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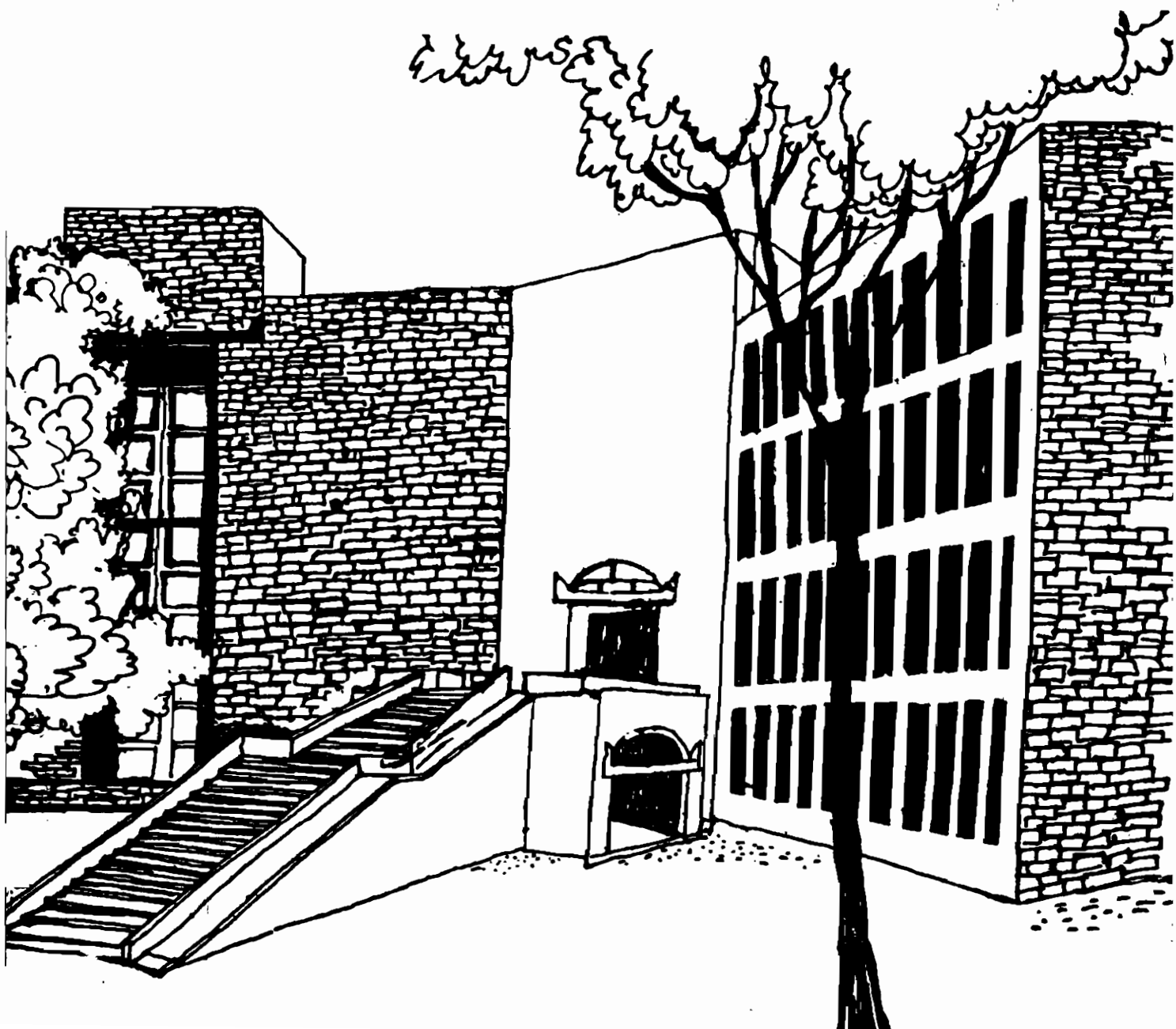

ECONOMIES OF SCALE AND SCOPE OF DISTRICT CENTRAL CO-OPERATIVE BANKS

By

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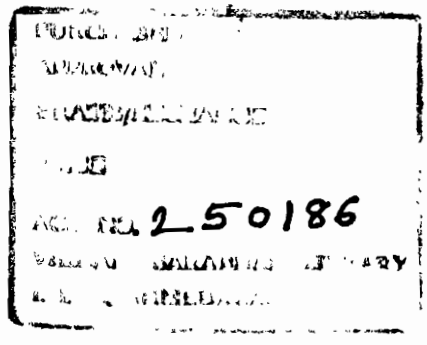

Economies of Scale and Scope of District Central Co-operative Banks

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Introduction

The main objective of this study is to explore the cost relationship of District Central Cooperative Banks (DCCBs). This is examined in terms of economies of scale and cost complementarities of joint production or economies of scope. Deasi and Namboodiri (1996) have very comprehensively examined the viability of cooperative rural financial institutions at the grass root level. But there is hardly any attempt to study the issue of product specific scale and scope economies of DCCBs.

