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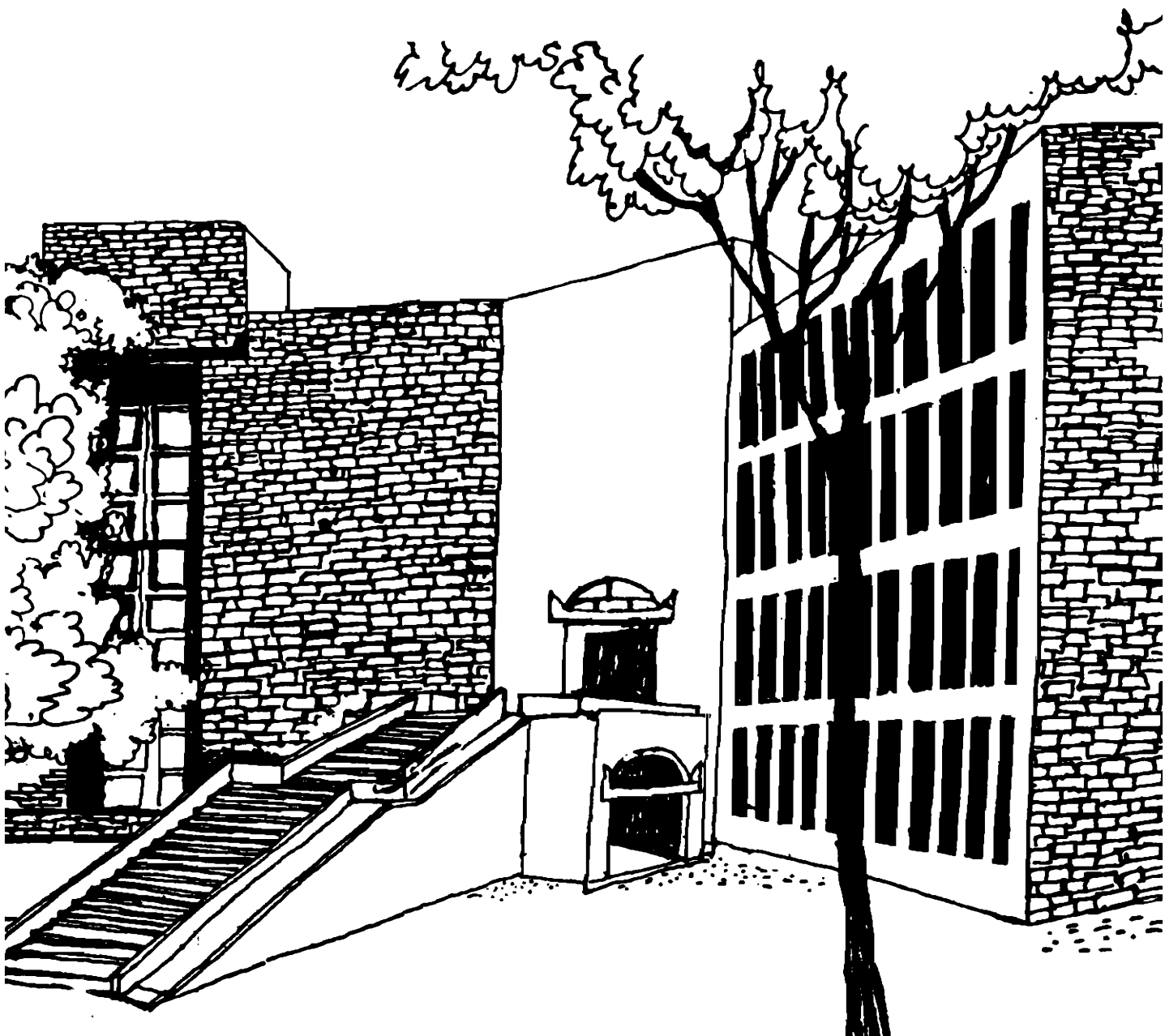

VIABILITY OF RURAL BANKING BY THE NATIONALIZED COMMERCIAL BANKS IN INDIA

By

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VIABILITY OF RURAL BANKING BY THE NATIONALIZED COMMERCIAL BANKS IN INDIA *

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Introduction

This paper addresses the current debate on the viability of rural banking by the Nationalized Commercial Banks (NCBs) in India. The debate centers around two divergent views about the future role of the NCBs. One viewpoint is that rural banking by the NCBs is unviable due to low interest rates for the priority sector advances (PSA)[1], its target setting approach, bureaucratization and politicization according to two Committees set up by the Government of India, namely, Agricultural Credit Review Committee (ACRC)[2], 1989 and Committee on Financial System (NC), 1991. Therefore these committees recommended closure of loss-making rural branches, increase in minimum lending rate and limited concessional finance to redefined priority sector to improve margins for transaction (i.e. administrative) costs, deregulation of interest rates, debureaucratization and depoliticization. On the other hand, studies have shown that rural branches of NCBs have low viability rather than non-viability mainly due to poor management and resultant inefficiency (Analyst, 1993; Desai and Mellor, 1993;

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Desai 1994, Desai and Namboodiri, 1996a and 1996b). These studies have shown that viability of rural banking could be improved by fully reaping scale economies in their costs through more decentralized, debureaucratized, depoliticized and autonomous operations.

The methodology used in this paper to examine the viability of rural branches differ from the above studies in two respects. One, cost analysis considers input prices in addition to various portfolios of the rural branches. And two, it integrates the contribution of scale economies in costs as well as different portfolios with the profitability analysis. These modifications would enable better evaluation of options for improving the viability of rural banking.

Conceptual Framework

A. *Cost Analysis*

Several studies have applied the Theory of Costs to the field of financial services in order to examine the scale economies in their costs (Benston, 1982; Murray and White, 1983; Youn Kim, 1986; Desai and Mellor, 1993; Desai, 1994 and Desai and Namboodiri, 1996a). The scale economy parameter can be computed by using an appropriate cost function which allows for varying output elasticity.

Any financial institution, including banks, tend to minimize costs subject to production constraint or a given level of output

$$\text{Min. } C = \Sigma\, p_j x_j \qquad (1)$$

subject to a production constraint

$$F(\, y_1, \ldots, y_n;\ x_1, \ldots, x_n) = k$$

where

C= cost comprising of the interest cost, transaction (administrative) cost and both costs taken together;

p_j= unit price of the j^{th} factor input;

x_j= quantity of the j^{th} factor input; and

y_i= quantity of the i^{th} output which consists of loans and advances, services and deposits.

