EXCESS RESERVES AND THE INTERBANK MARKET

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ABSTRACT. Note on how excess reserves are calculated and how demand for reserves varies with the inter-bank interest rate. There is also a description of the inter-bank loan market with explanation of the various indexes used by the money markets.

1. Excess Reserves

Calculating Barclay's R_{min} over a fortnight. The Barclay's minimum reserve requirements $R_{\min}$ are calculated on a day to day basis depending on the deposits and withdrawals from the Barclays Bank. The Barclay's does not have to maintain the reserve requirement everyday. It just has to ensure that over a period of a fortnight, the reserve requirements are met.

Looking forward there is an uncertainty about the amount of $R_{\min}$ over a period since Barclays does not have to meet the requirement on every single day. Barclay's have a sense how the position would evolve over the next fornight and then take a call on how much to leave with the Central Bank. Lets take an example of a period of a fortnight and see how the reserve requirement rate R^{Barclays} and excess reserves R_e are calculated over that period. Useful to note here that i_{repo} rate would influence exactly how cautious Barclay's wants to be about meeting the reserve requirements over the fortnight.

Day	R^{Barclays}	$R_{\min}$	R_e
Monday	101	85	16
Tuesday	101	75	26
Wednesday	101	95	6
Thursday	101	100	1
Friday	101	105	-4
Monday	101	120	-19
Tuesday	101	90	11
Wednesday	101	70	31
Thursday	101	150	-49
Friday	101	90	11
Average	101	98	+3

TABLE 1. Barclays maintains reserves of 101 with the Central Bank over a fortnight. The minimum reserve requirement turns out to be 98 over this period and consequently there is a excess reserve of +3 over this period. On this excess reserve, the Barclays gets $(i_{\text{repo}} - 100bps)$.

Day	R^{Barclays}	$R_{\min}$	R_e
Monday	98	111	-13
Tuesday	98	88	10
Wednesday	98	79	19
Thursday	98	101	-3
Friday	98	105	-7
Monday	98	109	-11
Tuesday	98	89	9
Wednesday	98	119	-21
Thursday	98	115	-17
Friday	98	104	-6
Average	98	102	-4

TABLE 2. Barclays maintains reserves of 98 with the Central Bank over another fortnight. The minimum reserve requirement turns out to be 102 over this period and consequently there is a excess reserve of -4 over this period. On this excess reserve, the Barclays has to pay ($i$repo $+ 100bps$) to the Central Bank.

Example 1. In the example in Table 1, Barclays leaves a constant amount of 101 with the Central Bank over a fortnight. After the fortnight is over, Barclays finds out that the average required over the fortnight was just 98. Of course, Barclays did not know this in advance and was just being over-cautious in retrospect. Turns out, that ex post the excess reserves on the the average each days was +3, on which Barclays gets an interest rate of ($i_{\text{repo}} - 100bps$).

Example 2. In the example in Table 2, chastened by the experience in the previous example, Barclays leaves a constant amount of 98 with the Central Bank over a fortnight. After the fortnight is over, Barclays finds that the average required over the fortnight was actually 102. Barclays may not have know that the deposits would be higher in this period and ended up leaving insufficient reserves with the Central Bank. The ex post the excess reserves on the the average each days turns out to be -4, on which Barclays pays an interest rate of ($i_{\text{repo}} + 100bps$) since they have deemed to have borrowed this from the Central Bank over the fortnight.

Discussion. As the i_{repo} rate increases, Barclays' opportunity cost of leave R with the Central Bank increases. Naturally, Barclays would reduce the reserves it keeps with the Central Bank. Thus, the demand for reserves (and remember that excess reserve is the residual element here and thus calculated ex post) decreases with an increase in i_{repo}. This is how we obtain the downward sloping demand curve for reserves R^d in the $i - R$ space.

It is useful to think of how the Central Bank pays the $i_{\text{repo}} - 100bps$ rate on positive excess reserves or what it does with the $i_{\text{repo}} + 100bps$ it receives for the negative excess reserves. The Central Bank is organisation which does not explicitly produce anything or sell anything. So, it outflow and inflows that have to match.

What happens if R suddenly increases for the Central Bank. If buys assets. If R suddenly decreases, it sells assets. So, if the banking sector on the whole increases the reserves it leaves with the central bank so that on the whole the aggregate excess reserves are positive, where does the Bank pay out the $i_{\text{repo}} - 100bps$ from. The answer is that it buys assets with the new reserves such that change in reserves matches the change in assets. These are interest paying assets, which enables the Central Bank to pay out the $i_{\text{repo}} - 100bps$ to the commercial banks. On the balance

sheets, the $i_{\text{repo}} - 100bps$ payout gets put down as increase in R. Similarly, on the asset side, the interest received is gets put down as increase in A.

2. The Interbank Market for Funds

The Barclay's does not have to just meet the reserve requirement through its own resources. If it over-lent, it can also borrow from other banks which have surplus at the interbank lending rate. Conversely, if it has under-lent, it would have surplus which it can lend to other banks for the purposes of reserve requirement at the interbank rate.

Useful to note the difference between interbank rate and i_{repo} rate. Interbank rate is the lending and borrowing rate between the Banks. i_{repo} determines the rate at which the Barclay's shortfall on reserve requirement is penalised and excess fund left over is remunerated. Of course, if the i_{repo} rate moves, the interbank rate often follows.

There are two distinct measures of the interbank rate used by the money markets across the world.

(1) London Inter-Bank Offer Rate (LIBOR) is a measure of the expected rate of interbank rate on a particular day. It is important to note that it is the expected rate and so it an ex ante measure. All commercial banks send in the interest rate at which they expect to lend that day to the authorities, which then remove the top and bottom quartile and average the remaining figures to reach the final LIBOR. LIBOR is calculated for one-month, three-month, six-month and one-year loans.

In your lectures, there the interaction of demand and supply of reserves is set as interbank rate. That is obviously an abstraction. The demand and supply of loans markets can be further segmented along the lines of the duration of the loans and the demand and supply of loans for each duration determine the interbank rate for loans of that duration.

(2) It is interesting to note that one of the measures used by the money market is the Interbank curve. This is a curve that plots that interbank rate on the vertical axis and the loan duration on the horizontal axis. Like the yield curve, the interbank curve is used the money market participant to get a sense of what the market think about the future. Compared to the yield curve, the interbank curve tend to be much steeper for the short duration loans.

(3) The other measure used by the money markets is Sterling Overnight Interbank Average Rate (SONIA). This measure was established in 1997. SONIA is an index that the tracks Sterling overnight funding rates for trades that occur in off hours. The Sterling overnight funding rate is a reflection of the depth of the overnight business in the market. SONIA thus is an ex post measure of the interbank rate.

There is certainly a relationship between i_{repo} rate and the interbank rate. As the i_{repo} increases, it also drives up the interbank rate since the commercial banks are being penalised and remunerated at a higher rate. This influences the value the money market places on funds changing hands between the banks. When would you expect there to be a great difference between the interbank rate and the LIBOR rate. This can happen when on the whole when the whole banking system has over lent or if the risk premium on loans go up because the commercial banks becomes extremely distrustful of each other. The latter would happen when there is imperfect information and the money markets expects the imminent collapse of a commercial some banks. At this point the funds lent out get rationed and the interbank rate could suddenly increase quite significantly.

References