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Optimality of base rate system of loan pricing of developing and emerging market economies: an evaluation

Abstract

This paper provides an analytical assessment of the base rate loan pricing rule by the commercial banks in a regulated environment that could relate to some developing and emerging market economies. The study found that the base rate approach to loan interest rate has an inbuilt upward bias due to specification of short-term yield on investment in government securities and measurement of overhead cost charge for loans. The upward bias in the base rate could be in the range of 150 to 300 basis points. From policy perspective, the base rate due to its upward bias could impose a sub-optimal and excess loan pricing structure on the banking system. Therefore, countries which have adopted the system of base rate may benefit from a critical review of such loan pricing regulation for the purpose of macroeconomic and financial system stability.

Keywords: base rate, interest rate pass-through; bank competition; monetary policy transmission.
JEL Classification: C23, D4, E43, E52, G21, L10.

Introduction

The successful conduct of policy through the interest rate channel requires that commercial banks should adjust interest rates on loans in an appropriate and adequate manner in tandem with policy actions. However, numerous studies have shown that the pass-through of policy actions to loan interest rate could be affected by rigidity in banks' lending decisions due to several factors such as market imperfection and non-pricing objectives (Pringle, 1974; Hancock, 1986), capital decisions (Pringle, 1974; Taggart and Greenbaum, 1978), credit rationing due to information asymmetry and moral hazard problems (Stiglitz and Weiss, 1981; Hannan and Berger, 1991; Neumark and Sharpe, 1992), product diversification (Hanweck and Ryu, 2005; Allen, 1988; Saunders and Schumacher, 2000), relationship banking (Mayer, 1988; Sharpe, 1990; Boot et al., 1993; Aoki, 1994), bank specific characteristics such as size and ownership unfavorable to competition (Demrguc-Kunt and Huizinga, 1990; Angbazo, 1997) and monetary targeting (Thakor, 1996). No doubt, these explanations provide a generalized perspective for developed and developing economies. However, developing and emerging market economies could be distinguished from developed economies in terms of structural characteristics and more importantly, the regulatory environment. Illustratively, in the Indian context, commercial banks have to comply with a variety of regulatory and prudential requirements. It is not known, either theoretically or empirically, how these regulatory parameters could be associated with the banks' lending rate decision.

In the Indian context, the issue of pricing of loans has received considerable attention in recent years. In the wake of global crisis, the Reserve Bank of India (RBI) in its annual policy statement expressed a concern that while the policy rate softened by 550 basis points amid the global crisis, the lending rates of banks declined by 250 basis points. Such inadequate response of the banks prompted the RBI to constitute a Committee to look into the practices of banks and thus, suggest recommendations thereof. Thus, the motivation comes for this paper to engage in a theoretical analysis on the subject. Deriving from the standard theory of banking firm (Matthews and Thompson, 2005; Santomero, 1984; Slovin and Sushka, 1983; Sealey and Lindley, 1977; Wood, 1975; Baltensperger, 1980; Mingo and Wolkowitz, 1977; Goldberg, 1981; Klein, 1971; Zarruk and Madura, 1992 among others), we demonstrate that the regulatory requirements could impinge on banks' balance sheet and thus, influence their lending rates. In such a situation, the policy rate could not be the sole criteria for the banks to change their lending rates. Authorities may require a calibrated approach to bring about desired changes in the banks' lending rate.

The rest of the paper comprises theoretical analysis in Section 1, Section 2 followed by empirical perspectives. The final section includes.

1. Theoretical approaches

1.1. The base rate approach. According to this approach, banks' interest rate on loans and advances (r_L) can be defined in terms of four components, i.e. (a) cost of funds/deposits, (b) negative carry on account of reserve (θ) and liquidity requirements (s), (c) overhead cost, and (d) average return on net worth:

$$r_L = a + b + c + d. \tag{1}$$

Where we have k = cost of deposits/funds (r_D), b = negative carry on reserve and liquidity requirements $\left[\frac{(r_D - s r_G^T)}{(1-\theta-s)}\right] - r_D$, c = Unallocatable overhead cost to deployable funds ratio $= \frac{U_c}{\hat{D}}$ with deployable funds $\hat{D}$ defined with respect total deposits net of reserve and liquidity requirements: $\hat{D} = D\,(1-\theta-$

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s), and k: average return on net worth $= \frac{\Pi}{D} = \frac{\Pi}{K} * \frac{K}{D}$, with net worth K equals to capital and free reserves.