Hence the cost of any financial institution is a function of its total output and the prices of inputs. The studies analyzing the production characteristics of financial institution have often used functional forms such as Cobb-Douglas and Constant Elasticity of Substitution which are restrictive in nature. Moreover, the output is represented by a single output variable which ignores the heterogeneous nature of various operations the financial institutions perform. Hence returns to scale is forced to remain constant over an output range and therefore presents a biased picture at the extreme levels of output (Murray and White, 1983).

Since rural banks have several operations, the functional form chosen should incorporate multiple outputs and allow for varying output elasticity or scale parameter.

Therefore in a generalized form a cost function would be

$$C = f\ (y_i,\ p_j)$$

The condition of linear homogeneity in input prices is satisfied if sum of the coefficients associated with the price variable (v_j) is equal to one or in other words,

$$\Sigma\ v_j = 1$$

The cost function should also be an increasing function of both input prices and output. This condition is fulfilled when the first derivative with respect to input prices and output is greater than zero or in other words

$$\delta C/\delta p_j > 0 \text{ and } \delta C/\delta y_i > 0 \text{ for all } p_j \text{ and } y_i$$

In the case of a multi-product firm, there exists two kinds of economies of scale, namely, economies arising from overall production activity and economies arising from expansion of a particular product as well as particular product set (Youn Kim, 1986). The former is termed as total scale economies (TSE) and the latter is termed as partial scale economies (PSE). The individual output elasticities are the partial scale economy parameters (PSE). The total scale economies (TSE) of a multi-product firm is obtained when all the outputs are increased by a common factor. Mathematically, it is a summation of elasticity of all outputs or y_i (Murray and White, 1983). In other words, TSE is equal to $\Sigma\ \delta C/\delta y_i * y_i/C$.

If TSE is greater than 1, the banks will experience decreasing returns to scale, i.e., costs increase proportionately more than

output. TSE value equal to 1 implies constant returns to scale and a value less than 1 suggests increasing returns to scale for the bank.

This study considers the multi-product nature of financial institutions as well as classifies their various products or outputs into innovative and non-innovative.

The classification of outputs of nationalized commercial banks into innovative and non-innovative groups was done because ***new methods of operation*** are followed in various portfolios, which are unique to rural banking in the Indian context. The innovative factors are priority sector advances (PSA) and the current and savings deposits (CSD). Priority sector advances are those advances which are directly or indirectly connected with either production, marketing or processing of output from agriculture, animal husbandry and pisciculture. Also included in PSA are the advances given to small scale industries (SSI), exports, small businesses like loans given to the retailers and traders and housing finance upto Rs. 200000 given to individuals.

PSA is termed as innovative primarily for three reasons: (1) Location-specificity of PSA provides the bankers scope for different types of advances due to the diversity in terms of agro-climatic factors; (2) Nature of appraisal and follow-up for PSA is entirely different from conventional banking. PSA appraisal

requires banks to collect and prepare documents for loaning as the customers (except perhaps for SSI and exports) cannot provide their own financial and other statements. Also it entails judging credit-worthiness based on information which are altogether different and even requires more continuous monitoring and control; and (3) Disbursement of credit for PSA and its recovery are different from the cash credit system prevalent for industrial loans. [3] Loan disbursement is often in both cash and kind and/or to the suppliers of inputs and assets. Similarly, recovery of loans requires banks to issue periodic notices and even collection by personal visits.

Current and Savings deposits (CSD) is also classified as innovative as it caters to the needs of the rural savers who have small and short-lived surpluses, characteristics peculiar to agriculture and business linked to it in rural areas. Such product also encourages monetization of the rural economy in which barter transactions are sometimes found. Pygmy Deposit Scheme of Syndicate Bank and Forced Savings Scheme of the Grameen Bank in Bangladesh are some relevant examples [4].

The non-innovative factors are the non-priority sector advances (NPSA) and the term deposits (FD). The former typifies an industrial loan, whereas the latter one suits primarily the needs of urban population who have more continuous and larger flow of income. Both these are considered non-innovative because they have long established "product" and "process" characteristics. For

example, in case of NPSA a structured project appraisal method is followed irrespective of the form of advances, while for term deposits, most NCBs have a similar product range with very few new features.

As is evident from the preceding discussion, these four portfolios, namely, CSD, FD, PSA and NPSA constitute the major business for the branches in rural areas. Hence volume of business (VOB) is defined to include these four services.

Another major departure of this study from the earlier cited studies on India is that the prices of resources used in the production of services are also explicitly considered. Three types of prices are considered -- prices of capital (P_k), manpower (P_s) and that of miscellaneous items (P_m) such as stationary and office space, etc. The first one shows the impact of unit price of capital expenditure on various costs, the second price captures the effect of unit staff related expenditure on different costs and last one shows the effect of unit price of other expenditure on various costs. P_s is defined as the manpower expenses per staff, P_k is defined as financial (interest) costs per rupee of volume of business and P_m is defined as the costs of sundry expenses per rupee of volume of business.

Thus, the cost function is

$$C = f\ (CSD,\ PSA,\ FD,\ NPSA,\ P_k,\ P_s,\ P_m)$$

This cost function is estimated for financial (interest) costs (FC), transaction (administrative) costs (TRC) and total costs (i.e. both of these costs-TC).

B. *Profitability Model*

The above analysis of the various costs provides clues regarding the viability of the rural branches at the present level of operations. With the prices of capital regulated by the Reserve Bank of India (Central Bank), the bankers have the options to either change the composition of various portfolios and/or reduce their transaction and miscellaneous costs to improve viability. The profitability model of rural banking by the NCBs examines these alternatives.

The theory of firm can be used to study factors influencing the viability of financial institutions. For any commercial bank, like a manufacturing firm, profitability arises from the flow of output. Revenue of these banks is generated from relative shares of various types of loans such as priority sector loans (i.e. innovative loans-SPSA) and other loans (i.e. non-innovative loans-SNPSA). The former unlike the latter is hypothesized to have an adverse impact on the viability because it is considered to be high cost and more risky as is contended by some committees, practitioners and academicians (ACRC, 1989; NC, 1993).

