Chapter - V

OTHER FACTORS AFFECTING COSTS AND EARNINGS

5.1 Other Factors Affecting Costs and Earnings

It emerges from the discussion of the preceding two chapters that, size (volume of business) explains only part of the variation in costs and earnings. There are other factors also, which influence costs and earnings at branch level. Basically these other factors relate to the structure of business or product-mix and they may be enumerated as below :

(a) Loan portfolio

(b) Deposit-mix

(c) Composition of Assets

(d) Other services.

It is therefore, necessary to take into account structural characteristics of rural and urban branches for analysing the effect of other factors on costs and earnings. In this connection, Gramely observes that "the observed differences in costs and earnings between large and small banks reflect in part, differences in types of services they provide".[1]

The structural characteristics as reflected in loan-mix, deposit-mix, asset-mix, income-mix etc., in different size-groups of rural, urban and all branches for the years 1978 and 1979 are shown in Tables 5.1 and 5.2

Table 5.1 : Volume and Structure of Business, 1970. (Ratios are expressed in percentage)

Size-group of Branches ~~& No. of Branches in each size-group~~ (Volume of business in lakh--crore of rupees)	Volume of Business per annum (in Rs.lakh)	Ratio of total loans to volume of business	Ratio of agricultural loans to total loans	Ratio of commercial and institutional loans to total loans	Ratio of small inds.& small business loans to total loans	Ratio of individual loans to total loans	Ratio of total deposits to volume of business	Ratio of time deposits to total deposits	Ratio of saving deposits to total deposits
	1	2	3	4	5	6	7	8	9
RURAL BRANCHES									
Less than 10 lakh	6.66	32.55	45.65	6.97	39.24	8.14	67.45	53.04	35.31
10-50 lakh	25.51	31.71	60.34	5.59	25.50	8.55	68.29	54.09	36.76
50 lakh-1 crore	73.33	33.38	53.96	16.09	25.49	4.46	66.62	54.72	38.99
1-5 crore	166.16	30.51	25.79	36.01	35.98	2.22	61.49	51.99	41.21
All branches	52.74	35.27	41.50	23.59	30.81	4.10	64.73	53.54	35.72
URBAN BRANCHES									
10-50 lakh	27.55	15.23	0.59	19.42	57.37	15.62	84.77	52.57	35.94
50 lakh-1 crore	79.10	20.32	14.56	19.30	61.66	4.43	79.68	51.25	33.29
1-5 crore	240.15	31.52	16.03	32.56	47.26	5.55	68.13	56.91	35.98
5-10 crore	724.90	24.45	01.65	61.39	23.72	12.74	75.55	69.08	18.67
Above 10 crore	2558.03	30.74	10.97	59.48	17.27	3.28	69.26	72.82	15.23
All branches	316.36	30.81	15.95	45.37	33.49	4.19	69.19	64.15	24.36
ALL BRANCHES									
Less than 10 lakh	6.66	32.55	45.65	6.97	39.24	8.14	67.45	53.04	35.31
10-50 lakh	26.04	27.19	52.56	7.71	36.40	9.31	72.81	53.61	37.86
50 lakh-1 crore	74.91	29.64	46.23	16.72	32.59	4.46	70.36	53.59	37.15
1-5 crore	225.69	33.17	19.93	33.21	44.62	3.24	66.83	55.99	32.85
5-10 crore	724.90	24.45	01.65	61.39	23.72	12.74	75.55	69.08	18.67
Above 10 crore	2558.33	30.74	10.97	59.48	17.27	3.28	69.26	72.82	18.23
All branches	140.23	31.11	22.80	40.15	32.55	4.17	68.89	62.04	27.79

cont...

Table 5.1 (contd.)

Size-group of branches ~~and number of branches in each size-group~~ (volume of business in lakh-crore of rupees)	Ratio of demand deposits to total deposits	Ratio of cash to total assets	Ratio of total loans to total assets	Ratio of other assets to total assets	Ratio of interest & discount income to total income	Ratio of commission & exchange income to total income	Ratio of other income to total income	Ratio of net head office interest to volume of business
	10	11	12	13	14	15	16	17
RURAL BRANCHES								
Less than 10 lakh	11.65	82.45	11.53	6.02	95.04	2.61	2.35	2.58
10-50 lakh	7.15	89.29	6.14	3.43	96.03	1.54	1.23	3.19
50 lakh-1 crore	6.25	92.53	4.10	3.37	95.40	2.67	1.93	2.78
1-5 crore	6.00	94.95	3.56	1.49	94.99	3.28	1.73	2.01
All branches	6.74	92.90	4.42	2.68	95.56	2.79	1.65	2.51
URBAN BRANCHES								
10-50 lakh	11.49	76.34	14.62	9.04	89.25	5.00	5.75	6.16
50 lakh-1 crore	15.46	83.97	8.77	7.26	93.67	2.36	3.77	5.03
1-5 crore	12.11	90.07	5.56	3.57	91.71	3.72	4.57	3.06
5-10 crore	12.25	91.10	5.62	3.03	95.77	2.41	1.82	4.23
Above 10 crore	8.95	92.20	1.91	5.89	93.27	4.65	2.08	3.37
All branches	10.99	90.71	4.25	5.04	92.73	3.91	3.29	3.41
ALL BRANCHES								
Less than 10 lakh	11.65	82.45	11.53	6.02	95.04	2.61	2.35	2.58
10-50 lakh	8.53	87.59	7.70	4.72	95.45	1.89	2.66	4.01
50-lakh-1 crore	9.26	90.72	5.09	4.19	95.07	2.60	2.33	3.42
1-5 crore	11.13	91.17	5.11	3.72	92.50	3.61	3.89	2.95
5-10 crore	12.25	91.10	5.62	3.03	95.77	2.41	1.82	4.23
Above 10 crore	8.95	92.20	1.91	5.89	93.27	4.65	2.08	3.37
All branches	10.17	91.22	4.29	4.49	95.34	3.71	2.95	3.22

Note: In rural branches ~~no branches~~ are reported doing volume of business above 5 crore. Similarly in urban branches, no branches are reported doing volume of business less than 10 lakh during 1970.

Source: Calculated on the basis of 1970 data given in appendix tables 1 to 9. However, regressions have been run on the basis of respective data of individual branch for the year 1970.

Table 5.2 : Volume ~~of Business~~ And Structure of Business, 1979 (Ratios are expressed in percentage)

Size-Group of Branches ~~and number of Branches in Each size-Group~~ (Volume of Business in lakh-crore of Rupees)	Volume of Business per annum(In Rs.lakh)	Ratio of total loans to volume of business	Ratio of Agricultural loans to total loans	Ratio of commercial & institutional loans to total loans	Ratio of small industries & small business loans to total loans	Ratio of Individual loans to total loans	Ratio of total deposits to volume of Business	Ratio of Time deposits to total deposits	Ratio of Saving deposits to total deposits
	1	2	3	4	5	6	7	8	9
RURAL BRANCHES									
Less than 10 lakh	6.22	29.00	52.00	5.00	38.00	6.00	71.00	40.00	56.00
10-50 lakh	24.24	37.00	61.00	5.00	30.00	5.00	63.00	50.00	45.00
50 lakh-1crore	72.66	33.00	66.00	5.00	25.00	5.00	67.00	55.00	39.00
1-5 crore	171.23	40.00	20.00	35.00	34.00	3.00	60.00	51.00	42.00
All Branches	84.17	37.00	42.00	23.00	31.00	4.00	63.00	52.00	42.00
URBAN BRANCHES									
10-50 lakh	31.44	37.00	-	47.00	49.00	4.00	63.00	40.00	36.00
50-1 crore	76.29	22.00	12.00	35.00	44.00	9.00	79.00	52.00	37.00
1-5 crore	243.41	32.00	19.00	31.00	46.00	4.00	68.00	56.00	32.00
5-10 crore	589.52	31.00	8.00	52.00	38.00	2.00	69.00	56.00	30.00
Above 10 crore	2469.94	28.00	16.00	61.00	18.00	3.00	72.00	77.00	16.00
All branches	362.30	30.00	17.00	46.00	34.00	3.00	70.00	65.00	25.00
ALL BRANCHES									
Less than 10 lakh	6.22	29.00	52.00	5.00	38.00	6.00	71.00	40.00	56.00
10-50 lakh	24.69	37.00	54.00	9.00	32.00	5.00	63.00	49.00	44.00
50lakh-1 crore	73.82	29.00	53.00	12.00	29.00	6.00	71.00	54.00	36.00
1-5 crore	216.23	34.00	22.00	32.00	42.00	4.00	66.00	55.00	35.00
5-10 crore	589.22	31.00	8.00	52.00	38.00	2.00	69.00	56.00	30.00
Above 10 crore	2469.94	28.00	16.00	61.00	18.00	3.00	72.00	77.00	16.00
All Branches	104.85	31.00	24.00	40.00	33.00	3.00	68.00	62.00	29.00

cont...

Table 5.2 (contd.)

Size-group of Branches ~~& number of branches in each size-group~~ (volume of business in lakh-crore of rupees)	Ratio of demand deposits to total deposits	Ratio of cash to total assets	Ratio of total loans to total assets	Ratio of other assets to total assets	Ratio of interest & discount income to total income	Ratio of commission & exchange income to total income	Ratio of other income to total income	Ratio of Net Head office/ interest- to volume of business
	10	11	12	13	14	15	16	17
RURAL BRANCHES								
Less than 10 lakh	4.00	11.00	75.00	14.00	97.00	2.00	1.00	2.00
10-50 lakh	5.00	5.00	92.00	3.00	96.00	2.00	2.00	2.00
50 lakh-1 crore	6.00	4.00	94.00	2.00	96.00	2.00	2.00	3.00
1-5 crore	7.00	3.00	92.00	5.00	94.00	4.00	2.00	2.00
All branches.	6.00	3.00	92.00	5.00	95.00	4.00	1.00	2.00
URBAN BRANCHES								
10-50 lakh	22.00	9.00	87.00	4.00	88.00	2.00	10.00	1.00
50 lakh-1 crore	11.00	7.00	90.00	3.00	94.00	2.00	4.00	6.00
1-5 crore	12.00	5.00	91.00	4.00	94.00	4.00	2.00	3.00
5-10 crore	14.00	12.00	83.00	5.00	94.00	4.00	2.00	3.00
Above 10 crore	7.00	1.00	88.00	11.00	91.00	5.00	4.00	4.00
All branches	10.00	4.00	89.00	7.00	93.00	4.00	3.00	4.00
ALL BRANCHES								
Less than 10 lakh	4.00	11.00	75.00	14.00	97.00	2.00	1.00	2.00
10-50 lakh	7.00	5.00	91.00	4.00	95.00	2.00	3.00	2.00
50 lakh-1 crore	6.00	4.00	93.00	3.00	95.00	2.00	3.00	4.00
1-5 crore	11.00	4.00	92.00	4.00	94.00	4.00	2.00	3.00
5-10 crore	14.00	12.00	83.00	5.00	94.00	4.00	2.00	3.00
Above 10 crore	7.00	1.00	88.00	11.00	91.00	5.00	4.00	4.00
All Branches	9.00	4.00	90.00	6.00	93.00	4.00	3.00	3.00

Note: In rural branches, there are no branches reported having volume of business above Rs.5 crore. Similarly, in urban branches no branches reported having volume of business less than Rs.10 lakh during the period under study i.e. 1978 and 1979. However,

Source: Calculated on the basis of 1979 given in appendix tables 1 to 9/regressions have been run on the basis of respective data of individual branch for the year 1979.

