.

Technically this means that the bank can either

- issue new debt or acquire deposits (a) in the inter-bank market or (b) from others (secured or unsecured); or
- sell assets (ultimately or temporarily by "sell and buyback" deals).

Assuming that new debt issuance and the acquisition of deposits is modelled we concentrate on deals which are security related and consider:

- sales and "sell/buyback" deals; and
- repos.

D. Future Flows and Inventories

Each sale, sell/buyback and repo deal causes a (future) change in the position, a Forward Asset Flow (FAF) of the security. For each security which will be liquefied in a CBC scenario, we need to know today how much we will possess of it at any time in the future: the security's Forward Asset Inventory (FAI) is recursively determined by its FAFs:

- yesterday (t_{-1}): the nominal amounts of all historical deals in this security are accumulated but unsettled legs of pending transactions (e.g. repos) are excluded - this is the current FAI_{-1}.
- today (t_0): the nominal amounts of all historical deals in this security that settle in t_0 are aggregated into today's FAF_0. The current FAI is
  $$FAI_0 = FAI_{-1} + FAF_0.$$
- on a future date t_n: $$FAI_n = FAI_{n-1} + FAF_n.$$

As a result we obtain a series of FAIs: $FAI_{-1}, FAI_0, FAI_1, \ldots, FAI_n$.

In the following example we have illustrated the FAF of a specific security, assuming that the FAI in t_0 is known from t_{-1}.

Table A

maturity		28.09.10	
coupon		5,750%	act / act
price		105,180%	
23.09.2009	=today	available assets	
Date	transaction	FAF	FAI
22.09.2009	as of		100,0
23.09.2009	sell	-20,000	80,0
24.09.2009	buy	15,000	95,0
25.09.2009	repo	5,000	100,0
28.09.2009	interest	0,000	100,0
29.09.2009		0,000	100,0
30.09.2009	reverse repo	-20,000	80,0
30.09.2009	sell back	-20,000	60,0
01.10.2009		0,000	60,0
02.10.2009		0,000	60,0
05.10.2009	buy back	100,000	160,0
06.10.2009		0,000	160,0
07.10.2009		0,000	160,0
08.10.2009		0,000	160,0
09.10.2009		0,000	160,0
28.09.2010	interest	0,000	160,0
28.09.2010	maturity	-160,000	160,0

To determine the impact of the asset flows and inventories in Table A on the FLE, we will calculate the Future Cash Flows (FCF) and establish the corresponding Future Cash Inventories (FCI):

- in t_{-1}: the cash flows of all historical deals in this security are accumulated, excluding unsettled legs of pending transactions (e.g. repos) - this is the current cash inventory FCI_{-1}.
- in t_0: the cash flows of all historical deals in this security that settle in t_0 are aggregated into today's FCF_0. The current cash inventory is
$$FCI_0 = FCI_{-1} + FCF_0.$$
- in t_n: $$FCI_n = FCI_{n-1} + FCF_n;$$

this will give us a series of FCIs : $FCI_{-1}, FCI_0, FCI_1, \ldots, FCI_n$.

In Table B below we have illustrated the future cash flows of a specific security, assuming that the starting FCI in t_0 is known from t_{-1}. The cash flows are functions of the asset flows: if the prices at the beginning and end of, for example, a repo transaction are known, the cash flows equate simply to: – (dirty price) · (asset flow).

Table B

maturity		28.09.10				
coupon		5,750%	act / act			
price		105,180%		CBC_0 scenario 0		
23.09.2009	=today	available assets		cash		
Date	transaction	FAF	FAI	price	FCF	FCI
22.09.2009	as of		100,0	104,340		-104,340
23.09.2009	sell	-20,000	80,0	105,180	21,036	-83,304
24.09.2009	buy	15,000	95,0	105,180	-15,777	-99,081
25.09.2009	repo	5,000	100,0	105,200	-5,260	-104,341
28.09.2009	interest	0,000	100,0	0,058	5,750	-98,591
29.09.2009		0,000	100,0		0,000	-98,591
30.09.2009	reverse repo	-20,000	80,0	105,210	21,042	-77,549
30.09.2009	sell back	-20,000	60,0	105,200	21,040	-56,509
01.10.2009		0,000	60,0		0,000	-56,509
02.10.2009		0,000	60,0		0,000	-56,509
05.10.2009	buy back	100,000	160,0	102,340	-102,340	-158,849
06.10.2009		0,000	160,0		0,000	-158,849
07.10.2009		0,000	160,0		0,000	-158,849
08.10.2009		0,000	160,0		0,000	-158,849
09.10.2009		0,000	160,0		0,000	-158,849
28.09.2010	interest	0,000	160,0	0,058	9,200	-149,649
28.09.2010	maturity	-160,000	160,0	100,000	160,000	10,351

By calculating the FCIs of the base scenario FLE_0, we have determined the Basic Scenario CBC_0.