Furthermore, although any deposit is more of an input, it is considered here as both input and output. It is treated as input because it entails costs to the bank. But, since the deposits have a multiple credit creation feature and since this service can also attract loan customers, it is also treated as an output. Therefore the production process of financial institution is multi-stage involving intermediate outputs where loanable funds borrowed from depositors and serviced by banks through the use of labour, capital and material inputs results in the production of earning assets (Sealey and Lindley 1977). But the framework distinguishes between two types of deposit portfolios mentioned earlier, namely, share of current and savings deposits as innovative (SCSD) and share of fixed deposits as non-innovative (SFD). While the innovative portfolio share is hypothesized to be inversely related with profitability as innumerable small accounts have to be served coupled with shortage of staff at the branch, the non-innovative deposits share is expected to have a positive association with the profitability.

Three other determinants of profitability are unit gross margin or the banker's incentive (i.e. UGM- interest spread), unit transaction costs (i.e. UTRC- costs of labour, material and durable inputs like furniture per Rupee of business volume) and unit financial costs (i.e. UFC- costs of funds like deposits and borrowings per Rupee of business volume). UGM is considered to capture the concerns of both policy makers and bankers that it

should be adequate to meet transaction costs in banking operations. This is a price intervention beyond the control of the managers both at the corporate and branch level and therefore has to be taken as given. Such an intervention to improve the profitability is considered as non-innovative as it is a conventional accounting approach. On the other hand, the managers both at the corporate and branch level can use their expertise and experience in allocating scarce resources to mobilization of new deposits and advances that are profitable to the bank/branch. This may get reflected in the scale economies in various costs. Reaping such economies is under the control of the managers and therefore such non-price interventions are considered as innovative. UTRC and UFC being unequivocal criteria of depicting these scale economies, they influence behaviour of profitability of banks (Desai and Namboodiri, 1996). If UTRC and UFC increase/decrease (i.e. prevalence of scale diseconomies/economies), then they would reduce/increase profitability (i.e. unit profits ($u\pi$) - profit per Rupee of business volume). In other words, it suggests an a priori hypothesis of inverse relationship of viability with both UTRC and UFC. But, increase in UGM (i.e. incentives for bankers) is expected to improve profitability.

Hence the unit profit model at the branch level is

$U\pi$ or UL = f (SPSA, SCSD, SNPSA, SFD, UGM, UTRC, UFC)

Data Sources

The data related to the half-yearly audited financial statements of the rural[5] and semi-urban branches[6] in two regions namely, Vardhaman and Garwah, in West Bengal which is a part of the Eastern Zone of the nationalized commercial bank were collected for three consecutive time periods. The Vardhaman and Garwah regions have 31 and 29 rural and semi-urban branches respectively. Semi-urban branches are also included in the study as they come under the official definition of rural banking.

ANALYSIS

I. Cost Model

A. *Estimation Procedure*

The cost function was estimated for the financial costs (FC), transaction costs (TRC) and total costs (TC) for Vardhaman and Garwah regions separately. Financial costs were regressed not only on deposits, but also on various portfolios of advances to account for implicit opportunity costs associated with loan delinquency. High loan delinquency results in non-recycling of funds and hence the banks have to mobilize more deposits to undertake the same level of business. This in turn will add to the financial cost indirectly: Cost function for transaction costs was estimated to study whether it has scale economies so that the appropriate policy interventions related to interest rates and management could be identified. These costs accounted for as much as 18.8 to 41.4 percent of the total costs of sample branches in March 1995.

Four functional forms - cubic (CUB), translog (TRANSL), transcendental (TRAN), and log-log inverse (LLI) which give inverted S-shaped total cost curve and hence U-shaped average cost curve were estimated using Ordinary Least Squares procedure. The first two have been used extensively for cost analysis (Cubic function- Chiang 1967 and Rangarajan, 1972 ; Translog function- Binswanger, 1974; Benston, 1982; Murray and White, 1983 and Youn Kim, 1986). Appendix 1 provides a proof showing that TRAN and LLI functional forms also satisfy U-shaped average cost curves.

A restricted system of cost equation as well as panel estimation was initially attempted but none of these estimations was considered as some of the portfolios gave negative partial scale parameters. This is not acceptable because cost curve being in the positive quadrant of a diagram on costs and output, the scale economy parameters also have to be positive. Hence, Ordinary Least Squares estimation with and without restriction in input prices was tried for individual data points for the two regions separately.

The four functional forms were estimated as single cost equations for each of the three data points of the sample branches for both the regions, by considering the restriction of linear homogeneity in input prices. The procedure of estimating single equation without restriction in linear homogeneity in input prices is quite common in literature because statistical efficiency gains are not so significant with restriction (See, for example, Benston, 1982;

Desai and Mellor, 1993, Desai, 1994 and Desai and Namboodiri, 1996a). Therefore, this procedure was also attempted for all the four functional forms.

The estimates of both cubic and translog functional forms with and without restriction in input prices had some of the computed scale parameters negative sign for almost all the data points for the two regions. This could be probably due to low degrees of freedom for these functions as the number of estimated parameters was high. Hence results of only Transcedental and Log-Log Inverse functional forms are discussed below.

Except for one data point of March 1995 for Garwah region, these two functional forms provided positive value of partial scale parameters. For this one exceptional data point (March 1995) for Garwah region, Log-Log Inverse cost function without restriction in input prices was chosen as its estimation with restriction in input prices also yielded some scale economy parameters that are negative.

Thus, the choice from amongst all these cost functions was guided first and foremost by whether it gave a scale parameter that is positive or not. The other criteria considered were signs of the estimated coefficients and statistics such as R Bar square, `F' ratio, and `t' values of the coefficients. Parameter estimates and goodness of fit statistics for the selected equations are

reported in Tables 1 to 6 for the two regions. Most of the coefficients associated with the various deposit and loan portfolios as well as price variables have expected positive signs. However, the coefficients which do not conform to the expected signs are statistically non-significant'. All the R Bar squares are very high indicating that a large variation in costs is explained by the specified model.

B. *Results*

The partial scale economy parameters for each of the innovative portfolios (i.e. current and savings deposits and priority sector advances) and non-innovative factors (i.e. fixed deposits and non-priority sector advances) and total scale economy parameters for each of the three costs are given in Table 7 and Table 8 for Vardhaman and Garwah region, respectively.