Moreover, unlike commercial banks, the behaviour of their cost structure is different because of the nature of their banking operations. The loan portfolios of these banks are in the hands of the members of these institutions, i.e. primary co-operative societies, individuals and other institutions. Similarly they are their major depositors as well as the users of the credit advanced to them. They mainly cater to the local financial deficits and surpluses as agriculture is characterised by such a phenomenon. Yet the viability of these institutions are important not only from the point of view of their own growth but also for the development of cooperative institutions down the stream served by them and agricultural growth in general. An empirical analysis based on a multi-product cost function approach as is done here could reveal the cost structure of these banking institutions and economies of scope for future expansion in their banking operations.

The paper is divided into 6 sections. Section 2 briefly reviews the application of various methodologies in examining the cost attributes of multi product banking firms. Section 3 describes the methodology employed and the data utilized. Section 4 presents a

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♠ *The author is grateful to Professor Bhupat M. Desai for his valuable comments.*

brief description of DCCBs and the composition of their various portfolios. Section 5 presents the results of the estimated equation on scale and scope economies. Section 6 summarises the major findings and their implications.

Application of Multi-product Cost Functions in Banking

By using separable Cobb-Douglas production function approach Benston(1965), Murray and White (1983) have examined banks cost and indicated the prevalence of either scale economies or constant returns to scale in banking. Berger, Hanweck and Humphrey (1987) found slight scale diseconomies of scale and product mix. Followed by these studies, translog cost functions with single output (Benston *et al*, 1982) was used to examine the nature of banking cost. Single output cost functions can not capture the cost complementarities among various outputs. In other words cost saving from joint production *i.e.*, cost complementary, which refers to the extent to which cost of producing one output vary with respect to output levels of other activities can not be studied.. These cost complementarities gives rise to economies of scope. Desai and Namboodiri (1996a) examined the scale and scope economies with three outputs namely, deposits, loans and non-loan assets without using input prices. Gilligan, *et al* (1984) have studied scale and scope economies in multi-product banking firms with translog cost function by considering two outputs, viz., loan and deposits and two input prices, viz., wage and capital. Murray and White (1983) employed translog cost function with three outputs, namely, two types of loans and investments and used share equation for demand and term deposits in a simultaneous equation framework. The study by Berger and Humphry (1991) have gone beyond scale and scope economies to inefficiencies in banking operations. Studies on cooperative banking have indicated both economies of scale or constant returns to scale Taylor (1972) and decreasing returns to scale Koot (1978). Our study employs a translog cost function with five outputs, two input prices and estimated the total cost equation separately for different size of banks, deposit share and loan portfolio.

Methodology

Total cost is a function of various outputs(Y_i) and the prices of inputs(P_i). The translog cost function employed here allows to enter various outputs as separate variables and does not force to treat homogeneity and constant elasticity of substitution. Moreover a translog cost function permits the estimation of U shaped average cost curves, derivative of scale and scope economies and allows them to vary by size of banks. The cost function in this analysis is a Taylor series expansion in five output variables and two input prices as shown below. Standard symmetry and homogeneity restrictions are employed in the system equation and the full form of the equation with input homogeneity restrictions are given in Exhibit 1. The estimated cost equation is of the form:

$$ln\ TC = \alpha_0 + \sum_{i=1}^{5} \alpha_i\, ln\, Y_i + \sum_{j=1}^{2} \beta_j\, ln\, P_j + 1/2 \sum_{i=1}^{5} \sum_{j=1}^{5} \lambda_{ij}\, ln\, Y_i\, ln\, Y_j +$$

$$1/2 \sum_{i=1}^{5} \sum_{j=1}^{2} \gamma_{ij}\, ln\, P_i\, ln\, P_j + \sum_{i=1}^{5} \sum_{j=1}^{2} \delta_{ij}\, ln\, Y_i\, ln\, P_j + \varepsilon$$

Since the above equation is linear, it is amenable to Ordinary Least Square method to estimate the unknown parameters. Cost share equation can be directly derived from the above equation by differentiating it with respect to the price variables and their normalised sample means. Since the sum of the cost share equals to one, one of the equations is redundant.

The scale parameter related to each of the outputs can be obtained by differentiating the above cost equation with respect to each of the outputs. The overall economies of scale is represented by $\sum (\partial ln\, C / \partial ln\, Y_i) = s$. If s greater than 1, there is decreasing returns to scale, while s is equal to one there is constant returns to scale and for s less than one there is increasing returns to scale. Bailey and Friedlaender (1982) emphasised the cost-or-supply side benefits from joint production. In case of banking cost can be saved or revenue improved by supplying joint output. This is mainly met by spreading fixed cost

and to some extent through risk reduction. The existence of scope economies are examined here based on pairwise cost coplementarities. Using this concept the condition for economies of scope is given by $(\partial^2 C / \partial Y_i \partial Y_j) < 0$ and is approximated by when α_i $\alpha_j + \lambda_{ij} < 0$, where $i \neq j$. Though cost complementarities exist between all product pairs which always may not occur in reality.