Some pertinent questions arise in this context. How was this formula derived? Did it come from the optimization of an objective function of a representative bank? What were the underlying assumptions to derive the formula? What would happen if these assumptions were to be relaxed? Most importantly from practical perspective, whether this formula would calibrate a minimum rate or maximum rate? Thus, this paper is motivated to derive some analytical perspectives which could be useful for policy purposes.

1.1.1. Analytical perspectives on base rate approach. Firstly, let us add up four components in the formula. The sum of first and second components will reduce to the square bracketed component of the second component. Overall, the formula will be simplified to:

$$r_L = \left[\frac{(r_D - s * r_G^T)}{\left(1 - \theta - s\right)} \right] + \frac{U_c}{\hat{D}} + \frac{\Pi}{\hat{D}}. \tag{2}$$

Assuming for simplicity, there is no borrowing, the first component could refer to interest rate on deposits (r_D). Regarding the second component, the formula uses 364-day treasury bill rate (r^T_D), a short term risk free interest rate, as a proxy for return on banks' investment predominantly in government securities due to statutory liquidity requirement (s). A pertinent issue arises here. Banks' investment in government securities could pertain to medium-longer maturity securities. Whether the short-term treasury bill rate could exactly match the medium-longer term yield? Let the medium-longer yield could be modelled in line with the term structure of interest rate:

$$r_G^m = \alpha + \beta r_G^T . \tag{3}$$

Thus, medium-longer yield would be equal to the short-term yield, provided $\alpha = 0$ and $\beta = 1$. The first condition $\alpha = 0$ would imply for zero risk premium to various risks pertaining to liquidity, inflation and economic growth while pricing medium and longer term government bonds. It is plausible that the second condition $\beta = 1$ would be satisfied under perfect operating efficiency of the market, reflecting upon the integration of financial market segments. However, the first condition may not be met for all the time. Because, this would imply for zero mean of the yield spread. The crucial point here is that for $\alpha > 0$, the numerator of the negative carry term will be higher due to short-term yield but lower due to medium-longer term yield. Accordingly, the formula has an inbuilt mechanism of deriving higher loan interest rate due to treasury bill rate rather than a lower loan interest rate due to medium term yield.

The third component is measured as overhead cost to deployable deposits ratio in order to capture the cost of financial intermediation. For a bank, the overhead cost is equivalent to operating cost due to wages and salary, establishment expenses and various transaction costs. Deployable deposits are measured by aggregate deposits less CRR (θ) and SLR (s) balances. This characterization of overhead cost ratio implies that banks incur operating cost only due to deposits available for loans and advances! But banks may incur operating costs due to intermediation service involving its entire range of business activities, principally, comprising deposit mobilization, credit deployment and investment in securities. A major difficulty here is that banks' cost function may not be separable, i.e., operating costs cannot be measured separately for deposits, lending and investment. From operational consideration, thus, two alternative perspective arise with regard to measuring intermediation cost to banks' business ratio: (1) the ratio of operating cost to business comprising deposits, lending and investment activities and (2) the ratio of operating cost to loans and investment, which are funded activities. In this way, the intermediation cost ratio would be much lower than the overhead cost to deployable deposits ratio. Consequently, the loan interest rate based on the intermediation cost would be lower than the loan interest rate based on overhead cost ratio in line with the base rate approach.

The fourth component refers to the return on net worth, i.e. capital plus free reserves, as return on capital of promoters and shareholders. The formula, however, combines profitability (π_D) over deployable funds (equivalent to profit over sales ratio for non-financial goods producing companies) and return on capital employed. Thus, the loan interest rate calculation is based on net profitability chargeable over loans and advances funded out of available deposits (π_L), since deployable funds exclude SLR investment and CRR balance. A critical question arises here. Why should not banks charge profitability to investment which is a funded business activity? Thus, an alternative perspective is profitability should be measured over loans and investment taken together (π_{LG}). In the literature, most of studies, however, measure profitability as return on total assets (ROA), (π_A). By definition, π_D will be higher than π_{LG} and π_A and thus, the loan interest rate derived from the base rate approach will be higher than the one based on π_{LG} and π_A.