The branches in both the regions exhibit scale economies in transaction costs for all the three time periods. Similarly, a constant returns to scale in financial costs is observed except for the first period for Garwah region where there is scale economies. Moreover, the branches in both the regions show increasing returns to scale for total costs except for the last two time periods for Garwah region where it is constant returns to scale. Scale economies in various costs may be due to more than one loan services in a given year in addition to multiple and diversified range of services with some costs (like transaction costs) common

for them. These services include wide variety of loaning to priority and non-priority sectors, various deposit services and other services like issuing bank drafts, non-fund based credit, remittances, safe-deposit vaults, etc. Transaction costs like salaries and wages, office space, stationery, etc which on an average account for as much as 33 percent are common to many of these activities of the bank.

Another interesting finding is that partial scale economies (PSE) of innovative portfolios are superior to non-innovative portfolios for most of the time periods for all the three costs. This may be because both the frequency and range of these services are higher. Moreover, PSE for advances are superior than that for the deposits. This could be because of the structure of the rural economy being agriculture-oriented provides greater opportunities for loan rather than deposit services. It could also be because typical rural loan amount per client is larger than the typical rural deposit from a client.

II. Profitability Model

A. *Estimation Procedure*

An OLS estimation for the sample branches of both the regions for individual data points was initially done using different functional forms like linear and log-log. These were not chosen because the data exhibited high multi-collinearity. Thus a pooled regression was used to estimate profitability model separately.

This helped in gaining higher degrees of freedom. The final form was chosen on the basis of statistics like Buse R^2, `t' values and signs of the estimated coefficients.

B. *Results*

For Vardhaman region linear functional form was chosen as it performed better in terms of statistics such as Buse R^2, and `t' values which are given in Table 9. In this model, SPSA is defined to include advances to agriculture and other priority sector advances but excludes advances to small scale industries. While the former has a share of about 85 percent, the latter has only 15 percent.

Scale economies in transaction costs is the most important variable in explaining profitability as shown by the standardized coefficients (See Table 9). Moreover, it has the highest impact as can be seen from the elasticity. In fact it is superior to the impact of unit gross margin i.e. interest spread considering both standardized coefficients and elasticities.

The signs of the co-efficients associated with SPSA and the share of non-priority sector loans (SNPSA) are negative (See column 2 in rows 1 and 6 in Table 9). This means that compared to the small scale industries, these two portfolios have a smaller impact on the profitability. It was therefore necessary to investigate which of these two loan portfolios has a greater impact on unit profit. For

this purpose, the share of advances to small scale industries(SSSI) and SNPSA were considered as separate variables and SPSA was dropped from the model. The estimated model gave positive sign for the former (SSSI) and negative sign for the latter (SNPSA) (See Table 9). This shows that among the various loan portfolios, the increase in the share of the non-priority sector advances has the least impact on unit profit in Vardhaman region. The branches in this region should therefore concentrate on priority sector advances for improving their profitability. Moreover, both the advances portfolios have a greater impact than the deposit portfolios as can be seen from both the standardized coefficients and elasticities.

The estimated models for Garwah region are also better for linear as compared to double log form of function. These models are reported in Table 10 in which SPSA is defined as advances to agriculture and other priority sector advances. It is evident from this table that the estimated models have satisfactory statistics like Buse R^2 and `t' values.

For Garwah region also, the scale economy in transaction costs is the most important variable as determined by the relative ranking based on the standardized beta values. The unit gross margin is the second most significant variable followed by the share of two deposit portfolios (See columns 3 and 7 in Table 10). The unit profit elasticities of both the scale economies are superior

compared to that for the unit gross margin. This signifies that a percent change in these economies will have greater impact on unit profit than a corresponding change in UGM, i.e., interest spread.

Furthermore, both the loan portfolios have positive coefficients for the rural branches in Garwah region as is evident from Column 2 in Table 10. This means that the increase in the share of these two portfolios has larger impact on the profitability compared to that for the share of SSI advances. But to test which of these two loan portfolios (i.e. SPSA and SNPSA) has larger impact on profitability, the share of SSI was included in the model and SPSA was excluded. The re-estimated model shows that the increase in the share of non-priority sector advances (SNPSA) has a larger impact as compared to priority sector advances (SPSA) (See column 6 in Table 10). This suggests that the bankers in this region may concentrate on the non-priority sector advances first, followed by agriculture and other priority sector advances. Lastly, the elasticity for current and saving deposits is also larger than that for the fixed deposits share (See column 5 and 9 in Table 10).

Summary and Conclusions

The issue of viability of rural banking by the NCBs was examined using both cost and profitability analyses. As standard translog cost function failed to conform to a priori specifications, transcedental and log-log inverse cost functions were used. A context specific profitability model was also developed to test the

diverse viewpoints expressed by different academicians and practitioners.

Major conclusions drawn from the preceding analysis are as follows:

(1) The branches in both the regions are yet to reap full scale economies in their costs, specially in transaction costs. This is corroborated from both the cost and profitability analysis. Reaping these economies will improve the viability of the rural branches of the NCBs.

(2) Garnering scale economies is much superior option as compared to increase in the interest rate for advances. Perhaps, it would be easier for the managers, both at the field and corporate level to allocate their scarce resources to those business which has the highest potential as well as scale economies.

(3) The priority sector advances (PSA) do not have negative influence on the viability as is often claimed. Judiciously expanding more business through PSA will enhance the profitability, specially in some regions, e.g., Vardhaman region.

(4) Reaping scale economies through more decentralized and autonomous operations is a superior option as compared to increase in interest rates.

These results have important policy implications. They indicate that the interest rate need not be deregulated and be kept at the

present level. The former is also justified as interest rates are positive in real terms[8]. The interest rates may be kept at the present level because cost-based changes in interest rate is unwarranted due to scale economies. Secondly, the policy makers and corporate officials should promote an institutional set-up which is more autonomous and decentralized so that the field-level managers can harness greater efficiencies based on location-specific knowledge and opportunities for rural banking. This study thus reinforces the findings of some of the earlier studies and negate committees arguments and recommendations other than related to bureaucratization and politicization.