(a) Loan Portfolio

Broadly speaking, the loan portfolio represents the earning capacity of the branches, as different loans yield different returns and involve varying costs.

The loan portfolio of the branches under study can be expressed in terms of the following ratios :

i) Ratio of total loans to volume of business.
ii) Ratio of agricultural loans to total loans.
iii) Ratio of commercial and institutional loans to total loans
iv) Ratio of small industries and small business loans to total loans.
v) Ratio of individual loans to total loans.

It is observed from column 2 to 6 in table 5.1 and 5.2 that loan-mix differ in different size-groups in rural and urban branches. It is interesting to note that the proportion of agricultural loans is relatively more in rural branches, whereas the proportions of commercial and institutional loans and small industries and small business loans are more in urban branches.

Normally, the size of agricultural loans and small business loans is small but the processing of these loans requires more manpower due to large number of small accounts. At the

time, these loans bring low earning because of low rate of interest. On the contrary, earning from commercial and institutional loans will be relatively more. This is in view of the fact that these loans are large and hence processing of these loans requires less manpower. Also, the interest income is high due to high rate of interest on these loans.

However, the exact relationship between cost, earning and different categories of loans will ultimately depend upon loan-mix and head office interest in rural and urban branches.

(b) Deposit-mix

Deposit-mix differs in different size-groups in rural and urban branches. The following ratios may be considered for expressing the deposit-mix :

i) Ratio of total deposits to volume of business.
ii) Ratio of time deposits to total deposits.
iii) Ratio of saving deposits to total deposits.
iv) Ratio of demand deposits to total deposits.

These ratios are shown in columns 7 to 10 in tables 5.1 and 5.2.

It is observed from the tables that as the size of the branches increase, relative importance of time deposits increases and that of saving deposits decreases. Usually time deposit accounts require less manpower and hence less wage-salary cost, whereas processing of saving deposit accounts

and demand deposit accounts in particular entail more burden and require more manpower and hence more wage-salary cost. Similarly, when different categories of deposits and therefore total deposits increase, the earning capacity of the branches also increases as a result of increasing credit creation. However, the earning capacity of branches is impaired by the requirements of statutory liquidity and other restrictions in the form of priority sector lending, lending under differential interest rate scheme, leading to government, transfer of surplus funds to head office, the decision of bulk advances concentrated at head office, etc. These factors may affect the earning in the opposite direction.

When the behaviour of deposits and advances in different size-groups in rural and urban branches under study is examined, an interesting point which emerges is that rural and urban branches are still pockets of deposit mobilisation. Urban branches are more deposit oriented than rural branches. This is observed from the deposit-advance ratio in different size-groups presented in Table 5.3. It also follows that though deposits are concentrated at branch level, bulk advances are concentrated at head office level and so surplus funds are transferred from branches to head office.

Table 5.3 : Advance Deposit Ratio in Branches - 1979.

Size-group of branches ~~and No. of branches~~ (Volume of business lakh-crore Rs.)	No. of branches	Deposits (in lakh of Rs.)	Advances (In lakh of Rs.)	Advance deposit Ratio (%)
RURAL BRANCHES				
Less than 10 lakh	19	4.41	1.81	40.87
10-50 lakh	61	15.54	8.90	57.9[illegible]
50 lakh-1 crore	32	46.92	23.54	48.[illegible]
1-5 crore	29	102.73	68.45	66.61
All branches	141	69.59	23.9[illegible]	59.71
URBAN BRANCHES				
10-50 lakh	6	19.46	11.[illegible]	58.29
50 lakh-1 crore	15	60.04	16.25	27.62
1-5 crore	43	165.75	77.56	46.79
5-10 crore	6	406.35	183.17	45.08
Above 10 crore	5	1790.03	679.91	38.38
All branches	80	254.55	107.75	42.24
ALL BRANCHES				
Less than 10 lakh	19	4.41	1.81	40.87
10-50 lakh	67	15.75	9.14	58.01
50lakh-1 crore	47	52.40	21.42	41.03
1-5 crore	77	142.04	74.19	56.05
5-10 crore	6	406.35	183.17	45.08
Above 10 crore	5	1790.03	679.91	38.38
All branches	221	130.80	54.05	45.99

Source: Calculated on the basis of 1979 data given in Appendix Tables Nos.2-3.

Note: In rural branches, there are no branches doing the business more than Rs.5 crore. Similarly, in urban branches, no branches are reported doing business less than Rs.10 lakh

(c) Composition of Assets

This characteristic of the branches includes broadly the proportion of cash, loans and other assets including government securities in the total assets. To reflect the characteristic of assets structure and relative importance of each category in total assets, the following ratios may be considered:

i) Ratio of cash to total assets.

ii) Ratio of loans to total assets.

iii) Ratio of other assets to total assets.

Assets structure may be different in rural and urban branches. This is because proportion of different assets in total assets differs in different size-groups. This can be seen from columns 11 to 13 in Tables 5.1 and 5.2.

It is observed from the tables that as the size of the branches increases, total loans to total assets increase, as a result of which cash and other assets to total assets decrease. Fluctuations in assets structure are observed in larger branches and more particularly in urban branches. Sharp fall in loans and increase in cash assets in 1979 in urban branches in larger size-groups may be ascribed to the requirement of higher liquidity ratio by urban branches. It is also apparent that the ratio of loans to total assets is higher in rural branches than in urban branches. This may

perhaps be due to the responsibility assigned to rural branches for lending to priority sector and weaker sections of rural community.

When proportion of loans in total assets increases, wage-salary cost and hence operating cost declines upto certain level of volume of business because of scale economies. The opportunity cost of keeping cash in the liquidity ratio or reserve ratio is high. Similarly, processing of other assets and maintenance of accounts, particularly of government securities, is less profitable on two accounts. Firstly, they entail more burden and so higher operating cost and secondly, there is low interest yield on these securities.

(d) Other Services

Besides the main activity of mobilising deposits and advancing loans, the bank branches perform a number of other services for which they charge commission or fees. The proportion of other services in the total business can be reflected through the proportion of various types of income in total income. The following ratios may be considered for this purpose.

i) Ratio of interest and discount income to total income.
ii) Ratio of commission and exchange income to total income.
iii) Ratio of other income to total income.

It is observed from columns 14 to 16 in tables 5.1 and 5.2 that interest and discount income occupies major share in total income of the branches. It is obvious, therefore, that as the share of interest and discount income increases with increase in volume of business, the share of other categories of income declines.

The shares of commission and exchange income and other income are relatively low in total income of the branches. For this reason commission and exchange income and other income have not been considered for examining their relationship with operating cost. However, they are considered for examining the relationship with earnings.

To reflect the influence of transactions between branches and the head office on operating cost, a variable, i.e., ratio of net head office interest to volume of business has also been considered separately.

5.2 Specification of Variables.

For examining the factors affecting operating cost and earning, multiple regression analysis has been resorted to. For the purposes of regression analysis, following dependent and independent variables have been considered.

Dependent Variables	Symbol
i) Ratio of operating cost to volume of business (in percentage)	C
ii) Ratio of Earning to volume of business (in percentage)	Y
Independent Variables	
i) Volume of Business	X_1
ii) Ratio of total loans to volume of business	X_2
iii) Ratio of agricultural loans to total loans	X_3
iv) Ratio of commercial and institutional loans to total loans	X_4
v) Ratio of small industries and small business loans to total loans	X_5
vi) Ratio of individual loans to total loans	X_6
vii) Ratio of total deposits to volume of business	X_7
viii) Ratio of time deposits to total deposits	X_8
ix) Ratio of savings deposits to total deposits	X_9
x) Ratio of demand deposits to total deposits	X_{10}
xi) Ratio of cash to total assets	X_{11}
xii) Ratio of loans to total assets	X_{12}
xiii) Ratio of other assets to total assets	X_{13}
xiv) Ratio of interest and discount income to total income	X_{14}
xv) Ratio of commission and exchange income to total income	X_{15}
xvi) Ratio of other income to total income	X_{16}
xvii) Ratio of net head office interest to volume of business	X_{17}

When dependent variables, C and Y are expressed in ratio, they give unit operating cost and average earning respectively. However, for the sake of convenience, the words operating cost and earning are used in the subsequent discussion.

For the purposes of regression analysis, above stated explanatory variables have been considered. However, variables X_{15} and X_{16}, i.e., ratio of commission and exchange income to total income and ratio of other income to total income respectively have not been considered for explaining variation in operating cost for the reasons stated earlier.

In the above explanatory variable, volume of business (X_1) is a size variable and is presented in absolute figure, i.e., in lakhs of rupees per annum. As specified in chapter II, volume of business includes total deposits plus total advances but does not include contra items [like remittances and inland, foreign bills, etc.

Other explanatory variables, i.e., from X_2 to X_{17} are expressed in percentage which shows relative importance of each explanatory variable in different groups of variables.

Variables X_2 to X_6 are variables in loan portfolio. Variable X_2, i.e., ratio of total loans to volume of business indicates loans per given volume of business, that is to say, if volume of business is given, increase in total loans would

raise this ratio. The changes in this ratio will affect operating cost and earning, depending upon the composition of different types of loans and their relative importance in total loans.

Variables X_7 to X_{10} are variables in deposit portfolio. Variable X_7, i.e., ratio of total deposits to volume of business, indicates deposits per given volume of business. It is assumed that given the volume of business, as total deposits increase this ratio will also increase, which will affect operating cost and earnings, depending upon the composition of different deposits and relative importance of different deposits in total deposits of rural and urban branches.

Variables X_{11}, X_{12} and X_{13} are asset variables. The respective asset ratio is derived by dividing respective asset by total assets. Changes in respective asset ratio would affect operating cost and earning, depending upon the relative importance of respective asset in total assets.