1.2. Optimization approach. Now we turn to the theory of banking firm perspective for deriving loan interest rate from the optimization problem of a representative bank! For this purpose, we demonstrate the optimizing behavior of a representative profit maximizing banking firm subject to regulatory and prudential requirements intertwined with balance sheet and profit and loss accounts. Let the bank's balance sheet is characterized as follows:

$$D + K = L + G + R, \tag{4}$$

where total liabilities comprizing deposits (D) and capital and free reserves (K) equal total assets comprising loans, investment in government securities and balance held with the central bank. In line with SLR requirement, banks are required to invest in government securities equal to a fraction s of deposit liabilities. Similarly, balances with the central bank (R) on account of cash reserve requirement can be measured as fraction k of deposits. Banks are also subject to prudential capital requirement, i.e. capital to risk weighted assets such as loans and advances ratio must be k. Thus, we have:

$$\left\{ \begin{array}{lcl} G & = & s\,D \\ R & = & \theta\,D \\ K & = & k\,L \end{array} \right\}. \tag{5}$$

Substituting the above constraints in balance sheet equation, we have:

$$D + k_L = L + s_D + \theta_D, \tag{6}$$

$$\text{or } D = \frac{1-k}{1-\theta-s}L. \tag{7}$$

Now let us have the income and expenditure accounts:

$$R_L + R_G = R_D + C + \mu\sigma L + \Pi, \tag{8}$$

where the sum of income from loans and investment should be equal to the sum of expenditure on deposits, operating cost and profit. Thus, a bank's objective function can be derived with respect to profit maximization or operating cost minimization:

$$\Pi = R_L + R_G - R_D - C - \mu\sigma L, \tag{9}$$

$$C = R_L + R_G - R_D - \Pi - \mu\sigma L. \tag{10}$$

Let us take the profit objective first. Using interest rates r_L, r_G and r_D corresponding to quantum of loans (L), investment (G) and deposits (D), and operating cost proportional to banks' business ($L + G + D$), we have the profit function:

$$\Pi = (1-\sigma)r_L L + r_G G - r_D D - C(L,G) - \mu\sigma L, \tag{11}$$

$$\text{or } \Pi = (1-\sigma)r_L L(r_L) - (r_D - r_G s)\frac{(1-k)}{(1-\theta-s)}\times \\ \times L(r_L) - C(L,G) - \mu\sigma L(r_L). \tag{12}$$

The objective function is now a function of quantity of loans and advances (L), interest rates and regulatory and prudential parameters. The first order condition with respect to loans will give us the solution to optimal loan interest rate:

$$r_L = \left[\left(\frac{1}{1-\dfrac{1}{\epsilon_L}}\right)\frac{(r_D - r_G s)(1-k)}{(1-\sigma)(1-\theta-s)}\right] + C'(L) + \mu\sigma. \tag{13}$$

A comparison of the optimal loan interest rate with the base rate approach brings to the fore various crucial insights. First, in the optimal loan interest rate formula, if we set capital to risk asset (loan) ratio $k = 0$, loan defaults $\sigma = 0$ and interest elasticity of loan demand $\epsilon_L = \infty$ (the latter implies perfect competition in loan market), then the first term would equal to the bracketed negative carry component of 'base rate' approach, which can be the sum of 'a' and 'b' components. This raises a fundamental issue. Is it realistic to assume $\epsilon_L = \infty$, $k = 0$, and $\sigma = 0$. Second, the term $C'(L)$ in the above formula accounts for marginal operating cost of loans as compared with the base rate's average overhead cost ratio. A critical question arises here. Should marginal cost be equal to average cost? The answer to this question requires us to know the exact functional specification of the cost function in terms of linear or non-linear form. Let us consider the linear form. Here, we can have the cost function explicitly specified in alternative ways:

$$C = c_L \tag{14}$$

$$C = \alpha + c_L. \tag{15}$$

For the first specification, we will have marginal cost equal to average cost of loans:

$$MC = \frac{\partial C}{\partial L} = c = \frac{C}{L} = AC. \tag{16}$$

For the second function, however, we will have average cost higher than the marginal cost:

$$MC = \frac{\partial C}{\partial L} = c, \tag{17}$$

$$AC = \frac{C}{L} = \frac{a}{L} + c. \tag{18}$$

In this case, marginal cost will tend to equal average cost when fixed cost (a) will be much lower relative to loan quantity (L).

In the above, the operating cost function was specified in terms of loans. However, the operating cost function can be specified with respect to loans and investment taken together or separately. Illustratively, consider the linear cost function:

$$C = \alpha + c^b(L + G). \tag{19}$$

The marginal cost of loans in this case c^b could be greater than the marginal cost k. Thus, the optimal lending rate corresponding to c^b would be lower than the one corresponding to c. The cost function here implies for similar marginal cost for loans and investment. However, the cost of loans could be different from that of investment. For this purpose, we can have a cost function in linear form as follows:

$$C = \alpha + c^L L + c^G G. \tag{20}$$

For equation, c^L could be different from c^b and c. Now let us consider the non-linear cost function of the following form:

$$C = AL^{\alpha}G.^{\beta} \tag{21}$$

From which we can derive:

$$MC = \alpha AC. \tag{22}$$

In this case, for $\alpha = 1$ MC will be equal to AC and accordingly, the base rate approach will be similar to the optimization approach in accounting for cost of loans. However, for $0 < \alpha < 1$, the base rate approach will lead to overcharging of cost to loans.