Table 1: Estimated Transcedental Cost Functions with Restriction for Sample Rural Branches in Vardhaman Region, March 1994

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi.	Co-eff	t-values	Signi.
PSL	0.256	1.372	NS	1.031	4.217	0.01	0.590	3.13	0.01
PKL	0.881	5.539	0.01	-0.250	-1.201	NS	0.419	2.614	0.02
PML	-0.137	-1.688	NS	0.218	2.054	0.1	-0.010	-0.122	NS
PSAL	0.023	0.371	NS	-0.051	-0.634	NS	-0.074	-1.180	NS
NPSAL	0 164	1.498	NS	0.162	1.137	NS	0.104	0.952	NS
CSL	0.196	2.394	0.05	0.092	0.857	NS	0.175	2.122	0.05
FDL	0.336	2.123	0.05	0.230	1.11	NS	0.337	2.112	0.05
PSA	0.001	1.341	NS	0.002	1.631	NS	0.002	2.431	0.05
NPSA	-0.003	-0.901	NS	-0.0003	-0.072	NS	-.0003	-0.091	NS
CS	0.0006	0.653	NS	0.0006	0.485	NS	0.001	1.094	NS
FD	0.004	0.423	NS	0.0001	0.105	NS	-.0001	-0.159	NS
Constant	1.684	2.845	0.01	1.162	1.501	NS	2.115	3.545	0.01
Adj. R^2	0.9830			0.9160			0.9747		
F-Ratio	175.01			33.725			116.738		

Legend:

Co-eff.: Co-efficients
Signi.: Significance level
PSL: Log of Price of Staff
PKL: Log of Price of Capital
PML: Log of Price of Miscellaneous items
PSAL: Log of Priority sector advances
NPSAL: Log of Non-Priority sector advances
CSL: Log of Current and Savings deposits
FDL: Log of Fixed deposits
PSA: Priority sector advances
NPSA: Non-priority sector advances
CS: Current and saving deposits
FD: Fixed deposits
NS: Not significant

Table 2: Estimated Transcedental Cost Functions with Restriction for Sample Rural Branches in Vardhaman Region, September 1994

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi.	Co-eff	t-values	Signi.
PSL	0.2090	2.230	0.05	0.829	4.386	0.01	0.4711	4.246	0.01
PKL	0.7626	7.301	0.01	-.0326	-0.155	NS	0.4405	3.569	0.01
PML	0.0279	1.023	NS	0.2026	3.680	0.01	0.0882	2.734	0.02
PSAL	0.0463	2.591	0.02	-0.0407	-1.130	NS	-0.028	-1.326	NS
NPSAL	0 1723	3.966	0.01	0.2744	3.132	0.01	0.2299	4.477	0.01
CSL	0.324	7.297	0 01	0.1355	1.514	NS	0.2593	4.939	0.01
FDL	0.382	5.065	0.01	0.1503	0.986	NS	0.2912	3.259	0.01
PSA	0 0006	1.088	NS	0.0019	1.722	NS	0.0015	2.328	0.05
NPSA	-0.0024	-1.516	NS	-.0013	-0.419	NS	-0.003	-1.398	NS
CS	-.0008	-1.498	NS	0.0003	0.321	NS	-0.001	-0.9587	NS
FD	0.0009	2.285	0.05	.0001	0.157	NS	0.0009	1.857	0.1
Constant	1.258	3.763	0.01	1.436	0.674	NS	1.997	5.053	0.01
Adj. R^2	0.9971			0.9698			0.9944		
F-Ratio	1029.81			97.852			530.485		

Table 3: Estimated Transcedental Cost Functions with Restriction for Sample Rural Branches in Vardhaman Region, March 1995

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi.	Co-eff	t-values	Signi.
PSL	0.1608	1.493	NS	1.109	4.505	0.01	0.4588	3.147	0.01
PKL	0.8432	8.526	0.01	-0.2409	-1.103	NS	0.4592	3.429	0.01
PML	-0.0045	-0.103	NS	0.1400	1.406	NS	0.0818	1.389	NS
PSAL	0.0310	1.924	0.1	0.0170	0.462	NS	0.0059	0.271	NS
NPSAL	0.1209	3.295	0.01	0.1805	2.151	0.05	0.1725	3.473	0.01
CSL	0.4519	5.956	0.01	0.1500	0.939	NS	0.3652	3.864	0.01
FDL	0.3328	3.974	0.01	0.1628	0.850	NS	0.2109	1.860	0.1
PSA	0.0009	1.707	NS	0.0010	0.766	NS	0.0015	1.902	0.1
NPSA	-0.0016	-1.091	NS	0.0009	0.272	NS	-0.002	-0.860	NS
CS	-0.0005	-1.207	NS	-0.0001	-0.141	NS	-.0006	-1.089	NS
FD	0.0006	2.059	0.1	0.0005	0.703	NS	0.0008	2.043	0.1
Constant	1.258	3.301	0.01	0.4551	0.522	NS	1.897	3.676	0.01
Adj. R^2	0.9973			0.9679			.9934		
F-Ratio	1109.35			91.666			450.615		

Table 4: Estimated Transcedental Cost Functions with Restriction for Sample Rural Branches in Garwah Region, March 1994

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi	Co-eff	t-values	Signi.
PSL	0.0585	0.7084	NS	0.5626	2.817	0.02	0.2829	2.346	0.05
PKL	1.031	10.741	0.01	0.3929	1.694	NS	0.7906	5.517	0.01
PML	-0.0904	-1.317	NS	0.0444	0.267	NS	-0.079	-0.780	NS
PSAL	0.1343	2.746	0.02	0.0894	0.757	NS	0.1181	1.619	NS
NPSAL	0.1234	2.129	0.05	0.0288	0.206	NS	0.0986	1.140	NS
CSL	0.1879	2.991	0.01	-0.0405	-0.267	NS	0.0451	0.482	NS
FDL	0.4165	3.700	0.01	0.0604	0.222	NS	0.2575	1.533	NS
PSA	0.0001	0.142	NS	0.0041	1.585	NS	0.0014	0.866	NS
NPSA	-0.0005	-0.302	NS	0.0012	0.266	NS	-0.001	-0.386	NS
CS	0.0017	2.109	0.05	0.0038	1.969	0.1	0.0034	2.871	0.01
FD	-0.0005	-3.541	0.01	-.00005	-0.132	NS	-.0003	-1.352	NS
Constant	1.490	4.901	0.01	2.504	3.409	0.01	2.621	5.777	0.01
Adj. R^2	0.9939			0.9081			0.9799		
f- Ratio	457.505			28.750			137.383		

Table 5: Estimated Transcedental Cost Functions with Restriction for Sample Rural Branches in Garwah Region, September 1994