Total costs (TC) include interest paid on borrowings and deposits, salary, rent, depreciation on fixed assets and other operating costs. Banks are viewed as financial intermediaries between deposits and loans as they collect or purchase funds and intermediate them into loans and other assets. Since all of them have some output attributes viz. value addition, all have to be treated as outputs. In fact several studies on scale economies differ with respect to the definition of output. This is because of the basic nature of the banking industry as these institutions produce services rather than physical products. Benston (1972), Gilligan *et al, (1984)* divided output into relatively homogeneous services such as demand and time deposits, loans of various kind. One might differ even considering deposit as an output since deposits are both input and output. Therefore in general banking operations which have value addition characteristics could be treated as outputs. This study considers five outputs in the total cost equation and they are: current and saving deposits (CSD), term deposits (TD), other borrowings (OB), loans to societies (LS), and loans to individuals (LI). The share of current and saving deposits in total deposits was around 40 per cent. In other words the term deposits had a share of three-fifth in total deposits. The share of other borrowings was one-fourth of the total loanable funds i.e., deposit plus other borrowings. Loans to societies predominated the credit portfolio having a share of over 85 per cent in total loans advanced. This is because DCCBs are the federations of Primary Agricultural Credit Societies (PACS) and generally they meet all the credit requirements of PACS.

One major difficulty faced was in terms of measuring the input prices. Most of the earlier studies used salaries per employee, hourly wage rates etc. for measuring the price of labour. First of all data on number of employees working in each of these banks are not available in the published source. Unlike other banks, only very few employees are employed at the branch offices of these banks. Average number of staff employed per branch office

was just over 3 and after adjusting for the part time employees in them the strength of staff at the branch level is barely 3. Since this study is being done at the bank level operating cost per office is considered as a proxy for the price of labour and capital. To validate this assumption a simple logarithmic function on operating cost with respect to number of offices was estimated. It explains as high as 81 per cent of the variation in operating cost. It also indicated that one per cent increase in the number of offices would increase the operating cost by 0.94 per cent. This suggests the strong association between operating cost and the number of branch offices. The operating cost per office is nothing but the price the bank pay towards labour, capital and other expenses to function as an office.

Another problem was related to prices of capital appropriated for rent and depreciation. The data available in the published form is on cost of management i.e., operating cost which is the sum total of salary, rent, depreciation and other operating expenses. The appropriateness of using this concept for pricing labour and capital could be further validated by comparing the actual share of operating cost in total cost and the share of operating cost obtained from the system equation. While the former accounted for 24 per cent of the total cost, the latter was 22 per cent or merely a difference of 2 per cent. Thus using operating cost per branch as a proxy for price of labour and capital may not distort the result. The price of fund is defined as the ratio of interest payments on total deposits plus other borrowings.

The study covers 243 District Central Co-operative Banks spread over ten states namely Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal. The data is taken from NABARD publications (NABARD, 1995). The data relates to 1995. While costs are measured in flow, outputs are measured in stock values.

First we have estimated the cost equation by taking all the 243 banks together. The size and output mix could also influence the scale and scope economies. This is because the slope of the cost curve could be influenced by the bank size, nature of deposit and loan portfolios. The interest and service costs could be different for various types of deposit, other borrowings etc. Bensten, Hanweck and Humphrey(1982) study reported scale economies for banks with less deposits size and scale diseconomies are more severe for

large size banks. The loaning portfolios could also influence the cost curve. Generally loans advanced to societies are of large sum per account unlike loans to individuals. Considering these features we have aslo studied the cost structure for banks of different size, deposit and loan portfolios. Thus cost equations were estimated for banks falling below and above median values of asset size (total assets per office), deposit share (share of total deposits in total liabilities) and loan portfolio(share of loans to societies in total loans advanced). Thus in all eight cost equations were estimated and due to poor statistical properties cost equation representing banks falling above median value of the share of loans to societies (LS) in total loans advanced has to be dropped.