The third argument is that the optimal lending rate does not have the return on capital or net owned funds unlike the base rate approach. This is because the underlying profitability objective is captured through optimal loan pricing. Thus, base rate's loan interest rate will be higher than a bank's optimal lending rate.

Now let us consider the case of cost optimization objective, which could be consistent with efficient financial intermediation objective. Unlike the profit optimization problem, the cost optimization will obviate the problem of functional specification of operating cost function. The cost optimization will enable us to take into account the return on capital considered for pricing of loans:

$$C = (1-\sigma) r_L L(r_L) - (r_D - r_G s)\frac{(1-k)}{(1-\theta-s)} L(r_L) - r_k kL - \mu\sigma L(r_L). \tag{23}$$

The first order condition with respect to loans will give solution to optimal loan interest rate:

$$r_L = \left(\frac{1}{1 - \frac{1}{\epsilon_L}} \right) \frac{(r_D - r_G s)(1-k)}{(1-\sigma)(1-\theta-s)} + r_k k + \mu\sigma. \tag{24}$$

In this case, the marginal overhead cost term disappears from the optimal lending rate. As in the case of profit optimization, here also we will require the assumptions $\epsilon_L = \infty$, $k = 0$, and in order to have the bracketed component of b of the base rate approach. In the optimal lending rate equation, both operating cost ratio and profitability ratio cannot appear simultaneously, unlike base rate. Therefore, base rate's loan rate will always be higher than the loan rate of a profit or cost optimizing bank. In other words, the base rate will force a bank to have higher floor for loan interest rate and allow for abnormal profit and higher spread over deposit cost and yield on investment in securities.

2. Empirical perspectives

First, the case for a medium-longer term yield would require two evidences: (1) banks hold a large part of investment in the medium-longer maturity bucket and (2) yield spread of medium-longer maturity yields over short-term yield is significant. Table 1 provides a summary of public sector and domestic banks' maturity composition of investment in 2010-11. It is evident that public sector banks and domestic banks (including public and private sector banks) accounted for as high as 71.2 per cent and 94.1 per cent of total investment of the banking sector in 2010-11. Investment in the maturity bucket above 3 years accounted for the bulk of total investment for public sector banks (69.2 per cent) and 62.2 per cent for domestic banks. The median of public sector banks investment in maturity bucket above 3-years was 77.6 per cent of their total investment.

Table 1. Maturity composition of banks' investment

	Rs Billion			% to total Investment			% to all banks	
	PSBs	Domestic banks	All	PSBs	Domestic banks	All	PSBs	Domestic
m < = 14 -day	456	872	1428	3.4	5.0	7.7	31.9	61.1
14 day< m < =28 day	172	376	439	1.3	2.1	2.4	39.1	85.5
29 day < m < = 3-month	870	1260	1353	6.5	7.2	7.2	64.3	93.1
3 month < m <= 6 months	395	636	717	3.0	3.6	3.8	55.1	88.7
6 month< m < = 1 year	516	859	967	3.9	4.9	5.2	53.3	88.8
1 year < m < = 3 year	1688	2645	2790	12.7	15.1	15.0	60.5	94.8
3 year < m < = 5 year	1908	2330	2367	14.4	13.3	12.7	80.6	98.4
m > 5 year	7290	8587	8600	54.8	48.9	46.1	84.8	99.8
Total	13294	17565	18662	100.0	100.0	100.0	71.2	94.1
sub-total								

Table 1. (cont.) Maturity composition of banks' investment

	Rs Billion			% to total Investment			% to all banks	
m < = 3 year	4096	6648	7694	30.8	37.8	41.2	53.2	86.4
m > = 3 year	9199	10917	10968	69.2	62.2	58.8	83.9	99.5
Cross section of banks Median (m > = 3 year)				77.6	73.6			
Cross section of banks Median (m > = 5 year)				59.9	54.1			

Now we come to the analysis of yield curve. Figure 1 shows the movements in yields for 364-day Treasury bill, 5-year and 10-year Government securities. Table 2 provides summary statistics of G-sec yields for daily data over a longer sample period from April 1994 to May 2012. On average, the sample means for G-sec yields for 10-year and 5-year maturities turn out higher by 129 basis points and 92 basis points than the 1-year treasury bill rate. Are these spreads statistically significant? Here, an analysis of the test of equality of means as shown in Appendix 1 clearly supports differential means for pairs of short and medium-longer yields, implying for statistically significant non-zero yield spread.