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi.	Co-eff	t-values	Signi.
PSL	0.3228	1.885	0.1	0.4873	1.984	0.1	0.3634	2.172	0.05
PKL	0.4655	3.313	0.01	0.3772	1.872	0.1	0.4483	3.265	0.01
PML	0.2115	2.713	0.02	0.1353	1.210	NS	0.1882	2.470	0.05
PSAL	0.1715	1.637	NS	0.0459	0.305	NS	0.1403	1.371	NS
NPSAL	0.0117	0.140	NS	0.0720	0.600	NS	0.0372	0.454	NS
CSL	0.2339	2.373	0.05	0.1810	1.280	NS	0.2205	2.289	0.05
FDL	0.4660	3.976	0.01	-0.0057	-0.034	NS	0.2751	2.402	0.05
PSA	0.0008	0.412	NS	0.0057	2.074	0.1	0.0022	1.158	NS
NPSA	0.0042	0.638	NS	0.0017	0.189	NS	0.0027	0.429	NS
CS	-0.0015	-0.791	NS	-0.0008	-0.303	NS	-0.001	-0.615	NS
FD	0.0008	1.237	NS	0.0016	1.746	0.1	0.0012	2.021	0.1
Constant	1.351	2.797	0.02	2.342	3.381	0.01	2.4333	5.156	0.01
Adj. R^2	0.9786			0.9246			0.9753		
F-Ratio	129.477			35.321			112.109		

Table 6: Estimated Log-Log Inverse Cost Functions without Restriction for Sample Rural Branches in Garwah Region, March 1995

Cost	Financial Costs			Transaction Costs			Total Costs		
Determi-nants	Co-eff.	t-values	Signi.	Co-eff.	t-values	Signi.	Co-eff	t-values	Signi.
PSL	-0.1758	-1.711	NS	0.3751	1.404	NS	-0.041	-0.342	NS
PKL	0.7862	6.507	0.01	0.2695	0.858	NS	0.4674	3.365	0.01
PML	-0.0673	-1.278	NS	0.2408	1.758	0.1	0.0225	0.372	NS
PSAL	0.2139	5.143	0.01	0.4561	4.219	0.01	0.2542	5.320	0.01
NPSAL	-0.0379	-1.125	NS	-0.0185	-0.212	NS	-0.027	-0.706	NS
CSL	0.4521	6.663	0.01	0.2349	1.332	NS	0.3732	4.788	0.01
FDL	0.3982	4.706	0.01	0.4118	1.872	0.1	0.4305	4.427	0 01
PSAI	0.8912	1.013	NS	5.5012	2.405	0.05	1.8634	1.843	0.1
NPSAI	-0.5464	-1.463	NS	-0.2422	-0.249	NS	-0.508	-1.184	NS
CSI	6.5677	3.443	0 01	6.0213	1.214	NS	6.458	2.947	0.01
FDI	6.5828	1.703	NS	0.7738	0.077	NS	-3.161	-0.711	NS
Constant	-0.3211	-0.557	NS	-0.7520	-0.501	NS	-0.389	-0.587	NS
Adj. R^2	0.9938			0.9122			0.9893		
F-Ratio	405.949			27.451			237.155		

Table 7: Partial Scale Economies (PSE) and Total Scale Economies (TSE) in Various Costs of Sample Branches of Vardhaman Region

Details	MARCH 1994			SEPTEMBER 1994			MARCH 1995		
COST	TRC	FC	TC	TRC	FC	TC	TRC	FC	TC
FFC	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R
INNOVATIVE FACTORS									
PSE(CSD)	0.1447	0.2500	0.2671	0.1758	0.2317	0.1888	0.1329	0.3517	0.2871
PSE(PSA)	0.0548	0.0899	0.0484	0.0164	0.0641	0.0173	0.0497	0.0628	0.0539
NON-INNOVATIVE FACTORS									
PSE(FD)	0.2484	0.3785	0.3221	0.1697	0.5217	0.4256	0.2420	0.4383	0.3464
PSE(NPSA)	0.1569	0.1131	0.0992	0.2548	0.1371	0.1915	0.1945	0.0962	0.1462
PSE(INNO)	0.1995	0.3399	0.3155	0.1922	0.2958	0 2061	0 1826	0.4145	0.3410
PSE(NON-INNO)	0.4053	0.4916	0.4213	0.4245	0.6588	0 6171	0.4365	0.5345	0.4926
TSE (INNO+ NON-INNO)	0 6048	0.8315	0.7368	0.6167	0.9546	0 8232	0.6191	0 9490	0.8336
Nature of Scale Economies	SE	CRS	SE	SE	CRS	SE	SE	CRS	SE

Legend: TRC: Transaction Costs
FC: Financial Costs
TC: Total Costs
FFC: Functional form chosen;
TRAN-R: Transcedental with restriction;
PSE: Partial Scale Economies Parameter;
CSD: Current and Savings deposits;
PSA: Priority sector advances;
FD: Fixed deposits;
NPSA: Non-Priority sector advances;
INNO: Innovative factors;
NON-INNO: Non-innovative factors;
TSE: Total Scale Economies Parameter;
CRS: Constant Returns to Scale;
SE: Scale Economies i.e. increasing returns to scale;

Table 8: Partial Scale Economies (PSE) and Total Scale Economies (TSE) in various costs of Sample Branches of Garwah Region

DETAILS	MARCH 1994			SEPTEMBER 1994			MARCH 1995		
COSTS	TRC	FC	TC	TRC	FC	TC	TRC	FC	TC
FFC	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	TRAN-R	LLI-WR	LLI-WR	LLI-WR
INNOVATIVE FACTORS									
PSE(CSD)	0.1117	0.2552	0.1821	0.1367	0.1528	0.1589	0.0937	0.2981	0.2215
PSE(PSA)	0.2250	0.1393	0.1639	0.2995	0.2066	0.2368	0.2870	0.1865	0.1969
NON-INNOVATIVE FACTORS									
PSE(FD)	0.0561	0.3681	0.2305	0.1349	0.5354	0.3857	0.4017	0.4838	0.4716
PSE(NPSA)	0.0428	0.1169	0.0861	0.0907	0.0556	0.0661	0.0012	0.0065	0.0139
PSE(INNO)	0.3367	0.3945	0.3460	0.4362	0.3594	0.3957	0.3807	0.4846	0.4184
PSE(NON-INNO)	0.0989	0.4850	0.3166	0.2256	0.5910	0.4518	0.4029	0.4903	0.4855
TSE (INNO+ NON-INNO)	0.4356	0.8795	0.6626	0.6618	0.9584	0.8475	0.7836	0.9749	0.9039
Nature of Scale Economies	SE	SE	SE	SE	CRS	CRS	SE	CRS	CRS