Variables X_{14}, X_{15} and X_{16} are variables in income-mix. To derive income ratio, respective income variable is divided by total income. Changes in respective income ratio could also affect cost and earning depending upon the relative importance of respective income variable in total income.

Variable X_{17} indicates net head office interest per given volume of business. The changes in this ratio would affect operating cost depending upon the relative importance of head office interest in branch activities.

The data regarding size, costs, loans, deposits, income, assets, head office interest, etc., for 141 rural and 80 urban branches for the years 1978 and 1979 are used for running multiple regressions.

6.3 Interrelation Between the Variables

Since it is intended to explain the variations in operating cost, and earning with the help of selected explanatory variables as specified earlier, it is necessary first to examine the relationship between dependent variables and independent variables. This can be examined with the help of coefficients of determination (R^2). The coefficients of determination with respect to operating cost and earning are presented in Tables 5.4 and 5.5 respectively.

Following conclusions are derived from tables 5.4 and 5.5.

(i) The selected explanatory variables, individually explain the variation in operating cost in the range of 6 to 49 per cent for all branches, in the range of 9% to 39% for the

Table 5.4 : Coefficients of Determination (R^2) For Selected Independent Variables.

Dependent variable: Ratio of Operating Cost to Volume of Business (In Percentage)

Independent Variables	RURAL BRANCHES		URBAN BRANCHES		ALL BRANCHES	
	1978	1979	1978	1979	1978	1979
X_1	(-)0.0762**	(-)0.1092**	(-)0.0424*	(-)0.0111	(-)0.0185*	(-)0.0132
X_2	0.0022	(-)0.0036	(-)0.0078	(-)0.0117	0.0024	(-)0.0077
X_3	(-)0.0015	(-)0.0019	(-)0.0077	(-)0.0060	0.0009	(-)0.0012
X_4	(-)0.0028	(-)0.0195	(-)0.0321	(-)0.0191	(-)0.0105	(-)0.0179*
X_5	00.0021	0.0036	(-)0.0045	(-)0.0276	(-)0.0015	(-)0.0035
X_6	0.0004	0.0021	(-)0.0022	(-)0.0058	0.0003	0.0003
X_7	(-)0.0653**	0.0092	0.0197	(-)0.1253**	(-)0.0361*	(-)0.0115
X_8	0.0069	(-)0.0270*	0.0050	0.0319	(-)0.0019	0.0002
X_9	0.0685**	0.0580**	0.0016	0.0135	0.0619**	0.0262*
X_{10}	(-)0.0064	(-)0.0144	0.0007	0.0044	(-)0.0035	(-)0.0006
X_{11}	0.0173	0.0069	0.0042	0.0272	0.0102	0.0149
X_{12}	(-)0.0317*	(-)0.1403**	(-)0.2378**	(-)0.0250	(-)0.0540**	(-)0.0625**
X_{13}	0.0350**	0.3905**	0.0049	0.0093	0.0125**	0.1374**
X_{14}	(-)0.0030	(-)0.0121	(-)0.0092	0.0136**	(-)0.0027	0.4275**
X_{17}	0.0019	0.00001	0.0360	0.7646**	0.0015	0.3519**

Notes: 1. ** Significant at 1 per cent level
* Significant at 5 per cent level
2. R^2 is calculated on the basis of individual branch data for 1978 and 1979

Table 5.5 : Coefficients of Determination (R^2) for Selected Independent Variables.

Dependent Variable: Ratio of Earning to Volume of Business.

Independent Variables	RURAL BRANCHES		URBAN BRANCHES		ALL BRANCHES	
	1978	1979	1978	1979	1978	1979
X_1	0.1050**	0.1232**	0.0140	0.0459*	0.0190*	0.0542**
X_2	0.0008	0.0003	(-)0.0112	(-)0.0203	(-)0.00009	(-)0.0009
X_3	0.0020	(-)0.0014	(-)0.0561*	(-)0.0628*	(-)0.0070	(-)0.0303**
X_4	0.0107	0.0253	0.0002	0.0590*	0.0262*	0.0560**
X_5	0.0054	0.0029	0.0202	(-)0.00007	0.0247*	0.0125
X_6	0.00009	(-)0.0006	(-)0.0132	0.0055	(-)0.00007	(-)0.0012
X_7	(-)0.0296*	(-)0.0010	0.0165	0.0276	(-)0.0056	0.0000
X_8	(-)0.0023	0.0071	(-)0.0068	(-)0.0135	0.00001	0.0071
X_9	(-)0.0183	(-)0.0305*	(-)0.0003	(-)0.0011	(-)0.0226*	(-)0.0552**
X_{10}	0.0201*	0.0287*	0.0455	0.0579	0.0413**	0.0431**
X_{11}	(-)0.0032	(-)0.00001	(-)0.0006	0.0003	(-)0.0011	0.0302
X_{12}	0.0762**	0.1003**	(-)0.0123	(-)0.00010	0.0747**	0.0955**
X_{13}	(-)0.0492**	(-)0.3006**	(-)0.0192	(-)0.0007	(-)0.0556**	(-)0.2749**
X_{14}	0.0230	0.1785**	(-)0.0121	(-)0.0795**	0.0246*	0.1260**
X_{15}	0.0011	0.0006	(-)0.0102	0.0426	0.0027	0.0057
X_{16}	0.0113	0.0561*	(-)0.0009	0.0333	0.0092	0.0345**

Notes: 1. ** Significant at 1 per cent level
* significant at 5 per cent level
2. R^2 is calculated on the basis of individual branch data for 1978 and 1979.

rural branches and in the range of 24% to 91% for the urban branches. Similarly, the explanation for the variation in earning ~~of~~ ranges between 7% and 23% for all branches; 11% and 51% for rural branches and between 6% and 8% for urban branches.

(ii) It is observed from the tables that in all branches dependent variable (C), i.e., ratio of operating cost to volume of business is significantly and positively associated with X_3, X_{13} in 1978 and 1979, X_{14} (1979) and X_{17}(1979); it is significantly and negatively associated with X_1(1978), X_4(1979), X_7(1978) and X_{12} (1978 and 1979). In rural branches, it is significantly and positively associated with X_3 and X_{13} in 1978 and 1979; significantly and negatively associated with X_1(1978 and 1979), X_7(1978), X_9(1979) and X_{12}(1978 and 1979). In urban branches, it is significantly and positively associated with X_{14}(1979) and X_{17}(1979); significantly and negatively associated with X_1(1978), X_7(1979) and X_{12}(1978). Other variables are not found to be significantly associated with dependent variable in all, rural and urban branches.

Similarly, dependent variable (P), i.e., ratio of earning to volume of business in all branches is significantly and positively associated with X_1(and), X_4(1978 and 1979), X_9(1979), X_{12}(and), X_{14}(1978 and 1979) and X_{16}(1979); it is

significantly and negatively associated with X_4(1979), X_5 and X_{15}(1978 and 1979). In rural branches, it is significantly and positively associated with X_1, X_{10} and X_{12}(1978 and 1979), X_{14}(1979), X_{16}(1979); and is significantly and negatively associated with X_7(1978), X_9(1979) and X_{13}(1978 and 1979). In urban branches, it is significantly and positively associated with X_1(1978), X_4(1979); and is significantly and negatively associated with X_5(1978 and 1979) and X_{14}(1979). Other explanatory variables are not found to be significantly associated with dependent variables in all, rural and urban branches.

(iii) Though, size variable, i.e., volume of business (X_1) is found to be statistically significant more particularly in rural branches in explaining variation in operating and earning, it hardly explains in rural branches 9% and 11% variation in operating cost in 1978 and 1979 respectively; and 11% and 13% variation in earnings in 1978 and 1979 respectively. This implies that with the association of other explanatory variables size variable (X_1) loses its significance, particularly for explaining variation in operating cost.

(iv) As all branches reflect the behaviour of rural and urban branches, it is interesting to observe that structural

characteristics of the branches, particularly deposit portfolio and loan portfolio, have undergone considerable change during 1979. This gets reflected in relative changes of the variables explaining variation in operating cost and earning.

It also seems that variables other than size are more significant individually in explaining variation in operating cost in urban branches. For example, X_{14}, i.e., ratio of interest and discount income to total income and X_{17}, i.e., ratio of net head office interest to volume of business individually explain 9% and 7% variation in operating cost in 1979 in urban branches. However, with respect to variation in earning, variables in structural characteristics individually have low explanatory power, except X_{13}, i.e., ratio of other assets to total assets, which explain 3% variation in earning in rural branches.

Thus, it appears that structural characteristics are also important for explaining variation in operating cost, and earning in all, rural and urban branches.

In order to provide total explanation for the variation in operating cost and earning, with the help of selected explanatory variables, the technique of multiple regression has been resorted to. But before running the regressions, it is necessary to check interrelation between different

explanatory variables, so as to remove the problem of multicollinearity. In this connection Irving Ilotkin observes that "the presence of collinearity among independent variables renders merely impossible the direct estimation of the cost efficiences with individual bank activities".[2] Therefore other cost studies, namely Gramely[3], Benston,[4] Bell and Murphy[5] and Birla Institute Study[6] have removed multicollinearity before running multiple regression.

To resolve the problem of multicollinearity among independent variables, correlation matrix has been prepared separately for all, rural and urban branches on the basis of 1979 data. Correlation matrix for all, rural and urban branches are presented in tables 5.6, 5.7 and 5.8 respectively.

Table 5.6 shows interrelationship among independent variables in all branches. After removing multicollinearity, following independent variables have been selected and used alternatively for explaining variation in operating cost and earning in all branches.

i) X_1, X_5, X_{14}, X_{17} - for operating cost.
ii) X_1, X_5, X_{13} for earnings.

Table 5.7 shows interrelationship among independent variables in rural branches. After removing multicollinearity, following variables have been selected and used alternatively for explaining the variation in operating cost and earning in rural branches.