A more formal analysis involving the cointegration technique provided further evidence. Both the medium-longer G-sec yield such as the 10-year yield and 364-day yield can be first order integrated I (1) series and cointegrated. In line with the equation, the null hypothesis of $\beta = 1$ cannot be rejected due to insignificant chi-square test statistic. However, the intercept term in the cointegration vector characterizing the long run average yield spread is non-zero at 1.23, more or less similar to the figure reported in Table 1.

Table 2. Yield curve summary statistic

	Yields			Spreads	
Statistic	BD10Y	BD5Y	BD1y	XSP10	XSP5
Mean	9.25	8.88	7.97	1.29	0.92
Median	8.14	7.98	7.50	1.13	0.65
Maximum	14.50	15.00	18.00	4.15	4.00
Minimum	4.95	4.59	3.45	-4.00	-3.00
Std. Dev.	2.69	2.67	2.64	1.01	0.92
Skewness	0.47	0.54	0.49	0.81	1.14
Kurtosis	1.97	2.16	2.43	3.80	4.21
Jarque-Bera	373.13	360.54	244.29	622.95	1276.35
(Probability)	0	0	0	0	0

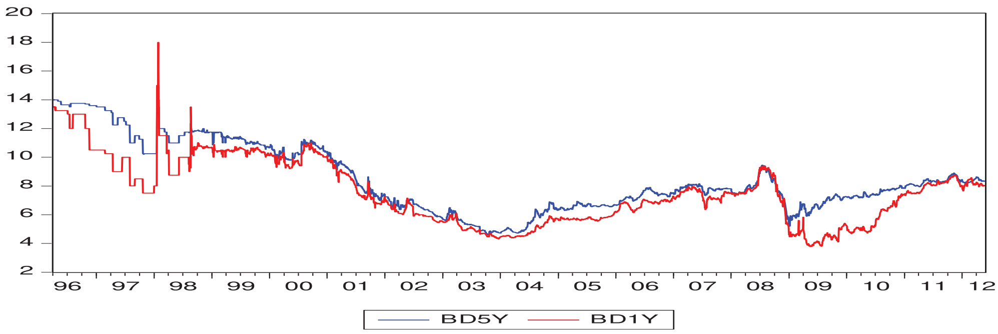

Fig 1. 5-years and 1-year government bond yield curves

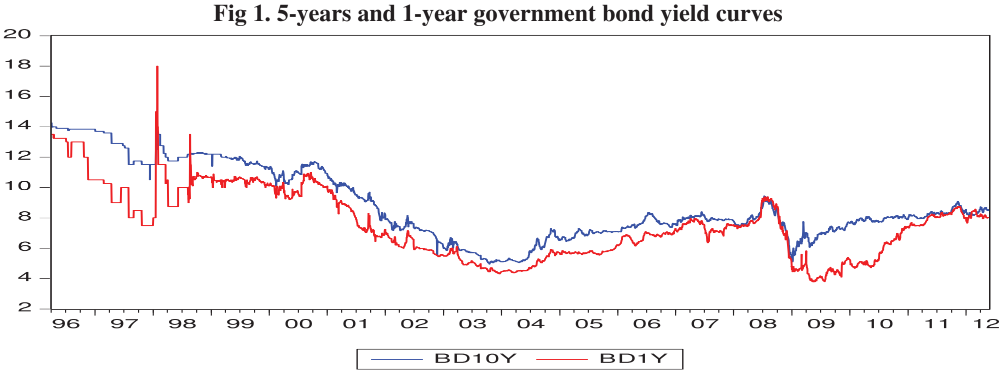

Fig 2. 10-years and 1-year government bond yield curves

Secondly, the annual balance sheet data for the banking sector during 1996-97 to 2010-11 could be used to demonstrate alternative measures of overhead operating cost ratio for pricing of loans. Here, we examine the four different measures: (1) overhead cost to deployable funds ratio in line with the base rate approach, (2) overhead cost to loans and investment ratio, (3) overhead cost to business (loans, investment and deposits) ratio (Table 3). Thus, it is evident that the operating cost ratio of base rate approach was 130 to 230 basis points higher than the two alternative measures.