E. The Liquification Algorithm

Firstly, for each scenario, the security's liquifiability parameters need to be laid down in a term structure $t_0, t1, ..., t_H$ until the end of the relevant time horizon t_H.

In the next step, the liquifiability parameters are recursively applied to the structural position - which is the position after the last pending transaction's settlement:

- the percentage (between 0% and 100%) of the security's structural position that we assume will be sold during the time bucket is the saleability.
- the nominal amount up to which we assume we can sell the security during the time bucket is the upper sale limit.
- the percentage (between 0% and 100%) of the FAI at the start of the time bucket) we assume to repo the security until the end of the time bucket is the repoability.
- the nominal amount up to which we assume the bank will be able to repo the security until the end of the time bucket is the upper repo limit.

Next additional parameters are set: (a) a repo haircut (e.g. as applied by central banks) and (b) a price decline for sales (e.g. VAR-based).

It would be quite laborious in practice to determine in a large portfolio the liquification parameters for each security individually. Therefore we group each asset in a liquifiability class which comprises all securities we assume will behave similarly in a specific CBC Scenario.

F. CBC - Results

If the above steps are performed, the result is a series of hypothetical sales and repo deals which simulate for this security, in this scenario, the development of its asset inventory.

Finally the cash flows of each hypothetical deal are calculated, applying the haircut for repos and the price decline for sales.

The hypothetical FCI can be added to the initial FLE in order to determine whether the CBC is large enough to fill potential liquidity gaps respectively if the bank has to change its business model.

Table C

maturity		28.09.10				160,000	structural position							
coupon		5,750%	act / act											
price		105,180%		CBC_1 scenario 1: Going Concern										
23.09.2009	=today	available assets		sale						repo				
Date	transaction	FAF	FAI	%	FAI start	FAF	price	FCF	FAI end	%	FAF	haircut	FAF -h	FAI end
22.09.2009	as of		100,0											
23.09.2009	sell	-20,000	80,0	0%	80,00	0,00	105,180%	0,00	80,00	20%	-16,00	95%	15,20	64,00
24.09.2009	buy	15,000	95,0	0%	95,00	0,00	105,127%	0,00	95,00	80%	-76,00	95%	72,20	19,00
25.09.2009	repo	5,000	100,0	20%	100,00	-32,00	105,106%	33,63	68,00	95%	-64,60	95%	61,37	3,40
28.09.2009	interest	0,000	100,0	20%	68,00	-32,00	105,062%	33,62	36,00	95%	-34,20	95%	32,49	1,80
29.09.2009		0,000	100,0	10%	36,00	-16,00	105,051%	16,81	20,00	95%	-19,00	95%	18,05	1,00
30.09.2009	reverse repo	-20,000	80,0	10%	0,00	-16,00	105,041%	16,81	-16,00	95%	16,00	95%	-15,20	0,00
30.09.2009	sell back	-20,000	60,0		-36,00	0,00	105,041%	0,00	-36,00	95%	36,00	95%	-34,20	0,00
01.10.2009		0,000	60,0	10%	-36,00	-16,00	105,031%	16,81	-52,00	95%	52,00	95%	-49,40	0,00
02.10.2009		0,000	60,0	10%	-52,00	-16,00	105,022%	16,80	-68,00	95%	68,00	95%	-64,60	0,00
05.10.2009	buy back	100,000	160,0	5%	32,00	-8,00	104,998%	8,40	24,00	95%	-22,80	95%	21,66	1,20
06.10.2009		0,000	160,0	5%	24,00	-8,00	104,990%	8,40	16,00	95%	-15,20	95%	14,44	0,80
07.10.2009		0,000	160,0	3%	16,00	-4,80	104,983%	5,04	11,20	95%	-10,64	95%	10,11	0,56
08.10.2009		0,000	160,0	2%	11,20	-3,20	104,976%	3,36	8,00	95%	-7,60	95%	7,22	0,40
09.10.2009		0,000	160,0	2%	8,00	-3,20	104,970%	3,36	4,80	95%	-4,56	95%	4,33	0,24
28.09.2010	interest	0,000	160,0		4,80	0,00	104,168%	0,00	4,80	95%	-4,56	95%	4,33	0,24
28.09.2010	maturity	-160,000	160,0											

G. Summary - the Likely Application of CBC

The CBC application can be used

- in risk control to measure and supervise liquidity risks,
- in liquidity risk management to assess limit breaches and for regulatory reporting requirements (stress tests); and
- in the front office for collateral management simulations.

CBC is not only intended as a regulatory tool, indeed most well run banks will tend to manage their liquidity risk with CBC and similar techniques to ensure survival in the roughest markets. However, using CBC will provide a transparent and industry grade approach to developing strategies and equipping banks with essential tools to manage liquidity risk.