Table 5.6 : Correlation Matrix - All Branches, 1979

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1											
X_2	-.0107										
X_3	-.1903**	.2663**									
X_4	.4444**	.1802**	-.4564**								
X_5	-.0249	-.1007	-.6531**	-.0743							
X_6	-.1172	-.5331**	-.2222**	-.1973**	-.1325*						
X_7	.0193	-.9593**	-.2293**	-.1599*	.1034	.5317**					
X_8	.2358**	-.0768	.0886	.0116	-.0684	-.0661	.0314				
X_9	-.3067**	-.2178**	.0694	-.2712**	-.0622	.2363**	.2134**	-.6916**			
X_{10}	.0597	.3464**	-.2365**	.3103**	.1788**	-.2415**	-.3479**	-.4129**	-.2728**		
X_{11}	-.0973	-.5963**	-.2017**	-.1361*	.0942	.4971**	.5713**	-.1915**	.2469**	-.0315	
X_{12}	.0981	.5980**	.1923**	.1990**	.0481	-.5191**	-.5842**	.2808**	-.4064**	.1298*	-.6331**
X_{13}	-.0805	-.4130**	-.0624	-.1706*	.0094	.4058**	.4057**	-.1690*	.3015**	-.1486*	.4899**
X_{14}	.0447	.4107**	.2557**	.0937	.0653	-.4836**	-.4039**	.2971**	-.3248**	.0183	-.3938**
X_{15}	-.0822	-.1268*	-.2775**	.1067	.2331**	.0747	.1147	.0017	-.0406	.0292	.0715
X_{16}	-.0089	-.3592**	-.1342**	-.0095	.0144	.2811**	.3507**	-.1174	.0052	.1797**	.6039**
X_{17}	.0039	-.6687**	.2006**	-.1293*	.0283	.2809**	.4665**	.2227**	.0673	-.1716*	.4260**
C	-.1250*	-.0875	-.0341	-.1338*	-.0593	.0003	-.1072	.1130	.1679**	-.0248	.1220
Y	.1848**	-.0308	-.1742**	.2369**	.1119	-.0345	.0283	.0842	-.2350**	.2077**	.0132

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
X_1								
X_2	.0992							
X_3	-.0792	.2437**						
X_4	.4332**	.2459**	-.3733**					
X_5	-.0634	-.0165	-.6413**	-.0304				
X_6	-.0776	-.5661**	-.3408**	-.1633	-.1487			
X_7	-.0932	-.9860**	-.2217**	-.2373**	-.0098	.5583**		
X_8	.0128	.0219	.2201**	-.0673	-.0890	-.0684	-.0347	
X_9	-.2302**	-.3340**	-.0949	-.1603*	-.0258	.2485**	.3485**	-.7510**
X_{10}	.3467**	.4431**	-.1348	.3311**	.1539	-.2869**	-.4360**	-.3599**
X_{11}	-.1107	-.6365**	-.2428**	-.1805*	.0985	.5670**	.6375**	-.1776*
X_{12}	.1877*	.6375**	.3063**	.1960*	.0584	-.5437**	-.6382**	.3209**
X_{13}	-.1534	-.4365**	-.1295	-.1419	.0150	.4095**	.4340**	-.1864*
X_{14}	.1027	.4359**	.3664**	.0914	.0895	-.5757**	-.4307**	.3275**
X_{15}	.0321	-.0792	-.2807**	.2194**	.1522	.0971	.0512	-.0508
X_{16}	.1460	-.3964**	-.1585	-.0905	.0536	.3288**	.4011**	-.0343
X_{17}	-.2837**	-.9391**	-.1784*	-.2220**	.0636	.5144**	.9239**	.0936
0	-.3306**	-.0937	-.0418	-.1394	.0601	.0456	.0957	-.1644*
Y	.3580**	.0284	-.0371	.1581	.0534	-.0254	-.0311	.0844

Table 5.8 : Correlation Matrix - Urban Branches, 1979

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1											
X_2	.0537										
X_3	-.0278	.1739									
X_4	.4191**	.3223**	-.2710*								
X_5	-.2356**	-.1639	-.5424**	-.4905**							
X_6	-.2030	-.5123**	-.1546	-.2619*	-.0220						
X_7	-.0223	-.8065**	-.1324	-.2476*	.2420*	.5274**					
X_8	.2993**	-.2115	.1677	-.0576	-.2042	-.0145	.1007				
X_9	-.3747**	-.1214	-.1798	-.1470	.2096	.1283	.0742	-.5559**			
X_{10}	-.0997	.3013**	-.1766	.1477	.0560	-.1058	-.3072**	-.6501**	-.0718		
X_{11}	-.1642	-.5253**	-.1919	-.1281	.0930	.3248**	.4334**	-.2296*	.0895	.3076**	
X_{12}	.1063	.6014**	.1791	.1763	-.1243	-.3622**	-.5209**	.1508	-.0484	-.2261*	-.9251**
X_{13}	-.0527	-.5045**	-.2440*	-.1628	.2086	.3542**	.4613**	-.0516	.0476	.0537	.4612**
X_{14}	.0541	.3990**	.0910	.1050	-.0611	-.2913**	-.3844**	.2597*	.0371	-.4056**	-.7144**
X_{15}	.0845	-.2062	-.2059	-.1383	.3402**	.0432	.2354*	.0466	-.0257	-.0691	-.0116
X_{16}	-.0934	-.3017**	.0136	-.0354	-.1133	.2771*	.2726*	-.2730*	-.0252	.4288**	.7185**
X_{17}	-.0718	-.5261**	-.1218	-.2357*	-.1073	.1407	.0774	.2986**	.1101	-.1031	.3143**
C	-.1055	-.1080	-.0827	-.1344	-.1662	-.0769	-.3540**	.1797	.1163	.0660	.1650
Y	.2143*	-.1441	-.2506*	.2430*	-.0027	.0594	.1660	-.1161	-.0337	.1948	.0913

i) $X_1, X_2, X_5, X_7, X_8, X_{17}$ for operating cost.

ii) X_1, X_8, X_{14}, X_{15} for earnings.

Table 5.6 shows interrelationship among independent variables in urban branches. After removing multicollinearity, following variables have been selected and used alternatively for explaining the variation in operating cost and earning in urban branches.

i) $X_1, X_3, X_{12}, X_{13}, X_{14}, X_{17}$ for operating cost.

ii) X_1, X_3, X_{14} for earning.

5.4 Multiple Regression Models.

After resolving the problem of multicollinearity, linear, semilogarithmic[7] and double-log[8] multiple regression models*, as stated below, have been fitted separately for all, rural and urban branches for the years 1978 and 1979. Ordinary least square method (OLS) has been used for estimating the parameters of the models.

---

* We also fitted semi-log quadratic cost function, as stated below, for estimating operating cost, expressing size variable (X_1) in common logarithm.

$$C = a + b_1(\log X_1) + C_1(\log X_1)^2 + b_2X_2 + b_3X_3 + \cdots + b_nX_n$$

Because of the inherent characteristic of quadratic cost function, the estimated cost curve is U-shaped in the above function, whereas, Scatters drawn with the help of original values of dependent and independent variables show asymptotic cost curve. Hence, this function is not considered for analysis.

Following regressions have been run using alternate variables for explaining variation in operating cost in all, rural andurban branches.

(A) All Branches

(I) $C = a+b_1X_1+b_5X_5+b_{14}X_{14}+U$

II) $C = a+b_1X_1+b_5X_5+b_{17}X_{17}+U$

III) $C = a+b_1\log X_1+b_5X_5+b_{14}X_{14}+U$

IV) $C = a+b_1\log X_1 + b_5X_5+b_{17}X_{17}+U$

V) $\log C = \log_a+b_1\log X_1+b_5\log X_5+b_{14}\log X_{14}+U$

VI) $\log_C = \log_a+b_1\log X_1+b_5\log X_5+b_{17}\log X_{17}+U$

(B) Rural branches

VII) $C = a+b_1X_1+b_2X_2+b_5X_5+b_8X_8+U$

VIII) $C = a+b_1X_1+b_5X_5+b_7X_7+b_8X_8+U$

IX) $C = a+b_1X_1+b_5X_5+b_7X_7+b_{17}X_{17}+U$

X) $C = a+b_1\log X_1+b_2X_2+b_5X_5+b_8X_8+U$

XI) $C = a+b_1\log X_1+b_5X_5+b_7X_7+b_8X_8+U$

XII) $C = a+b_1\log X_1+b_5X_5+b_8X_8+b_{17}X_{17}+U$

XIII) $\log C = \log_a+b_1\log X_1+b_2\log X_2+b_5\log X_5+b_8\log X_8+U$

XIV) $\log C = \log_a+b_1\log X_1+b_5\log X_5+b_7\log X_7+b_8\log X_8+U$

XV) $\log C = \log_a+b_1\log X_1+b_5\log X_5+b_8\log X_8+b_{17}\log X_{17}+U$

(C) Urban Branches

XVI) $C = a+b_1X_1+b_3X_3+b_{12}X_{12}+b_{14}X_{14}+U$

XVII) $C = a+b_1X_1+b_3X_3+b_{13}X_{13}+b_{14}X_{14}+U$

XVIII) $C = a+b_1X_1+b_{13}X_{13}+b_{17}X_{17}+U$

XIX) $C = a+b_1\log X_1+b_3X_3+b_{12}X_{12}+b_{14}X_{14}+U$

XX) $C = a+b_1\log X_1+b_3X_3+b_{13}X_{13}+b_{14}X_{14}+U$

XXI) $C = a+b_1\log X_1+b_{13}X_{13}+b_{17}X_{17}+U$

XXII) $\log C = \log_a+b_1\log X_1+b_3\log X_3+b_{12}\log X_{12}+b_{14}\log X_{14}+U$

XXIII) $\log C = \log_a+b_1\log X_1+b_3\log X_3+b_{13}\log X_{13}+b_{14}\log X_{14}+U$

XXIV) $\log C = \log_a+b_1\log X_1+b_{13}\log X_{13}+b_{17}\log X_{17}+U$

Following regressions have been run for explaining the variation in earning in all, rural and urban branches.

(A) All branches

I) $Y = a+b_1X_1+b_5X_5+b_{13}X_{13}+U$

II) $Y = a+b_1\log X_1+b_5X_5+b_{13}X_{13}+U$

III) $\log Y = \log_a+b_1\log X_1+b_5\log X_5+b_{13}\log X_{13}+U$

(B) Rural Branches

IV) $Y = a+b_1X_1+b_8X_8+b_{14}X_{14}+b_{15}X_{15}+U$

V) $Y = a+b_1\log X_1+b_8X_8+b_{14}X_{14}+b_{15}X_{15}+U$

VI) $\log Y = \log_a+b_1\log X_1+b_8\log X_8+b_{14}\log X_{14}+b_{15}\log X_{15}+U$

(C) Urban Branches

VII) $Y = a+b_1X_1+b_3X_3+b_{14}X_{14}+U$

VIII) $Y = a+b_1\log X_1+b_3X_3+b_{14}X_{14}+U$

IX) $\log Y = \log_a+b_1\log X_1+b_3\log X_3+b_{14}\log X_{14}+U$

Where,

C = Ratio of operating cost to volume of business

Y = Ratio of earning to volume of business.