Table 3. Measuring operating cost ratio (amount: Rs billion)

Year (march)	Deposits	CRR balance with RBI	Investment	SLR Investment	Loans	Operating expenditure	Operating cost ratio*		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	OER1	OER2	OER3
1994	3493	489	1541	1339	1683	115	6.9	3.6	1.7
1995	4061	602	1728	1455	2088	142	7.1	3.7	1.8
1996	4576	669	1856	1585	2524	176	7.6	4.0	2.0
1997	5378	569	2239	1861	2756	191	6.5	3.8	1.8
1998	6441	675	2721	2137	3246	209	5.8	3.5	1.7
1999	7708	768	3395	2553	3696	252	5.7	3.5	1.7
2000	9003	801	4139	3108	4435	276	5.4	3.2	1.6
2001	10552	785	4919	3744	5257	342	5.7	3.4	1.6
2002	12027	794	5881	4501	6457	337	5.0	2.7	1.4
2003	13556	779	6931	5518	7392	380	5.2	2.7	1.4
2004	15755	1043	8028	6543	8636	435	5.3	2.6	1.3
2005	18376	1084	8697	7117	11508	501	4.9	2.5	1.3
2006	21647	1324	8665	7004	15168	592	4.4	2.5	1.3
2007	26969	1798	9510	7635	19812	663	3.8	2.3	1.2
2008	33201	3026	11773	9308	24769	773	3.7	2.1	1.1
2009	40632	2741	14496	11677	29999	896	3.4	2.0	1.1
2010	47469	3369	17290	13639	34967	1000	3.3	1.9	1.0
2011	56164	4253	19161	14518	42987	1231	3.3	2.0	1.0

Note: operating cost ratio is defined as follows: OER1= (7)/[(2)-(3)-(5)]*100; the base rate approach deployable funds OER2 = (7)/[(6)+(4)]*100; with respect to Loans and Investment OER3 = (7)/[(2)+(6)+(4)]*100; with respect to funded business (deposits, loans, investment).

Deriving from the discussion on cost function, we estimated the cost function for the banking system to assess the marginal cost of loans (Table 4). For the specification of operating cost as a function of only loans and advances (Eq.1), the marginal cost comes to 2.8 per cent for every Rs 100 loan; 50 basis point higher than the overhead cost ratio in 2010-11. When the operating cost is estimated with loans and investment taken together (Eq.2), the marginal cost is estimated at 1.9 per cent, about 140 basis points higher than the overhead cost ratio in 2010-11. When the operating cost is estimated with loans and investment separate variables (Eq.3), the marginal cost of loans turns out to 1.5 per cent; 180 basis points higher than the overhead cost ratio in 2010-11. In this equation, the marginal cost of investment turns out to be higher than the marginal cost of loans. When the cost function is estimated in log-linear form similar to a Cob-Douglas function, it is evident that loans could account for higher share of cost than investment. However, the marginal cost of loans could be fifty per cent of overhead cost ratio in 2010-11. Thus, for a profit maximizing bank, the optimal lending rate could be lower than the base rate by 50 to 180 basis points due to the former based on marginal cost and the latter based on average cost.

Table 4. Estimated operating cost function

Variable	Eq1	Eq2	Eq3	Eq4
Intercept	11334 (17.6)	9814 (18.7)	11308 (6.59)	1.1405 (4.11)
Loan	0.0280 (21.2)		0.0150 (6.2)	0.4818 (9.3)
Investment			0.0239 (4.1)	0.2178 (3.2)
Loan + Investment		0.0187 (31.0)		
R2 DW	0.96 1.68	0.96 1.79	0.99 1.52	0.99 2.17

Finally, taking into account the yield spread of about 100 to 125 basis points and the operating cost differential from 50 to 180 basis points, it can be inferred that the base rate loan interest could be higher by 150 to 300 basis points than the optimal loan interest rate of a profit maximizing bank. Replicating the above estimates, we compared optimal loan interest rate with base rate's loan rate using balance sheet data of individual banks. The difference between the base rate approach and optimal approach is shown in the Chart below.