District Central Co-operative Banks and Major Portfolios

District Central Co-operative Banks are generally located at the head quarters of districts in a state. They are federations of Primary Agricultural Credit Societies. These banks are also scheduled banks and are governed under the Banking Regulation Act of Reserve Bank of India. As of 1995 there were 363 District Central Co-operative Banks with 11653 branches. Large majority of the branch offices are located in rural areas. The sample in this study covers 67 per cent of the total DCCBs in the country comprising 84 per cent of the total branch offices. The membership of DCCBs consists of co-operative societies and individuals. As of 1995 there were 246 thousand co-operative societies and 675 thousand individuals and others as members. Major portfolio of these banks include current and saving deposits; term deposits; borrowing from National Bank, Apex Bank, government and commercial banks; loans to societies and individuals. They collect deposits from co-operative societies, individuals, local bodies and others. The short-term credit portfolio include cash loans, cash credit, overdraft and bills purchased/discounted. Loans advanced are in the nature of short, medium and long terms. Share of the deposits in total liabilities accounted for about 60 per cent and the share of current and saving deposits in total deposits accounted for 40 per cent. Other borrowings i.e., borrowings from Apex and National Bank, commercial banks etc. in total loanable resources (deposits plus other borrowing) was around 30 per cent. Over three-fourth of the total income was by means of

interest earnings form loans and advances and about three-fourth of the total expenditure was incurred on payment of interest for deposits and borrowings.

It is worthwhile to examine the composition of various outputs under various size class of asset size, deposit ratio and share of loans to societies (CSD) in total loans. The composition of various outputs under each of them indicated the following. The share of current and saving deposits (CSD) declines as bank size increases (**Table 1**). However neither the share of other borrowings (OB) in total loanable resources nor the share of loans advanced to societies have any systematic relationship with the bank size. But the share of interest cost in total cost rises as the size of bank increases . One possible reason for this could be the dominant share of term deposits in total deposit portfolio of large size banks and cost of such funds are three to four times higher than the current and saving deposits. Banks with different levels of deposit ratio, i.e., total deposit to total liabilities, indicated that as the deposit ratio increases there is a decline in the share of current and saving deposits(CSD) in total deposits, decline in the share of other borrowings(OB) in total loanable resources, i.e, deposit plus borrowings , as well as decline in the share of loans to societies(LS) in total loans advanced (**Table 2**). Therefore banks with higher deposits ratio have greater dependence on term deposit for its loanable resources. Further the share of interest cost in total cost rises with rise in deposit ratio possibly due to the predominance of term deposits in total deposits. **Table 3** indicates that as the share of loan advanced to societies (LS) in total loan increases, there is an increase in the share of current and saving deposits (CSD) in total deposit, increase in the share of other borrowings (OB) in total deposit plus borrowings. But the share of interest cost in total cost declines. Variation in output mix and cost structure is evident from the above.

Results

The results of estimated equations are reported in ***Appendix 1***. Most of the estimated coefficients are statistically significant. Since large number of variables are entered in the cost equations some of the estimated parameters have unexpected signs but they are statistically non-significant. The overall goodness of fit of all the equations are within reasonable acceptance levels.

Total and partial scale economies of various outputs computed from the estimated equation are given in **Table 4** . The total cost equation considering all 243 banks together reveals constant returns to scale. The share of operating cost in total cost estimated from the cost equation using the share equation was at 22 per cent. This is as opposed to 24 per cent based on the actuals. Loan portfolios have superior scale economies compared to deposit portfolios. Most cost effective among all outputs were loans to societies (LS) followed by loans to individuals(LI). Borrowing from other sources was more cost effective than both term deposit(TD) as well as current and saving deposits(CSD).

Results of total cost equation estimated separately for those banks falling below and above median values of asset size, deposit share and share of loans to societies in total loan portfolios are respectively as under. There is constant returns to scale for bank whose asset size falls below median level . However for those falling above median asset size there is decreasing returns to scale but only at 20 per cent level of significance. Loans portfolios have superior partial scale economies compared to deposit and borrowings. However the partial scale economies of both loans to societies and individuals of large bank size were inferior compared to small bank size. While the share of operating cost in total cost was 30 per cent for the small banks, it was roughly 24 per cent for the large banks as revealed by the share equation.

The estimated cost equation based on banks with below and above median values of deposit share showed that the former have constant returns to scale while the latter have scale diseconomies in total cost. The partial scale economies of the latter were higher for all outputs except other borrowings. This is because the source of other borrowing for all banks are almost same. Since the share of interest cost in total costs for banks with high deposit ratio was low compared with those with low deposit ratio implies that the scale diseconomy observed in their case was not due to high interest cost but the difference in their product mix. The partial scale economies of various outputs of the cost equation estimated for banks with high share in loans to societies in their loan portfolios too have superior scale economies for loans than deposit portfolios.

Thus for all banks together as well as for banks based on asset size, deposit share and loan portfolios the partial scale economies of credit portfolios were superior to deposit

portfolios and other borrowings. Constant returns to scale prevails except for banks with high deposit share in their total liabilities and to some extent for large size banks who have decreasing returns to scale.