X_1 = volume of business

X_2 = Ratio of total loans to volume of business.

X_3 = Ratio of agricultural loans to total loans.

X_5 = Ratio of small industries and small business loans to total loans.

X_7 = Ratio of total deposits to volume of business.

X_8 = Ratio of time deposits to total deposits.

X_{12} = Ratio of total loans to total assets.

X_{13} = Ratio of other assets to total assets.

X_{14} = Ratio of interest and discount income to total income.

X_{15} = Ratio of commission and exchange income to total income.

X_{17} = Ratio of net head office interest to volume of business.

a = Constant

$b_1 \ldots 17$ = Regression coefficients

U = Error term.

Analysis of Multiple Regression Results for Operating Cost.

For explaining variation in operating cost in all branches and analysing the effect of rural-urban environment on operating cost, alternative sets of regressions have been run separately for all, rural and urban branches for 1978 and 1979.

Regression results for all branches are presented in Table 5.9. Regression results of linear, semi-logarithmic and double-log functions are presented in two alternative sets of regressions. Equation I, III and V present regression results of the above functions respectively, where X_1, X_5 and X_{14} are explanatory variables. Equations II, IV and VI present regression results of the fitted functions respectively, where X_1, X_5 and X_{17} are explanatory variables.

Regression results for rural branches are presented in Table 5.10. Regression results of linear, semi-logarithmic and double-log functions are presented in three alternative sets of equations. Equations VII, X and XIII present regression results of the above functions respectively, where X_1, X_2, X_5 and X_8 are explanatory variables. Equations VIII, XI and XIV present regression results, where X_1, X_5, X_7 and X_8 are explanatory variables. Equations IX, XII and XV present regression results, where X_1, X_5, X_8 and X_{17} are explanatory variables.

Similarly, regression results for urban branches are presented in table 5.11. Regression results of linear, semi-logarithmic and double-log functions are presented in three alternative sets of equations. Equations XVI, XIX and XXII present regression results of the above functions respectively, where X_1, X_3, X_{12} and X_{14} are explanatory

Table 5.9 : Multiple Regression Results : All Branches for 1978 and 1979.

Dependent Variable: Ratio of Operating Cost to Volume of Business (C)

Independent Variables	Regression Coeff. Eqn.	1978					
		Linear Function		Semi-logarithmic Function		Double-log Function	
		Eqn.I	Eqn.II	Eqn.III	Eqn.IV	Eqn.V	Eqn.VI
Constant	a	3.0378** (6.2253)	3.0413** (6.7139)	11.5383** (14.6701)	11.5509** (15.1887)	1.2330** (6.0511)	1.3655** (5.0125)
Volume of Business(X_1)	b_1	-0.0018* (1.9966)	-0.0018* (2.0274)	-1.9301** (11.9530)	-1.9320** (12.0925)	-0.2699** (7.0294)	-0.2506** (6.2259)
Ratio of Small Industries and small Business loan to Total loans (X_5)	b_5	-0.0061 (0.4098)	-0.0063 (0.5031)	-0.0059 (0.5701)	-0.0065 (0.5269)	0.1094** (3.3085)	0.1314** (3.5321)
Ratio of Interest & Discount Income to Total Income (X_{14})	b_{14}	-0.0633 (0.5374)	-	-0.0281 (0.2904)	-	0.1876** (5.3665)	-
Ratio of Net Head Office Interest to Volume of Business(X_{17})	b_{17}	-	-0.0349 (0.4490)	-	-0.0381 (0.6208)	-	-0.1375* (2.0587)
Coefficients of Determination	R^2	0.0216	0.0212	0.4297**	0.4306**	0.5099**	0.3750**
Adjusted coefficients of Determination	$\bar{R}^2$	0.0081	0.0077	0.4212**	0.4221**	0.4926**	0.3529**
F-Ratio (Degree of Freedom)		1.5977 (3,217)	1.5680 (3,217)	50.4865 (3,201)	50.6624 (3,201)	29.4746 (3,85)	16.9964 (3,85)
Durbin-Watson Statistic		1.9128	1.4496	3.201	0.8535	1.4380	1.4048

Notes: 1. Figures in the parenthesis below regression coefficients are t-values and below F-ratio show degree of freedom.
2. ** Significant at 1% level; * Significant at 5% level.
3. Regression results are based on individual branch data for 1978 and 1979.

Table 5.9 (contd.)

Independent Variables	Regression Coeff. Eqn.	1979					
		Linear Function		Semi-logarithmic Function		Double-log Function	
		Eqn.I	Eqn.II	Eqn.III	Eqn.IV	Eqn.V	Eqn.VI
Constant	a	0.8452 (1.4836)	2.5314** (4.2427)	7.5971** (8.2301)	9.4206** (9.1041)	0.0566** (3.4896)	0.8958** (3.1655)
Volume of Business(X_1)	b_1	-0.0016* (2.2139)	-0.0018* (2.2168)	-1.7361** (8.9948)	-1.7767** (8.0360)	-0.2354** (6.5921)	-0.2141** (5.5354)
Ratio of small industries and small business loan to total loans (X_5)	b_5	0.0001 (0.0096)	-0.0162 (1.4684)	0.0058 (0.5959)	-0.0129 (1.1478)	0.1709** (3.8896)	0.1721** (3.5742)
Ratio of interest and discount income to total income(X_{14})	b_{14}	0.6467** (14.2715)	-	0.6571** (16.7490)	-	0.1473** (4.1667)	-
Ratio of net head office interest to volume of business(X_{17})	b_{17}	-	0.5041** (11.0717)	-	0.5158** (12.7509)	-	-0.0562 (1.1457)
Coefficient of Determination.	R^2	0.4930**	0.3719**	0.6223**	0.5050**	0.4523**	0.3517**
Adjusted coefficients of Determinantion	$\bar{R}^2$	0.4860**	0.3652**	0.6171**	0.4981**	0.4334**	0.3293**
F-ratio (Degree of Freedom)		70.3297 (3,217)	42.0286 (3,217)	119.194 (3,217)	73.7903 (3,217)	23.9452 (3,87)	15.7316 (3,87)
Durbin-watson Statistic)		0.8731	1.2421	1.1141	1.5301	1.7655	1.6859

Table 5.10: Multiple Regression Results: Rural Branches for 1978 and 1979

Dependent Variable: Ratio of Operating Cost to Volume of Business (C)

Independent variable	Regression coeff. Eqn.	1978								
		Linear Function			Semi-logarithmic Function			Double-log function		
		Eqn.VII	Eqn.VIII	Eqn.IX	Eqn.VII	Eqn.VIII	Eqn.IX	Eqn.VII	Eqn.VIII	Eqn.IX
Constant	(a)	3.2002** (2.5703)	2.1600* (1.7935)	3.4603** (2.8367)	15.5704** (8.2704)	13.2490** (6.7796)	14.8235** (8.0412)	3.5693** (2.3556)	6.0964** (2.8137)	3.1793 (1.8809)
Volume of Business(X_1)	b_1	-.0310** (3.6736)	-.0326** (4.0234)	-.0306** (3.6304)	-2.7647** (10.1444)	-2.7211** (10.0134)	-2.7591** (10.0716)	-.3970** (6.5087)	-.3953** (6.2194)	-.3995** (5.7056)
Ratiof total loans to volume of business(X_2)	b_2	.0092 (.6449)	-	-	-.0111 (.9119)	-	-	0.1633* (2.0930)	-	-
Ratio of small industries & small business loans to total loans (X_5)	b_5	.0083 (.4180)	-.0024 (.1234)	.0093 (.4717)	-.0155 (.9347)	-.0151 (.9222)	-.0141 (.8697)	.0644 (1.2713)	.0651 (1.2886)	.0779 (1.3544)
Ratio of total deposits to volume of business(X_7)	b_7	-	0.0669** (3.5115)	-	-	-.0284* (1.6443)	-	-	-.5071 (1.0244)	-
Ratio of time deposits to total deposits(X_8)	b_8	.0347 (1.4946)	.0135 (.5138)	.0307* (1.6777)	.0291 (1.0427)	.0200 (1.1336)	.0214 (.7997)	.5087 (1.4259)	.3099 (1.0684)	.2636 (.6623)
Ratio of net head office interest to Vol. of Business(X_{17})	b_{17}	-	-	-.0818 (.7304)	-	-	-.0263 (.2945)	-	-	-.1005 (1.3430)
Coeff. of Determination	R^2	.0986**	.1710**	.0994**	.4707**	.4767**	.4675**	.8370**	.8230**	.7401**
Adjusted coeff. of determination	$\bar{R}^2$	.0721**	.1467**	.0729**	.4532**	.4615**	.4499**	.7645**	.7443**	.7003**
F-ratio (Degree of Freedom)		3.7203 (4,136)	7.0149 (4,136)	3.7528 (4,136)	26.9032 (4,121)	27.7815 (4,121)	26.5539 (4,121)	11.5503 (4,9)	10.4616 (4,9)	8.8916 (4,9)
Durbin Watson Statistic		1.5142	1.5107	1.5240	.9639	.9544	.9505	2.0275	1.9253	2.0417

Notes: 1. Figures in the parenthesis below regression coefficients are t-values and below F-ratio show degree of freedom.

2. ** Significant at 1% level; * Significant at 5% level.

3. Regression results are based on individual branch data for 1978-1979

Table 5.10 (contd.)