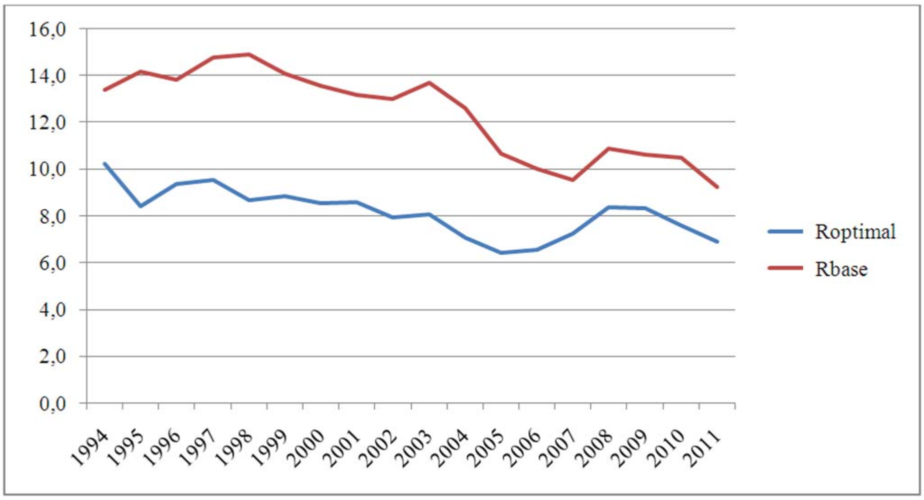

Fig 3. The difference between base and optimal rate

Conclusion

This study demonstrated alternative approaches to determination of loan interest rate and provided analytical and empirical perspectives. The study found that the base rate approach to loan interest rate has an inbuilt upward bias due to specification of short-term yield on investment in government securities and measurement of overhead cost charge for loans. As compared with the optimal loan interest rate of a profit optimizing bank, the base rate could not be considered a minimum rate but a maximum rate. The upward bias in the base rate could be in the range of 150 to 300 basis points. From policy perspective, the base rate due to its upward bias could impose a sub-optimal and excess loan pricing structure on the banking system. Studies show that sub-optimal and higher loan interest rate regime could accentuate the problem of non-performing loans and turn detrimental to investment activities and growth. Therefore, countries which have adopted the system of base rate under the garb of base rate system may benefit from a critical review of such loan pricing regulation for the purpose of macroeconomic and financial system stability.

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References

1. Allen, L. (1988). Determinants of Bank Interest Margins: A note, *Journal of Financial and Quantitative Analysis*, 23, June.
2. Baltensperger, E. (1980). "Alternative Approaches to the Theory of the Banking Firm", *Journal of Monetary Economics*, 6, January.
3. Boot, A.W.A. (2000). "Relationship Banking: What Do We Know?" *Journal of Financial Intermediation*, vol. 9
4. Boot, A.W.A., Greenbaum, S.I. and Thakor, A.V. (1993). "Reputation and Discretion in Financial Contracting,' *American Economic Review*, 83.
5. Campbell, T. (1978). "A Model of the Market for Lines of Credit", *Journal of Finance*, 33 (March 1978).
6. Demirgüç-Kunt, A. and Huizinga, H. (1999). "Determinants of commercial banks interest margins and profitability: Some international evidence", *World Bank Economic Review*, 13.
7. Goldberg, M.A. (1981). "The Impact of Regulatory and Monetary Factors on Bank Loan Charges", *Journal of Financial and Quantitative Analysis* Volume XVI, No. 2, June
8. Hancock, D. (1986). "A Model of the Financial Firm with Imperfect Asset and Deposit Elasticities", *Journal of Banking and Finance*, 10, March.
9. Hancock, D. (1986), "Testing Price Taking in Loan and Deposit Markets", *Financial Review,* 21.
10. Hannan, T.H. and A.N. Berger (1991). "The Rigidity of Prices: Evidence from the Banking Industry", *American Economic Review*, 81.
11. Hanweck, G.A. and Ryu, L.H. (2005). "The Sensitivity of Bank Net Interest Margins and Profitability to Credit, Interest-Rate and Term-Structure Shocks Across Bank Product Specializations", FDIC Working Paper No. 05-02.