The cost complementarities among various outputs i.e., the economies of scope computed from the estimated equations are reported in *table 5*. For all banks together significant economies of scope exist between term deposits and loans to societies (TD and LS) and other borrowings and loans to societies (OB and LS). For small banks, economies of scope exist between current and saving deposits and loans to societies (CSD and LS), and for large banks there is economies of scope between term deposits and loans to societies (TD and LS) , and other borrowings and loans to societies (OB and LS). For banks with relatively low deposit share in total liabilities there is strong economies scope between other borrowings and loans to societies (OB and LS), term deposits and loans to societies (TD and LS), current and saving deposits and loans to societies(CSD and LS). For banks with relatively high deposit share scope economies is found only for current and saving deposits and loans to societies(CSD and LS). Banks with high share of loans to societies in their loaning portfolio scope economies exist in respect of other borrowings and loans to individuals (OB and LI) and combining term deposits and other borrowings(TD and OB).

Summary and Implications

This paper presents the results of product specific scale and scope economies of District Central Co-operative Banks applying a system of translog cost equation. The study considered five outputs and two input prices. For all banks together there was constant returns to scale. The cost equations estimated for banks falling below and above medium values of bank size, deposit share and share of loans to societies also indicated constant returns to scale except for large banks and banks with high deposit share. While the former has slight scale diseconomy the latter has strong scale diseconomy. These scale diseconomies appears as result of the nature of their product-mix.

Partial scale economies of various outputs indicate that loan portfolios have superior scale economies compared to deposit portfolios. Among loan portfolios, loans to societies was the most cost effective outputs followed by loans to individuals which is because the former unlike the latter is a group loan that makes it possible to spread common transaction costs and risks. Among deposits and other borrowings, other borrowings have superior partial scale economy which may be due to larger amount of the latter per account.. Difference in the partial scale economies of current and saving deposits(CSD) and term deposits(TD) were marginal and if at all the latter was more cost-effective.

The share of operating cost in total cost as estimated by the share equation was 22 per cent for the total sample. The share of operating cost in total cost tends to rise as the size of bank increases. Similar is the case when there is rise in the share of deposit in total liabilities.

There is strong evidence of cost complementarities between term deposits (TD) and loans to societies(LS); and between other borrowings (OB) and loans to societies. There is also scope for promoting loans to individuals(LI) by raising funds through other borrowings and especially for those banks whose current loan portfolios are by and large dominated by loans to societies.

Implications of the above findings are three fold: First, banks of relatively large size and with high deposit share could alter their output configuration to reap either constant or increasing returns to scale. Second, the partial scale economy of current and saving deposits was inferior to term deposit in all cases is contrary to the common view that current and saving deposits are considered as cheap funds compared to term deposits. This indicates that proper management of current and saving deposits funds by promoting cash credit facilities for non-credit business of PACS, enhancing scale of finance under crop loan system and other short duration loans through *Kisan Credit Cards* etc. These low cost funds can bring down the average cost of the bank. At present DCCBs enjoy cheap funds made available by the apex bank. In short, DCCBs need to improve efficiency in terms of their deposit portfolio in general and their current and saving deposit portfolios in particular to improve their viability.

Table 1 : Deposit , Credit Portfolio and Interest Cost of District Central Cooperative Bank of Various Asset Size

Assets per Office (Rs. Million)	Number of Banks	Number of Offices	Share of CSD in total Deposits	Share of OB in total Deposit + OB	Share of LS in Total Loans Advanced	Interest Cost as % of Total Cost
Below 15	23	833	56.3	26.4	73.9	62.8
15 to 18	36	1662	52.6	23.6	90.5	69.0
18 to 21	39	1361	49.2	24.8	81.0	67.3
21 to 24	29	1598	49.1	28.1	85.3	73.9
24 to 30	33	1225	47.3	29.3	85.2	70.8
30 to 40	33	1555	36.1	20.7	86.2	78.2
40 to 50	22	529	31.6	27.9	84.4	76.7
Above 50	28	998	29.2	25.2	80.5	82.2
Overall	243	9761	40.8	25.3	84.0	76.2

CSD : Current and Saving Deposits
OB : Borrowings other than Deposits
LS : Loan to Societies

Source : Derived from (a) NABARD, Statistical Tables Relating to Co-operative Movement in India, 1994-95, Part I, Credit Societies, Mumbai, and
(b) NABARD, Financial Statements of the Cooperative Banks, 1994-95, Mumbai

Table 2 : Deposit , Credit Portfolio and Interest Cost of District Central Cooperative Ban of Various Deposit Size

Deposits to total Liabilities (%)	Number of Banks	Number of Offices	Share of CSD in total Deposits	Share of OB in total Deposit + OB	Share of LS in Total Loans Advanced	Interest Cost as % of Total Cost
Below 40	40	881	44.4	57.9	87.0	72.2
40 to 50	39	1186	44.2	45.1	83.3	73.1
50 to 60	53	2396	43.2	32.6	88.1	73.6
60 to 70	42	1870	41.6	21.4	82.9	75.3
70 to 80	43	2225	38.4	10.6	83.2	77.9
Above 80	26	1203	38.8	2.8	74.6	75.0
Overall	243	9761	40.8	25.3	84.0	76.2