Independent variable	Regression Coeff.	1979								
		Linear Function			Semi-logarithmic Function			Double-log function		
	Eqn.	Eqn.VII	Eqn.VIII	Eqn.IX	Eqn.VII	Eqn.VIII	Eqn.IX	Eqn.VII	Eqn.VIII	Eqn.IX
Constant	(a)	7.2719** (4.0641)	6.1662** (3.5208)	6.9426** (4.0829)	13.5252** (9.4579)	13.2640** (7.9826)	13.4643** (9.6248)	4.3246* (2.2719)	7.3990** (3.2064)	5.0260** (2.7670)
Volume of Business(X_1)	b_1	-.0209** (4.0009)	-.0208** (4.0114)	-.0211** (4.0805)	-2.5865** (9.4980)	-2.5855** (9.4964)	-2.5930** (9.5956)	-.3240** (3.1689)	-.3127** (3.1165)	-.3455** (3.3093)
Ratio of total loans to volume of business(X_2)	b_2	-.0106 (.7245)	-	-	-.0023 (.1922)	-	-	0.1535 (1.1691)	-	-
Ratio of small ind. & small bussiness loans to total loans (X_5)	b_5	.0044 (.3107)	.0047 (.3311)	.0044 (.3082)	-.0017 (.1434)	-.0016 (.1373)	-.0019 (.1604)	.0960 (1.0924)	.0643 (.7685)	.0611 (.6905)
Ratio of total deposits to volume of business(X_7)	b_7	-	.1101 (.7582)	-	-	.0027 (.2220)	-	-	-.4524 (1.4769)	-
Ratio of time deposits to total deposits(X_8)	b_8	-.0480* (1.9625)	-.0477* (1.9496)	-.0486* (1.9730)	-.0160 (.7042)	-.0159 (.7008)	-.0165 (.8048)	-.0130* (2.0309)	-.0712** (2.4630)	-.0366* (2.0129)
Ratio of net head office interest to vol.of business(X_{17})	b_{17}	-	-	.0070 (.0929)	-	-	.0152 (.2489)	-	-	-.0468 (.4329)
Coeff.of Determination	R^2	.1389**	.1392**	.1356**	.4211**	.4212**	.4212**	.5696**	.5900**	.5362**
Adjusted coeff.of determination	$\bar{R}^2$	.1135**	.1139**	.1102**	.4041**	.4041**	.4042**	.4548**	.4807**	.4125**
F-Ratio (Degree of Freedom)		5.4031 (4,136)	5.4375 (4,136)	5.3358 (4,136)	24.7328 (4,136)	24.7382 (4,136)	24.7436 (4,136)	4.9629 (4,15)	5.3961 (4,15)	4.3348 (4,15)
Durbin Watson Statistic		.7620	.7637	.7375	.0516	1.6676	.0479	2.2944	2.3565	2.3153

Table 5.11 : Multiple Regression Results: Urban Branches for 1978 & 1979

Dependent Variable: Ratio of operating cost to volume of Business (C_4)

Independent variables	Regression Coeff. Eqn.	1 2 7 8								
		Linear Function Equations			Semi-logarithmic Function Equations			Double-log Function Equations		
		XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
Constant	(a)	7.9996** (7.1570)	2.7353** (3.7993)	2.1375** (4.6373)	11.4928** (12.9567)	8.6947** (11.8775)	8.8626** (12.3275)	5.9619** (2.9632)	1.1375** (2.9582)	1.5339** (3.4061)
Volume of Business(X_1)	b_1	-.0004 (1.0535)	-.0008* (1.7202)	-.0007* (1.7251)	-.9272** (6.6961)	-1.3066** (10.6470)	-1.2861** (10.5248)	-.2092** (3.2756)	-.2433** (3.0594)	-.2013** (2.7627)
Ratio of Agril. loans to total loans(X_3)	b_3	.0022 (.2128)	-.0082 (.6624)	-	.0056 (.8061)	-.0004 (.0457)	-	.0222 (.7599)	.0277 (.9390)	-
Ratio of total loans to total assets(X_{12})	b_{12}	-.0783** (4.9929)	-	-	-.0674** (4.4206)	-	-	-1.0756* (2.3057)	-	-
Ratio of other assets to total assets(X_{13})	b_{13}	-	.0027 (.0370)	-.0295 (.4065)	-	-.0362 (.7555)	-.0552 (1.1645)	-	0.1054* (2.2059)	.0490 (.4735)
Ratio of Interest& discount income to totalincome(X_{14})	b_{14}	.2262* (2.0395)	-.0558 (.4725)	--	.2603** (3.5403)	.0634 (.8016)	-	.3257** (4.7541)	.2998** (4.6944)	-
Ratio of net head office interest to vol.of business(X_{17})	b_{17}	-	-	.1138 (1.5344)	-	-	.0045 (.0909)	-	-	-.1453 (1.2316)
Coeff.of Determination	R^2	.2695**	.0534	.0732	.6516**	.6132**	.6098**	.5391**	.5335**	.2114*
Adjusted coeff. of Determination	$\bar{R}^2$	.2516**	.0029	.0366	.6750**	.5923**	.5942**	.4815**	.4752**	.1397*
F-Ratio (Degree of Freedom)		7.6401 (4,75)	1.0579 (4,75)	2.0012 (3,76)	41.4922 (4,74)	29.9253 (4,74)	39.0757 (3,75)	9.3586 (4,32)	9.1491 (4,32)	2.9406 (4,32)
Durbin-Watson Statistic		1.7559	1.4453	1.3393	1.3446	1.4977	1.4161	1.9559	1.8442	1.7924

Notes: 1. Figures in the parenthesis below regressioncoefficients are t-values and below F-ratio show degree of freedom.

2. ** Significant at 1% level; * significant at 5% level.

3. Regression results are based on individual branch data for 1978 and 1979.

Table 5.11 (contd.)

Independent variables	Regression Coeff. Eqn.	1979								
		Linear Function Equations			Semi-Logarithmic Function Equations			Double-Log Function Equations		
		XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
Constant	(a)	10.3517 (6.4527)	-1.9765 (4.4237)	.5592 (.7945)	13.4953** (6.2623)	2.9567** (2.5627)	5.9013** (2.5069)	2.1557 (.7115)	1.2827** (3.0673)	1.3690** (3.1173)
Volume of Business(X_1)	b_1	-.0006* (1.7102)	-.0007* (2.0427)	-.0006 (.9041)	-.0665** (4.2626)	-.0591** (4.0169)	-1.0214** (2.4640)	-.2216** (3.2617)	-.2210** (3.3504)	-.1934** (2.7555)
Ratio of Agril. loans to total loans(X_2)	b_2	-.0613 (.1263)	.0029 (.2071)	-	.0012 (.1263)	.0056 (.6141)	-	-.0196 (.7006)	-.0137 (.5014)	-
Ratio of total loans to total assets(X_{12})	b_{12}	-.1263** (6.5905)	-	-	-.1118** (6.2390)	-	-	-.1525 (.2190)	-	-
Ratio of other assets to total assets(X_{13})	b_{13}	-	.3166** (6.3548)	-.2202* (2.3064)	-	.2865** (6.3359)	-.2476** (2.6560)	-	.1194 (1.2995)	.0125 (.1329)
Ratio of Interest & discount income to total income(X_{14})	b_{14}	.7864** (36.5350)	.7937** (36.2516)	-	.7760** (39.1456)	.7827** (39.4760)	-	.1576 (1.2354)	.1848** (2.3537)	-
Ratio of net head office interest to Val.of business(X_{17})	b_{17}	-	-	.7539** (17.2514)	-	-	.7410** (17.3703)	-	-	.0141 (.1706)
Coeff.of determination	R^2	.9406**	.9473**	.8005**	.9571**	.9575**	.8133**	.3179*	.3569**	.2184
Adjusted coeff. of determination	$\bar{R}^2$	.9459**	.9445**	.7927**	.9540**	.9552**	.8059**	.2169*	.2617**	.1347
F-ratio (Degree of Freedom)		346.373 (4,75)	336.975 (4,75)	101.671 (3,76)	417.311 (4,75)	422.478 (4,75)	110.317 (3,76)	3.1404 (4,27)	3.7466 (4,27)	2.6074 (3,28)
Durbin-Watson Statistic		1.7172	1.4909	1.8959	2.0247	1.9572	1.9206	2.0769	2.0651	1.7984

variables. Equations XVII, XX, XXIII present regression results, where X_1, X_5, X_{13} and X_{14} are explanatory variables. Equations XVIII, XXI and XXIV present regression results, where X_1, X_{13} and X_{17} are explanatory variables.

Following conclusions are derived from the results of Tables 5.9, 5.10 and 5.11.

(i) With the help of selected explanatory variables, the total explanation in operating cost in all the branches is provided by the linear function to the extent of about 1% in 1978 and 36% to 49% in 1979; by the semi-logarithmic function to the extent of about 42% in 1978 and 50% to 62% in 1979; by the double-log function to the extent of about 35% to 49% in 1978 and 33% to 43% in 1979.

In rural branches, the total explanation in operating cost is provided by the linear function to the extent of about 7% to 15% in 1978 and 11% in 1979; by the semi-logarithmic function to t e extent of about 45 to 46% in 1978 and 40% in 1979; by the double-log function to the extent of about 71 to 76 % in 1978 and 41 to 45% in 1979.

Similarly, in urban branches the total explanation in operating cost is provided by the linear function to the extent of about 4 to 25% in 1978 and 79 to 95% in 1979;

by the semi-logarithmic function to the extent of about 59 to 69% in 1978 and 96% in 1979; by the double-log function to the extent of about 14 to 48% in 1978 and 13 to 26% in 1979.

Thus, it seems that linear, semi-logarithmic and double log multivariate regression models are found to be 'good fit' for providing total explanation for variation in operating cost, except linear model in 1978 in both the equations in all branches and in equation No.XVI in urban branches. This can be seen from the value of coefficients of determination, $\bar{R}^2$, adjusted for degree of freedom, which is found to be significant statistically at 1% level.

(ii) It can be seen from the regression result that of the fitted function in all branches, in 1978, double-log function in equation V explains larger percentage variation in operating cost, where $\bar{R}^2$ is found to be 0.5035, whereas in 1979 semi-logarithmic function in both the equations, i.e., III and IV explain larger percentage variation in operating cost, where $\bar{R}^2$ are found to be 0.6171 and 0.4931 respectively.

In rural branches, of the fitted functions double-log function explains larger percentage variation in all the fitted equations in 1978 and 1979. In 1978, $\bar{R}^2$ in equations XIII and XIV are found to be 0.7645 and 0.7443 respectively, whereas in 1979 $\bar{R}^2$ in both equations are 0.4546 and 0.4307 respectively.

It is interesting to note that though the value of $\bar{R}^2$ is very low in linear function compared to double-log function, $\bar{R}^2$ is found to be statistically significant. This may be due either to large number of observations or due to non-linear type of relationship. Further much variation in total explanation is observed in double-log regression results in 1978 and 1979. This may perhaps be due to functional form of the function.*

Similarly, in urban branches, of the fitted functions, semi-logarithmic function explains larger percentage variation in ~~the~~ all the fitted equations in 1978 and 1979. In 1978, $\bar{R}^2$ in equations XIX and XX are found to be 0.6750 and 0.5923 respectively, whereas in 1979 $\bar{R}^2$ in both the equations are 0.9548 and 0.9552 respectively. The variation in $\bar{R}^2$ in 1978 and 1979 may be due to changes in structural characteristics of urban branches.

(iii) Among the selected explanatory variables in the linear function, in (a) all branches in equation I and II in 1978 only X_1, whereas in 1979 in equation I, variables X_1 and X_{14}, and in equation II, variables X_1 and X_{17} are found to be significant statistically.

---

* In double-log function the number of observations reduces to very small number due to problem of zero values of some variables in particular regression for the period under study. This can be seen from the degree of freedom.