12. Ho, T.S.Y. and Saunders, A. (1986). "The Determinants of Bank Interest Margins: Theory and Empirical Evidence", *Journal of Financial and Quantitative Analysis*, 16, November.
13. Dwight, M., Jaffee, D.N. and Modigliani, F. (1969). "A Theory and Test of Credit Rationing", *The American Economic Review*, Vol. 59, No. 5.
14. Klein, M.A. (1971). "A Theory of the Banking Firm", *Journal of Money*, *Credit and Banking*, 3.
15. Kazuhiro, I. and Kanatas, G. (1990). "Asymmetric Information, Collateral and Moral Hazard", *The Journal of Financial and Quantitative Analysis*, Vol. 25, No. 4.
16. Lam, C. and A. Chen (1985). "Joint Effects of Interest Rate Deregulation and Capital Requirements on Optimal Portfolio Adjustments", *Journal of Finance*, 35, June.
17. Lim, G.C. (2001). "Bank interest rate adjustments: are they asymmetric?" *Economic Record*, vol.77.
18. Maynes, Lucille S. (1972). "Supervisory Influence on Bank Capital", *Journal of Finance*, 27, June.
19. Matthews, K. and Thompson, J. (2005). "Economics of Banking", Wiley Publication.
20. Mingo, J. and Wolkowitz, B. (1977). "The Effects of Regulation on Bank Balance Sheet Decisions", *The Journal of Finance* Vol. 32, No. 5.
21. Murray, J.D. and White, R.W. (1983). "Economies of Scale and Economies of Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions", *Journal of Finance*, Vol. 38, No. 3.
22. Neumark, D. and Sharpe, S. (1992). "Market Structure and the Nature of Price Rigidity", *Quarterly Journal of Economics*, 107.
23. Pringle, J.J. (1974). "The Capital Decision in Commercial Banks", *The Journal of Finance*, Vol. 29, No. 3.
24. Pringle, J.J. (1974). "Imperfect Markets Model of Commercial Bank Financial Management", *Journal of Financial and Quantitative Analysis*, 9, January.
25. Robinson, J.W. (2000). "Commercial Bank Interest Rate Spreads in Jamaica – Measurement, Trends and Prospects", *Bank of Jamaica Discussion Paper*, February.
26. Santomero, A. (1984). "Modeling the Banking Firm: A Survey", *Journal of Money Credit and Banking*, 16, Part 2.
27. Saunders, A. and L. Schumacher (2000). "The Determinants of Bank Interest Rate Margins in Mexico's Post-privatisation period (1992-95). "In P.L. Brock and L. Suárez-Rojas, eds., Why so High? Understanding Interest Rate Spreads in Latin America. Washington DC: Inter-American Development Bank, pp. 181-209.
28. Scholnick, B. (1996a). "Asymmetric Adjustment of Commercial Bank Interest Rates: evidence from Malaysia and Singapore", *Journal of International Money and Finance*, 15.
29. Scholnick, B. (1996b). "Retail Interest Rate Rigidity after Financial Liberalization", *Canadian Journal of Economics*, 29.
30. Sealey, C. and Lindley, J. (1977). "Inputs, Outputs, and the Theory of Production and Cost at Depository Institutions", *Journal of Finance*, 32, September.
31. Sharpe, S.A. (1990). "Asymmetric Information, Bank Lending, and Implicit Contracts: A stylized model of customer relationships", *Journal of Finance*, 45.
32. Stiglitz, J.E. and Weiss, A. (1981). "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, 71.
33. Slovin, M.B. and Sushka, M.E. (1983). "A Model of the Commercial Loan Rate", *Journal of Finance*, 38.
34. Taggart, R.A. and Greenbaum, S.I. (1978). "Bank Capital and Public Regulation", *Journal of Money*, *Credit and Banking*, 10.
35. Wood, J. (1975). "Commercial Bank Loan and Investment Behavior", London: Wiley, 1975.
36. Wong, K.P. (1997). "On the Determinants of Bank Interest Margins under Credit and Interest Rate Risks", *Journal of Banking and Finance* 21.
37. Zarruk, E.R. and Madura, J. (1992). Optimal Bank Interest Margin under Capital Regulation and Deposit Insurance", *The Journal of Financial and Quantitative Analysis*, Vol. 27, No. 1.

Appendix

Table 1. "Test for equality of means and ANOVA"

Test for equality of means between series			
Method	df	Value	Probability
t-test	8430	17.49988	0.0000
Satterthwaite-Welch *t*-test*	8412.357	17.49988	0.0000
Anova *F*-test	(1. 8430)	306.2456	0.0000
Welch *F*-test*	(1. 8412.36)	306.2456	0.0000
*Test allows for unequal cell variances			
Analysis of Variance			
Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	1667.229	1667.229
Within	8430	45893.69	5.444091
Total	8431	47560.91	5.641195
Category statistics			

Table 1 (cont.). "Test for equality of means and ANOVA"

Test for equality of means between series				
Std. Err.				
Variable	Count	Mean	Std. Dev.	of Mean
BD5Y	4216	8.486229	2.386086	0.036748
BD1Y	4216	7.596900	2.279205	0.035102
All	8432	8.041564	2.375120	0.025865
Test for equality of means between series				
Method		df	Value	Probability
t-test		8430	24.68140	0.0000
Satterthwaite-Welch *t*-test*		8396.720	24.68140	0.0000
Anova *F*-test		(1. 8430)	609.1715	0.0000
Welch *F*-test*		(1. 8396.72)	609.1715	0.0000
*Test allows for unequal cell variances				
Analysis of variance				
Source of variation		df	Sum of Sq.	Mean Sq.
Between		1	3377.121	3377.121
Within		8430	46734.18	5.543794
Total		8431	50111.30	5.943696
Category statistics				
Std. Err.				
Variable	Count	Mean	Std. Dev.	of Mean
BD10Y	4216	8.862621	2.427511	0.037386
BD1Y	4216	7.596900	2.279205	0.035102
All	8432	8.229760	2.437970	0.026550