Source : Same as in Table 1

Table 3 : Deposit , Credit Portfolio and Interest Cost of District Central Cooperative Bank according to Share of Loans to Societies (LS) in total Loans Advanced

Share of LS in Total Loans Advanced (%)	Number of Banks	Number of Offices	Share of LS in Total Loans Advanced	Share of CSD in total Deposit	Share of OB in total Deposit + OB	Interest Cost as % of Total Cost
Below 70	26	896	54.2	34.6	12.7	74.5
70 to 85	36	1206	78.7	31.5	23.0	77.5
85 to 90	30	1288	87.4	38.5	22.3	77.0
90 to 94	46	2082	92.1	41.5	24.9	76.6
94 to 97	64	3064	95.7	47.6	28.0	72.3
Above 97	41	1225	98.3	49.1	38.2	72.0
Overall	243	9761	87.7	40.8	25.3	76.2

Source : Same as in Table 1

Table 4 : Partial and Total Scale Economies of All Banks and for different Asset Size, Deposit Share and Loan Portfolio

Output	All Banks	Asset Size		Deposit Share		LS Share
		M_B	M_A	M_B	M_A	M_A
Partial Scale Economies						
CSD	.3762	.4141	.3090	.3894	.4240	.4320
TD	.2641	.2877	.3080	.2389	.3250	.2234
OB	.1545	.2038	.1409	.2649	.0790	.2396
LS	.0909	.0313	.1544	.0215	.0900	.0226
LI	.1099	.1089	.2038	.0012	.3060	.0581
Total Scale Economy	.9956	1.0459	1.1160	.9159	1.2230	.9757
Test for Unity (t-value)	(0.54)	(0.71)	(1.62)	(1.08)	(2.60)	(0.31)
Share of Operating Cost	.2201	.2991	.2377	.2073	.2280	.2028
Share of Interest Cost	.7799	.7009	.7623	.7927	.7714	.7972

M_B Below Median
M_A Above Median

Source: Derived from Appendix I

Table 5 : Economies of Scope for All Banks, Below and Above Median Level for Asset Size, Deposit and Loan Share

	All Banks	Assets per Office		Deposit Size		LS Share
		M_B	M_A	M_B	M_A	M_A
$\alpha_1\alpha_2 + \lambda_{12}$	−.3061	−.1199	−.1039	.6667	−.2071	−.4037
$\alpha_1\alpha_3 + \lambda_{13}$	−.1521	−.0323	−.0322	.8602	.0384	1.2219
$\alpha_1\alpha_4 + \lambda_{14}$	.0505	−.1665*	.0293	−.9447*	−.8439*	−.1849
$\alpha_1\alpha_5 + \lambda_{15}$	.0398	.0102	.0498	−.3073	−.3584*	− .4072
$\alpha_2\alpha_3 + \lambda_{23}$	.4756	−.2113*	1.1695	1.4328	−.0769	−.8434*
$\alpha_2\alpha_4 + \lambda_{24}$	−.3751*	−.0502	−1.6036*	−1.3571*	.2105	.3638
$\alpha_2\alpha_5 + \lambda_{25}$	−.0274	.0541	−.1265	−.5563	.1082	.2916
$\alpha_3\alpha_4 + \lambda_{34}$	−.2435*	.2094	−.9834*	−1.6474*	.0040	−.5718
$\alpha_3\alpha_5 + \lambda_{35}$	−.0167	−.0389	−.0731	−.6300	−.0304	−1.0602*
$\alpha_4\alpha_5 + \lambda_{45}$	.0015	−.0587	.0719	.6014	.5189	.1918