(b) In rural branches in equation VII, X_1(1978,1979) and X_8(1979), in equation VIII, variables X_1(1978,1979) and X_7,X_8(1979) and in equation IX, variables X_1 and X_8 (1978,1979) are found to be significant statistically. The unexpected signs, i.e., positive signof the coefficient of X_8, i.e., ratio of time deposits to total deposits in equation IX and of X_7, i.e., ratio of total deposits to volume of business in equation VIII, may perhaps be due to interrelationship of these variables with X_1 i.e., volume of business. Whereas, in 1979, X_1 and X_8 are found to be statistically significant in all the three equations.

(c) In urban branches in equation XVI, variables X_1(1979), X_{12} and X_{14} (1978 and 1979); in equation XVII, variables X_1 (1978,1979), X_{13}(1979), X_{14}(1979); and in equation XVIII, variables X_1(1978), X_{13} and X_{17}(1979) are found to be significant statistically. The difference in sign of the coefficient of X_{13} i.e., ratio of other assets to total assets in equations XVII and XVIII may be due to the association of other factors.

In the semi-logarithmic function in (a) all branches in equation XII, variables X_1(1978,1979), X_{14}(1979); in equation IV, Variables X_1(1978,1979), X_{17}(1979) are found to be significant statistically.

(b) In rural branches in equation X, variables X_1(1978,1979); in equation XI, variables X_1(1978,1979) and X_7(1978); and

in equation XII, variables X_1(1978,79) are found to be statistically significant.

(c) In urban branches in equation XIX, variables X_1,X_{12} and X_{14}(in 1978,1979) ; in equation XX, variables X_1(1978, 1979), X_{13} and X_{14}(1979); and in equationXXI, variables X_1 (1978,1979), X_{13} and X_{17}(1979) are found to be statistically significant. The difference in sign of thecoefficient of X_{13}, i.e., ratio of other assets to total assets in 1979 in equation XX and XXI may be due to association of other variables.

In the double-log function in (c) all branches in equation V, variables X_1,X_5 and X_{14}(1978-1979) ; in equation VI, variables X_1(1978,1979), X_5 and X_{17}(1978) are found to be significant statistically.The negative sign of the coefficient of X_{17}, i.e., ratio of net head office interest to volume of business may be due to functional form of the equation, where due to negative values of this variable, computer discarded number of observations having negative value.

(b) In rural branches in equation XIII, variables X_1 (1978,1979) and X_2 (1978) and X_3(1979), in equation XIV, variables X_1(1978,79) X_7(1978) and X_5(1979); and in equation XV, variables X_1(1978,1979) and X_5(1979) are found to be

significant statistically. The positive sign of the coefficient of X_2 in 1978 and equation XIII, may firstly be due to the interrelationship between X_2, i.e., ratio of total loans to volume of business and X_1, i.e., volume of business, and secondly due to the functional form of the equation.

(c) In urban branches in equation XIII, variables X_1 (1978,1979), X_{12}(1979) and X_{14}(1978); in equation XIII, variables X_1(1978,1979), X_{13}(1978) and X_{14}; and in equation XXIV variables X_1(1978,1979) are found to be statistically significant.

(iv) It can be observed from the tables that the coefficient of X_1, i.e., volume of business carries the postulated negative sign in all the fitted functions, exceptin the linear function of equation XVI in urban branches. In other words, the negative association between size and operating cost implies that the branches which increase their size can also reduce their unit operating cost by the value of regression coefficients in the fitted functions. However, size variable, i.e., X_1 is more significant in rural, branches, which can be seen from the regression coefficient and t-values in respective regressions. This is in confirmity with our finding in Chapter III.

(v) It is also apparent that along with size variable other variables, namely, X_2, X_7, X_9, X_{13}, X_{14} and X_{17} are

also important in explaining the variation in operating cost. However, as all branches reflect the characteristics of rural and urban branches, the relative importance of explanatory variables in explaining the variation in operating cost may change in rural and urban branches.

(vi) In rural branches, it is changes in deposit portfolio, particularly X_3, rather than loan portfolio, along with size variable, which helps more in explaining variation in operating cost. For example, X_3, i.e., ratio of time deposits to total deposits, particularly in 1979 in linear and double-log functions, in all the three regression equations is found to be consistently significant. This can be seen from the regression coefficient and t-values in the respective equations. The value of the coefficient of X_3 ranges from -0.0477 to -0.0486 in the linear function and from -0.9130 to -0.9712 in double-log function in 1979. This indicates that, in the linear function if the time deposit ratio increases by 1 percentage point, operating cost ratio falls, on an average, by 0.0477 to 0.486 percentage point, whereas in double-log function it indicates that, 1 per cent increase in time deposits would lead to fall in operating cost by 0.91 to 0.97 per cent. This means that in the double-log function operating cost is highly elastic to time deposits. This is because regression coefficient assumes value nearer to unity, which implies

that higher the proportion of time deposits in total deposits, the more operating cost declines for any given increase in time deposits.

(vii) It also emerges from the results of rural branches that head office interest does not play any significant role in influencing operating cost, as X_{17}, i.e., ratio of net head office interest to volume of business is not turned out to be significant in any of the fitted regressions.

(viii) Though, erratic behaviour of structural characteristics in 1978 and 1979 is observed in urban branches, they are found to be more important in explaining the variation in operating cost. Variables in structural characteristics, particularly related with advance activities, namely X12, i.e., ratio of total loans to total assets, X_{13}, i.e., ratio of other assets to total assets, X_{14}, i.e., ratio of interest and discount income to total income and X_{17}, i.e., ratio of net head office interest to volume of business are significant in explaining the variation in operating cost in respective regression equations. However, out of the above four explanatory variables, X_{14}, and X_{17} are having more explanatory power than any other variable, which can be seen from the regression coefficients and t-values in respective regressions. Further,

X_{14}* individually explains 91 per cent variation in operating cost in 1979. This may be the reason that X_{14} and X_{17}, with the association of other explanatory variables, explain larger percentage variation in operating cost in respective regression equations in 1979.

Thus, it seems that in urban branches, it is changes in loan portfolio rather than deposit portfolio, help much in explaining the variation in operating cost. Not a single variable in deposit-portfolio is reflected in selected regressions.

It follows from the fore-going discussion that linear, semi-logarithmic and double-log multivariable models are found to be 'good fit' in explaining variation in operating cost in all, rural and urban branches. Fitness of these models can also be judged by testing auto-correlation. Traditional test applied for the incidence of auto-correlation is the Durbin-Watson test.[9] The Durbin-Watson statistics are computed for each regression. The value of the computed statistics indicates an absence of either positive or negative auto-correlation for all, rural and urban branches for 1976 and 1979. Practically all Durbin-Watson statistics are either

---

* To understand the relationship between the dependent variable, i.e., ratio of operating cost to volume of business and X_{14}, i.e., ratio of interest and discount income to total income, regression is run with 1979 data. The result obtained is :

$$C = -0.5936 + 0.7835^{**} X_{14}, \quad R^2 = 0.9135^{**}$$
$$(28.0965)$$

Note: 1. ** significant at 1%
2. Figure in the bracket denotes t-value.

close to 2 or the computed d are either $d > d_{4} > d_{L}$ or $d < 4-d_{4} < 4-d_{L}$ and are significant at 1% level.

Analysis of Multiple regression Results for Earning :

For explaining the variation in earning in all branches and the effect of rural-urban environment on earning, regressions have been run separately for all, rural and urban branches for 1978 and 1979. Regression results are presented in Table 5.12.

Regression results of linear, semi-logarithmic and double-log function for all branches are presented in the table in equation I, II and III respectively, where X_1, X_5 and X_{13} are explanatory variables whereas, regression results for rural branches are presented in the table in equations IV, V, and VI respectively, where X_1, X_3, X_{14} and X_{15} are explanatory variables. Similarly, regression results for urban branches are presented in equations VII, VIII and IX, where X_1, X_2 and X_{14} are explanatory variables.

Following conclusions are derived from the results of table 5.12.

(i) With the help of selected explanatory variables, the total explanation in earning in all branches is provided by the linear function to the extent of about 6% in 1978 and 30% in 1979; by the semi-logarithmic function to the extent of

Table 5.12 : Multiple Regression Results for Rural, Urban and All Branches

Dependent Variable: Ratio of Earning to Volume of Business (Y)

Independent Variables	Regression Coeff. R, R^2	ALL BRANCHES					
		1978			1979		
		Linear Eqn.I	Semi-log Eqn.II	Double-log Eqn.III	Linear Eqn.I	Semi-log Eqn.II	Double-log Eqn.III
Constant		-1.2221* (1.8453)	-9.0533** (6.3691)	-1.3103* (1.7422)	0.4125 (.8944)	-5.7509** (6.9187)	-0.7834 (1.0153)
Volume of Business(X_1)	b_1	.0018* (1.8255)	1.9368** (9.0229)	.2177* (1.8106)	.0015** (2.5867)	1.4681** (..316)	.1937* (1.7949)
Ratio of agricultural loans to total loans(X_3)	b_3	-	-	-	-	-	-
Ratio of small industries and small business loans to total loans(X_5)	b_5	0.0343** (2.5199)	0.0259* (1.9727)	0.1049 (.9407)	0.0192* (2.1335)	0.0143* (1.8206)	-0.0072 (0.0525)
Ratio of time deposits to total deposits (X_9)	b_9	-	-	-	-	-	-
Ratio of other (X_{13})assets to total assets	b_{13}	-0.1516** (3.5541)	-0.0361 (.8975)	0.0196 (.1491)	-0.2539** (9.0775)	-0.1641** (7.1459)	0.0966 (.7423)
Ratio of commission and exchange income to total income(X_{15})	b_{15}	-	-	-	-	-	-
Coefficient of Determination	R^2	0.0961**	0.3475**	0.0479	0.3093**	0.4762**	0.0381
Adjusted coefficients of multiple determination	$\bar{R}^2$	0.0836**	0.3378**	0.0144	0.3003**	0.4669**	0.0057
F-Ratio (Degree of Freedom)		7.6919 (3,217)	35.6857 (3,201)	1.4282 (3,35)	32.4683 (3,217)	65.7482 (3,217)	1.1712 (3,87)
Durbin-Watson Statistic		1.5426	1.0718	1.9643	1.0826	1.1796	1.8429

cont...

Table 5.12 (contd.)