Legend: TRC: Transaction Costs
FC: Financial Costs
TC: Total Costs
FFC: Functional form chosen;
TRAN-R: Transcedental with restriction;
LLI-WR: Log-log Inverse without restriction;
PSE: Partial Scale Economies Parameter;
CSD: Current and Savings deposits;
PSA: Priority sector advances;
FD: Fixed deposits;
NPSA: Non-Priority sector advances;
INNO: Innovative factors;
NON-INNO: Non innovative factors;
TSE: Total Scale Economies Parameter;
CRS: Constant Returns to Scale;
SE: Scale Economies i.e. increasing returns to scale;

Table 9: Estimated Profitability Models for Sample Rural Branches in Vardhaman Region

Explanatory Factors	SPSA AND SNPSA				SSSI AND SNPSA			
	coefficients	standardised Beta	t-values	elasticities	coeffecients	standardised beta	t-values	elasticities
FFC	LINEAR				LINEAR			
INNOVATIVE FACTORS								
SPSA	-0.020	-0.467 (3)	-10.982@	-2.817	NA	NA	NA	NA
SSSI	NA	NA	NA	NA	0.020	0.178 (4)	10.983@	0.484
SCSD	0.0005	0.005 (7)	0.164	0.054	0.0005	0.005 (7)	0.164	0.054
UTRC	-0.976	-0.802 (1)	-24.628@	-3.876	-0.977	-0.802 (1)	-24.628@	-3.876
UFC	-0.012	-0.047 (6)	-1.511	-0.122	-0.012	-0.047 (6)	-1.151	-0.122
NON-INNOVATIVE FACTORS								
SNPSA	-0 028	-0.703 (2)	-13.642@	-2 505	-0 008	-0.209 (3)	-10.355@	-0.747
SFD	0.014	0.142 (5)	5 501@	1.850	0.410	0.142 (5)	5.501@	1.850
UGM	0.008	0.410 (4)	9 500@	0 864	0.008	0.410 (2)	9.500@	0.864
Constant	0 030		10.465@		0.009		4.06@	
BUSE R^2	0.9245				0.9245			

Figures in brackets indicate the relative ranking of factors based on standardized B-values ignoring signs which are given by coefficient * (s.d. X_i/ s.d. Y_j) where s.d. is standard deviation, X_i is the i^{th} explanatory variable and Y_j is j^{th} dependent variable (Snedecor and Cochran, 1967).

Legend

FFC : Functional form chosen
SPSA : Share of priority sector advances in total advances
SSSI : Share of advances to small scale industries in total advances
SCSD : Share of current and savings deposits in total deposits
UTRC : Unit transaction cost
UFC : Unit financial cost
SNPSA : Share of non priority sector advances in total advances.
SFD : Share of fixed deposits in total deposits
UGM : Unit gross margin which is defined as interest revenue per rupee of advances minus interest costs per rupee of deposits
NA : Not Applicable
@ : Significant at 1 per cent

Table 10: Estimated Profitability Models for Sample Rural Branches in Garwah Region

Explanatory Factors	SPSA: AG + OPSA				SSSI AND SHARE OF NPSA			
	coeffecients	standardised Beta	t-values	elasticities	coeffecients	standardised beta	t-values	elasticities
FFC	LINEAR				LINEAR			
INNOVATIVE FACTORS								
SPSA	0.00007	0.0011 (7)	0.020	-0.110	NA	NA	NA	NA
SSSI	NA	NA	NA	NA	-0.0004	0.0007 (7)	-0.0203	0.014
SCSD	0.0101	0.0986 (4)	3.059@	-8.626	0.0101	0.0986 (4)	3.059@	-8.626
UTRC	-0.9515	-0.599 (1)	-18.783@	40.955	-0.9515	-0.599 (1)	-18.783@	40.955
UFC	-0.0975	-0.067 (5)	1.866$	7.468	-0.0975	-0.067 (5)	1.866$	7.468
NON-INNOVATIVE FACTORS								
SNPSA	0.0021	0.0271 (6)	0.482	-1.274	0.0021	0.0262 (6)	1.092	-1.236
SFD	0.0018	0.1242 (3)	1.982$	-2.973	0.0018	0.1242 (3)	1.982$	-2.973
UGM	0.0107	0.2136 (2)	6.751@	-4.731	0.0107	0.2136 (2)	6.751@	-4.731
Constant	0.0123		3.143@		0.0124		3.971@	
BUSE R^2	0.9767				0.9767			

Figures in brackets indicate the relative ranking of factors based on standardized B-values ignoring signs which are given by coefficient * (s.d. X_i/ s.d. Y_j) where s.d. is standard deviation, X_i is the i^{th} explanatory variable and Y_j is j^{th} dependent variable (Snedecor and Cochran, 1967).

Legend

FFC : Functional form chosen
SPSA : Share of priority sector advances in total advances
SSSI : Share of advances to small scale industries in total advances
SCSD : Share of current and savings deposits in total deposits
UTRC : Unit transaction cost
UFC : Unit financial cost
SNPSA : Share of non priority sector advances in total advances.
SFD : Share of fixed deposits in total deposits
UGM : Unit gross margin which is defined as interest revenue per rupee of advances minus interest costs per rupee of deposits
NA : Not Applicable
$: Significant at 10 per cent
@ : Significant at 1 per cent

APPENDIX 1

Derivation of Conditions Required for U-Shaped Average Cost Behaviour of Transcedental and Log-Log Inverse Cost Functions

A functional form is said to have an inverted S-shaped nature of total cost curve and therefore U-shaped average cost curve if the following three conditions are satisfied.

(1) Linear Homogeneity in Prices: It means that if the prices of all the factors are doubled, total cost also doubles.

(2) Monotonicity in Input prices and output: It means that cost is an increasing function of both input prices and volume of output. Therefore with the increase in prices of the input as well as increase in the quantity of production, the total cost increases.

(3) Concavity in Input prices: For a certain range of input prices the function must be negative semidefinite.

TRANSCEDENTAL FUNCTION

In a general form, cost function represented in a transcedental form would be the following:

$$\ln C = \Sigma a_i \ln x_i + \Sigma b_i x_i + \Sigma v_j \ln p_j \quad \ldots . (i)$$

where C is the cost incurred by a firm , x_i are the various outputs of a firm and p_j are the prices of the input used in the production.