* Significant at 5% level based on approximate t-values

Source: Derived from Appendix I

Appendix I : Parameter Estimates of the Total Cost Equations

Variable	All Banks		Asset Size[®]			
			Below Median (M_B)		Above Median (M_A)	
	Coeffi-cient	t-value	Coeffi-cient	t-value	Coeffi-cient	t-value
Constant (α_0)	5.3296	2.04	9.3280	2.19	3.9277	0.95
Output:						
α_1	−.2253	0.71	−.0772	0.17	.0159	0.28
α_2	.8295	3.05	−.2655	0.64	1.3494	2.88
α_3	.5980	3.38	.4567	1.78	.8918	3.43
α_4	−.4027	0.94	.4484	1.69	−1.1453	1.95
α_5	−.0261	0.16	−.1044	0.51	−.0859	0.37
Factor Prices:						
β_1	−.5878	1.75	−1.2628	2.18	−.6306	1.41
β_2	1.5878	4.73	2.2628	3.90	1.6306	3.62
Cross Product of Output:						
λ_{11}	.2358	5.19	.3357	4.37	.1198	1.96
λ_{12}	−.1192	5.20	−.1404	4.92	−.1254	3.01
λ_{13}	−.0171	0.96	.0029	0.11	−.0465	1.55
λ_{14}	−0403	0.97	−.1319	1.82	.0476	0.68
λ_{15}	.0339	2.56	.0021	0.12	.0515	2.50
λ_{22}	.1699	5.95	.1419	4.85	.2107	4.09
λ_{23}	_.0212	1.28	−.0901	3.23	−.0331	1.39
λ_{24}	_.0417	1.06	.0688	1.14	−.0581	1.01
λ_{25}	_.0057	0.54	.0264	1.98	−.0108	0.67
λ_{33}	.0424	5.37	.0595	5.44	.0307	2.13
λ_{34}	−.0023	0.23	.0047	0.37	.0374	1.16
λ_{35}	−.0009	0.12	.0088	0.69	.0035	0.29
λ_{44}	.0727	2.39	.0544	1.24	.0062	0.06
λ_{45}	−.0090	0.65	−.0119	0.64	−.0026	1.06
λ_{55}	−.0093	2.04	−.0096	2.15	−.0174	1.53

Continued.....

Appendix 1 Continued.....

	All Banks		Asset Size[⊗]			
			Below Median (M_B)		Above Median (M_A)	
Variable	Coeffi-cient	t-value	Coeffi-cient	t-value	Coeffi-cient	t-value
Cross Product of Output and Factor Prices:						
δ_{11}	−.0484	1.87	−.0313	0.77	−.0241	0.65
δ_{12}	.0484	1.87	.0313	0.77	.0241	0.65
δ_{21}	−.0396	1.64	.0521	1.33	−.0955	2.77
δ_{22}	.0396	1.64	−.0521	1.33	.0965	2.77
δ_{31}	−.0473	3.74	−.0062	0.30	−.0703	4.63
δ_{32}	.0473	3.74	.0062	0.30	.0703	4.63
δ_{41}	.0753	2.36	−.0029	0.61	.1307	3.67
δ_{42}	−.0753	2.36	.0029	0.61	−.1307	3.67
δ_{51}	−.0086	0.63	−.0088	0.56	.0110	0.56
δ_{52}	.0086	0.63	.0088	0.56	−.0110	0.56
Cross Product of Factor Prices:						
γ_{22}	.1713	6.38	.2070	4.31	.1496	
γ_{12}	−.1713	6.38	−.2070	4.31	−.1496	
Test Statistics:						
R^2	.9897		.9938		.9933	
Standard Error of the estimate	.0902		.0644		.0713	
D.W.Statistics	1.71		1.50		1.78	
F - Statistics	868.85		70.95		660.11	

⊗ Total assets per branch Office

Appendix I continued

Variable	Deposit Size⊕				LS Share⊖	
	Below Median (M_B)		Above Median (M_A)		Above Median (M_A)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant (α_0)	2.9355	0.64	6.7205	1.60	5.0704	0.75
Output:						
α_1	−.0048	0.08	−.3408	0.66	7897	0.90
α_2	−.1692	0.31	1.3131	3.46	−.3675	0.55
α_3	−.7740	0.91	.5063	2.04	1.9249	3.65
α_4	1.6571	1.72	−.5988	0.82	−.4763	0.46
α_5	.0547	0.24	−.0660	0.26	−.5843	2.65
Factor Prices:						
β_1	−.1859	0.34	−.9937	1.65	−1.3236	1.34
β_2	1.1859	2.17	1.9937	3.31	2.3236	2.35
Cross Product of Output:						
λ_{11}	.3283	3.34	.1863	2.57	.1523	1.73
λ_{12}	−.1161	3.31	−.1035	1.84	−.1135	2.40
λ_{13}	−.1193	1.36	−.0328	0.97	−.2982	5.12
λ_{14}	.0952	0.83	.0124	0.14	.1917	1.91
λ_{15}	.0595	2.70	.0363	1.26	.0542	2.05
λ_{22}	.1085	2.59	.0323	0.45	.0374	0.65
λ_{23}	.0855	1.13	−.0337	1.47	−.1360	3.62
λ_{24}	.1077	1.20	.0221	0.31	.1887	2.30
λ_{25}	.0084	0.44	.0506	1.89	.0049	0.24
λ_{33}	.1719	2.14	.0125	0.90	−.0884	3.38
λ_{34}	.0771	1.07	.0313	0.85	.3450	4.75
λ_{35}	−.0148	0.47	.0189	1.36	.0645	3.23
λ_{44}	−.1069	1.55	−.0117	0.09	−.5154	3.05
λ_{45}	−.0452	1.40	−.0693	1.96	−.0865	2.47
λ_{55}	−.0005	0.08	−.0271	1.62	−.0063	1.18

Continued.....