Independent Variables	Regression Coeff. R, R^2	RURAL BRANCHES 1978 Linear Eqn.IV	1978 Semi-log Eqn.V	1978 Double-log Eqn.VI	1979 Linear Eqn.IV	1979 Semi-log Eqn.V	1979 Double-log Eqn.VI
Constant		-3.5735** (2.4190)	-14.0561 (5.6444)	39.2691 (1.0437)	-19.1141** (5.7752)	-14.4791** (9.0005)	13.6514 (0.3736)
Volume of Business(X_1)	b_1	0.0359** (5.7242)	2.9169** (6.0939)	0.5170 (1.2038)	0.0221** (4.2385)	2.5403** (6.7672)	0.7011* (1.7617)
Ratio of Agricultural loans to total loans(X_3)	b_3	-	-	-	-	-	-
Ratio of small industries and small business loans to total loans(X_5)	b_5	-	-	-	-	-	-
Ratio of time deposits to total deposits(X_8) assets to total assets	b_8	-0.0771** (2.3382)	-0.0197 (0.6320)	-0.4537 (0.2387)	-0.0176 (.6792)	-0.0372* (1.6738)	-1.3588 (0.5465)
Ratio of interest and discount income to total income (X_{14})	b_{14}	0.0448* (2.1041)	0.0405* (1.8338)	-3.5331 (1.0823)	0.0947** (5.3265)	0.0675** (4.3338)	-2.3470 (0.2989)
Ratio of commission & exchange income to total income(X_{15})	b_{15}	0.0349 (0.3665)	0.0739 (0.9036)	-0.6905 (1.0253)	0.0546 (0.7981)	0.0524 (0.9714)	-0.4903 (0.9571)
Coefficient of Determination	R^2	0.1459**	0.4501**	0.4089	0.2317**	0.4805**	0.2756
Adjusted coefficients of multiple determination	$\bar{R}^2$	0.1203**	0.4401**	0.1475	0.2206**	0.4652**	0.0662
F-Ratio (Degrees of Freedom)		5.8103 (4,136)	25.5676 (4,121)	1.5629 (4,9)	13.3359 (4,136)	31.4443 (4,136)	1.4484 (4,15)
Durbin-Watson Statistic		1.5429	1.0652	2.3508	1.2544	1.3832	1.9772

Table 5.12 (contd.)

Independent Variables	Regression Coeff.	URBAN BRANCHES					
		1978			1979		
		Linear Eqn.VII	Semi-log Eqn.VIII	Double-log Eqn.IX	Linear Eqn.VII	Semi-log Eqn.VIII	Double-log Eqn.IX
Constant		1.9432* (1.8614)	2.4443* (1.9695)	1.7509 (.4778)	5.9304** (3.2502)	2.1932 (1.2244)	5.8540* (1.8064)
Volume of Business(X_1)	b_1	0.004 (1.1876)	0.3939** (2.5159)	0.1976 (1.0522)	0.0007* (2.1427)	0.9043** (5.0391)	0.1892 (0.9143)
Ratio of agricultural loans to total loans(X_3)	b_3	-0.190* (2.0095)	-0.0207* (2.2642)	-0.0967 (1.1210)	-0.0193* (2.1093)	-0.0232** (2.5288)	-0.1663* (1.9502)
Ratio of small industries and small business loans to total loans (X_5)	b_5	-	-	-	-	-	-
Ratio of time deposits to total deposits(X_8)	b_8	-	-	-	-	-	-
Ratio of interest and discount income to total income(X_{14})	b_{14}	-0.0095 (.8005)	-0.0351* (2.2963)	-0.5522 (.6606)	-0.0531** (2.6232)	-0.0603** (3.3566)	-1.4359* (2.0122)
Ratio of commission and exchange income to total income(X_{15})	b_{15}	-	-	-	-	-	-
Coefficient of determination	R^2	0.0785	0.1501**	0.1111	0.1301**	0.3483**	0.2224
Adjusted coefficients of multiple determination	$\bar{R}^2$	0.0421	0.1161**	0.0503	0.1477**	0.3226**	0.1392
F-Ratio (Degree of Freedom)		2.1583 (3,76)	4.4152 (3,75)	1.3751 (3,33)	5.5633 (3,76)	13.0382 (3,76)	2.6705 (3,28)
Durbin-Watson Statistic		1.9129	2.0510	2.6121	1.2995	1.4500	1.8526

** Significant at 1% level; * Significant at 5% level.

Notes: 1.Figures in the parenthesis below regression coefficients are tevalues and below F-ratio show degree of freedom.
2.Results are obtained on the basis of individual branch data for 1978 and 1979.

about 34% in 1978 and 47% in 1979; and by the double-log function to to the extent of about 1% in 1978 and 0.5% in 1979.

In rural branches, the total explanation in earning is provided by the linear function to the extent of about 15% in 1978 and 23% in 1979; by the semi-logarithmic function to the extent of about 44% in 1978 and 47% in 1979; by the double-log function to the extent of about 15% in 1978 and 6% in 1979.

In urban branches, the total explanation in earning is provided by the linear function to the extent of about 4% in 1978 and 15% in 1979; by the semi-logarithmic function to the extent of about 12% in 1978 and 32% in 1979; by the double-log function to the extent of about 3% in 1978 and 14% in 1979.

(ii) It appears that linear and semi-logarithmic functions are found to be 'good fit' for providing total explanation for the variation in earning, except linear function in urban branches in 1978. The coefficients of determination, $\bar{R}^2$ adjusted for degree of freedom is found to be statistically significant at 1% level. Double-log function is found to be 'poor fit' for explaining variation in earning either in rural branches or in urban branches.

(iii) It can be seen from the regression results that though $\bar{R}^2$ is found to be significant in the linear function, the larger percentage variation in earning is explained with

the help of semi-logarithmic function in 1978 and 1979 in all, rural and urban branches.

(iv) Among the selected explanatory variables in the linear function , in all branches; variables X_1, X_5 and X_{13} (in 1978 and 1979) ; in rural branches; variables X_1(1978,1979), X_5 (1978) and X_{14}(1978,1979); and in urban branches; variables X_1(1979), X_3,X_{14}(1978,1979) are found to be significant statistically.

In the semi-logarithmic function in all branches; variables X_1,X_5(1978,1979) and X_{13}(1978); in rural branches; variables X_1(1978, 1979), X_5(1979) and X_{14}(1978,1979); and in urban branches; variables X_1,X_3 and X_{14} (1978,1979) are found to be significant statistically.

In the double-log function in all branches; only X_1 (1978,1979) in rural branches; X_1 in 1979; and in urban branches; X_3 and X_{14} in 1979 are found to be significant statistically.

(v) It can be seen from the table that along with size variable,i.e., X_1, variables in structural characteristics are also importantin explaining the variation in earning. However, the relative importance of explanatory variables change in rural and urban branches. For example, X_5, i.e., ratio of time deposits to total deposits and X_{14}, i.e., ratio

of interest and discount income to total income in rural branches; and in urban branches X_3, i.e., ratio of agricultural loans to total loans and X_{14} are important in explaining variation in earning. This can be seen from the value of regression coefficients and t-value.

(v) It is interesting to note that X_{14} is positively related with earning in rural branches and negatively related in urban branches. This implies that as interest and discount income increases consequent upon increase in advances, earning per given volume of business has tendency to increase in rural branches, whereas it has tendency to decrease in urban branches. The negative and unexpected sign of the regression coefficient of X_{14} in urban branches may perhaps be due to priority sector lending and head office interest. As lending increase, urban branches may have to borrow funds from head office to meet priority sector and other sector lending. This might have caused negative effect on earning in urban branches. This is also supported by the negative sign of the coefficient of X_3, i.e., ratio of agricultural loans to totalloans in urban branches.

Thus, linear, semi-logarithmic and double-log functions provide explanation for variation in earning. Fitness of these three functions can also be ruled by testing Durbin-

-Watson statistics. The values of the computed Durbin-Watson statistics indicate absence of either positive or negative auto-correlation for 1978 and 1979. The Durbin-Watson statistics are either :

$$d > d_u > d_L \quad \text{or}$$

$$d < 4-d_u < 4-d_L$$

The Durbin-Watson statistics are statistically significant at 1% level.

5.7 Conclusion

From the foregoing analysis of factors affecting operating cost and earning in all, rural and urban branches, following conclusions are drawn.

(i) Linear, semi-logarithmic and double-log multivariate regression models are found to be 'good fit' for providing total explanation for variation in operating cost, whereas linear and semi-logarithmic models are found to be 'good fit' for providing total explanation for variation in earning in all, rural and urban branches. This can be seen from the value of the coefficients of determination, $\bar{R}^2$ adjusted for degree of freedom, which is found to be significant statistically at 1% level.

(ii) The negative association between size and operating

cost and positive association between size and earning is found to be significant. This implies that the branches which increase their size, i.e., volume of business can reduce their unit operating cost and increase their earning by the value of the regression coefficients in the fitted functions. However, size variable is more significant in influencing operating cost and earning in rural branches.

(iii) Empirical findings show that though size variable is significant, other variables in structural characteristics, particularly variables in deposit-mix and loan-mix, are also important in explaining variation in operating cost and earning. However, the relative importance of explanatory variables may change in rural and urban branches.

(iv) In rural branches, variables in deposit portfolio, namely time deposits is more important in explaining variation in operating cost, whereas in urban branches, variables in loan portfolio, particularly interest and discount income and head office interest are more important in explaining variation in operating cost.

(v) Head office activities, play crucial role in determining earning in rural and urban branches. This is also supported by the sign of the regression coefficient of ratio of interest and discount income to total income, in the

fitted regressions for earning in rural and urban branches. This variable is positively related with earning in rural branches and is negatively related with earning in urban branches. However, head office activities are not important in influencing operating cost in rural branches. This is evident from the fact that regression coefficient of net-head office interest is not found to be significant in any of the regressions run for explaining variation in operating cost in rural branches.

References

1 Gramely, Lyle, E., Scale Economies in Banking, Federal Reserve Bank of Kansas City, 1961, p.7.

2 Quoted, Ghosh, A.K., Cost-Accounting in Commercial Banking Industry, the Institute of Cost and Works Accountant of India, 1979, p.165.

3 Gramely, Lyle, E., op.cit.

4 Benston, George J., "The Cost of Bank Operations: A Statistical Study", Journal of Finance, XX, May 1965.

5 Bell, F.W. and Murphy, N.B., op.cit.

6 "Economics of Scale in Banking" in Banks Since Nationalisation, Birla Institute of Scientific Research, Allied Publication Ltd., 1981.

7 Semi-logarithmic function has been used by Gramely in his study, op.cit.

8 Double-log function is used by Bell and Murphy in their study, op.cit.

9 Durbin, J. and Watson, G.S., "Testing for Serial correlation in Least Square Regression", Biometrics, 1950.