Appendix 1 continued....

	Deposit Size[⊕]		LS Share[⊖]			
	Below Median (M_B))		Above Median (M_A)		Above Median (M_A)	
Variable	Coeffi-cient	t-value	Coeffi-cient	t-value	Coeffi-cient	t-value
Cross Product of Output and Factor Prices:						
δ_{11}	−.0016	0.03	−.0525	0.95	−.0298	0.49
δ_{12}	.0016	0.03	.0522	0.95	.0298	0.49
δ_{21}	.0086	0.19	−.0621	1.78	.0719	1.35
δ_{22}	−.0086	0.19	.0621	1.78	−.0719	1.35
δ_{31}	−.0709	1.06	−.0403	2.47	−.0520	1.76
δ_{32}	.0709	1.06	.0403	2.47	.0520	1.76
δ_{41}	−.1155	1.50	.0896	1.54	−.0782	1.02
δ_{42}	.1155	1.50	−.0896	1.54	.0782	1.02
δ_{51}	−.0101	0.53	−.0056	0.25	.0292	1.59
δ_{52}	.0101	0.53	.0056	0.25	−.0292	1.59
Cross Product of Factor Prices:						
γ_{22}	.1102	2.70	.2228	4.93	.2577	3.27
γ_{12}	−.1102	2.70	−.2228	4.93	−.2577	3.27
Test Statistics:						
R^2	.9896		.9921		.9918	
Standard Error of the estimate	.0776		.0859		.0782	
D.W.Statistics	2.06		2.15		2.21	
F - Statistics	422.11		551.82		539.41	

⊗ Total assets per branch Office

⊕ Total deposits as percent of total liabilities

⊖ Share of Loans to Societies as per cent of Total Loans Advanced

Exhibit I : Full Form of Estimated Equation

$$\ln TC = \alpha_0 + \alpha_1 \ln Y_1 + \alpha_2 \ln Y_2 + \alpha_3 \ln Y_3 + \alpha_4 \ln Y_4 + \alpha_5 \ln Y_5 + \beta_1 \ln P_1 + \beta_2 \ln P_2$$

$$+0.5 \sum \lambda_{11} \ln Y_1 \ln Y_1 + 0.5 \sum \lambda_{22} \ln Y_2 \ln Y_2 + 0.5 \sum \lambda_{33} \ln Y_3 \ln Y_3 + 0.5 \sum \lambda_{44} \ln Y_4 \ln Y_4$$

$$+0.5 \sum \lambda_{55} \ln Y_5 \ln Y_5 + \lambda_{12} \ln Y_1 \ln Y_2 + \lambda_{13} \ln Y_1 \ln Y_3 + \lambda_{14} \ln Y_1 \ln Y_4 + \lambda_{15} \ln Y_1 \ln Y_5$$

$$+\lambda_{23} \ln Y_2 \ln Y_3 + \lambda_{24} \ln Y_2 \ln Y_4 + \lambda_{25} \ln Y_2 \ln Y_5 + \lambda_{34} \ln Y_3 \ln Y_4 + \lambda_{35} \ln Y_3 \ln Y_5$$

$$+\lambda_{45} \ln Y_4 \ln Y_5 + 0.5 \sum \gamma_{11} \ln P_1 \ln P_1 + 0.5 \sum \gamma_{22} \ln P_2 \ln P_2 + \gamma_{12} \ln P_1 \ln P_2$$

$$+\delta_{11} \ln Y_1 \ln P_1 + \delta_{12} \ln Y_1 \ln P_2 + \delta_{21} \ln Y_2 \ln P_1 + \delta_{22} \ln Y_2 \ln P_2 + \delta_{31} \ln Y_3 \ln P_1$$

$$+\delta_{32} \ln Y_3 \ln P_2 + \delta_{41} \ln Y_4 \ln P_1 + \delta_{42} \ln Y_4 \ln P_2 + \delta_{51} \ln Y_5 \ln P_1 + \delta_{52} \ln Y_5 \ln P_2 + \varepsilon$$

Restrictions:

$$\beta_1 + \beta_2 = 0$$

$$\gamma_{11} + \gamma_{12} = \gamma_{22} + \gamma_{12} = 0$$

$$\delta_{11} + \delta_{12} = \delta_{21} + \delta_{22} = \delta_{31} + \delta_{32} = \delta_{41} + \delta_{42} = \delta_{51} + \delta_{52} = 0$$

Share Equation:

$$\text{Share of Operating Cost} = \beta_1 - \gamma_{12} \ln P_1 + \gamma_{12} \ln P_2 - \delta_{12} \ln Y_1 - \delta_{22} \ln Y_2 - \delta_{32} \ln Y_3 - \delta_{42} \ln Y_4 - \delta_{52} \ln Y_5$$

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