(1) Linear Homogeneity in Prices: If the prices of all the inputs are doubled, we get,

$$\ln C' = \Sigma a_i \ln x_i + \Sigma b_i x_i + \Sigma v_j \ln 2p_j \quad \ldots \quad \text{(ii)}$$

Subtracting Equation (ii) from (i)

$$\ln C' - \ln C = 0 + \Sigma v_j \ln 2$$

Hence,

$$C'/C = 2 \text{ if } \Sigma v_j = 1.$$

(ii) Monotonicity in input prices: The first derivative should be > 0, for a function to be monotonically increasing function. The first derivative for each individual price would be

$\delta \ln C/\delta \ln P_j = V_j$ and

if $V_j > 0 \ \forall \ j$, then it is monotonically increasing function.

Monotonicity in output: The first derivative of any output would be the following:

$$\delta C/\delta X = C\ (a/X + b)$$

For the function to be monotonically increasing function, one of these following two conditions have to be fulfilled

(i) Both a and b are positive

(ii) If a is positive and b is negative, then the absolute value of a/X should be > the absolute value of b or vice versa.

But these two conditions do not prove the U-shaped nature of the average cost curve and only gives that the function is increasing at a particular rate or a constantly increasing function. In order to show that the function has inverted S-shaped

nature in addition to being monotonic, the function should have a inflection point, i.e. rate of its slope should change sign at one value of output.

The inflection point for any function (here transcedental function) is given by setting the second derivative equal to 0.

$$\delta^2C/\delta X^2 = C\{(a^2-a)/X^2 + 2ab/X + b^2\} = 0.$$

$$X= (-a + \sqrt{a})/b$$

when $X= (-a + \sqrt{a})/b$, that particular point is called the inflection point.

Since only positive values of output or X are valid, the value of `a' should be between 0 and 1 while the value of `b' > 0. It is also valid when the value of `a' > 1 and `b' is negative.

When $\delta C/\delta X$ is positive and $\delta^2C/\delta X^2 < 0$, i.e. when $X^* < (-a + \sqrt{a})/b$, the function is concave to the origin. It means that the slope of the curve is positive and is increasing at a decreasing rate.

When $\delta C/\delta X$ is positive and $\delta^2C/\delta X^2 > 0$, i.e. when $X^* > (-a + \sqrt{a})/b$, it is convex to the origin. It means that the slope of the curve is positive and is increasing at an increasing rate.

This gives an inverted S-shaped nature of the total cost curve with respect to the output if X is treated to be an output and hence gives an U-shaped average cost curve. Such cost curves permit constant and non-constant returns to scale i.e. scale economies and scale diseconomies.

(iii) <u>Concavity in input prices</u>: For a certain range of input prices, the Hessian matrix is negative semidefinite. The negative

semi-definiteness is obtained if the hessian matrix is nonpositive or it is ≤ 0. The hessian matrix is given by the following formula.

For a two variable case, here two prices

$$\delta^2 C/\delta P_j^2 = f_{pkpk}\, dp_k^2 + 2f_{pkps}.dp_k.dp_s + f_{psps}\, dp_s^2$$

$$= 0^*\, dp_k^2 + 2^*0^*\, dp_k^*\, dp_s + 0^*\, dp_s^2$$

$$=0.$$

where

f_{pkpk} is second derivative with respect to pk

f_{psps} is second derivative with respect to ps

f_{pspk} is second derivative with respect to ps and pk

Hence the negative semidefiniteness condition is fulfilled.

LOG- LOG INVERSE

Cost function represented by log-log inverse form would be the following:

$$\ln C = \Sigma a_i \ln x_i + \Sigma b_i 1/x_i + \Sigma v_j \ln p_j \quad \ldots . (i)$$

where C is the cost incurred by a firm , x_i are the various outputs of a firm and p_j are the prices of the input used in the production.

(1) Linear Homogeneity in Prices: If the prices of all the inputs are doubled, we get,

$$\ln C' = \Sigma a_i \ln x_i + \Sigma b_i 1/x_i + \Sigma v_j \ln 2pj \quad \ldots . (ii)$$

Subtracting Equation (ii) from (i)

$$\ln C' - \ln C = 0 + \Sigma v_j \ln 2$$

Hence,

$$C'/C = 2 \text{ if } \Sigma v_j = 1.$$

(ii) Monotonicity in input prices: The first derivative for each individual price would be

$$\delta \ln C/\delta \ln P_j = V_j \text{ and}$$

if $V_j \geq 0 \ \forall \ j$, then it is monotonically increasing function.

Monotonicity in output: The first derivative for any output say X would be

$$\delta C/\delta X = C\ (a/X - b/X^2)$$

Since C is always positive, the term in the bracket should always be positive for the function to be a monotonically increasing function. Or in other words the

$$aX-b \geq 0$$

These conditions are fulfilled if

(1) both a and b are positive but ax > b, or

(2) a is positive and b is negative.

The inflection point is given by setting the second derivative equal to 0 and solving for X.

$$\frac{\delta^2 C}{\delta X^2} = C\left(-\frac{a}{X^2} + 2\frac{b}{X^3}\right) + \left(\frac{a}{X} - \frac{b}{X^2}\right)\frac{\delta C}{\delta X}$$

or

$$\frac{\delta^2 C}{\delta X^2} = \frac{C}{X^4}\left[(a^2 - a)X^2 + 2b(1-a)X + b^2\right]$$

The term in bracket in the above equation is in quadratic form the roots of which would be the following:

Since we are interested in the positive values of X, the root of the equation valid for the cost function is

$$X = \frac{-2b(1-a) + \sqrt{4b^2(1-a)^2 - 4(a^2-a)b^2}}{2(a^2-a)}$$

or

$$X = \frac{-b(1-a) + \sqrt{b^2(1-a)^2 - (a^2-a)b^2}}{(a^2-a)}$$

$$X = \frac{b\{-(1-a) + \sqrt{1-a}\}}{a(1-a)}$$

Therefore the inflection point is given by

$$X^* = \frac{b\{-(1-a) + \sqrt{1-a}\}}{a(1-a)}$$

Since only positive values of output or X are valid, the values of 'a' should be between 0 and 1 and value of 'b' should be positive. When $\delta C/\delta X$ is positive and $\delta^2 C/\delta X^2 < 0$, i.e. when the values of X is between 0 and X^*, the function is concave to the origin. It means that the slope of the curve is positive and is increasing at a decreasing rate.

When $\delta C/\delta X$ is positive and $\delta^2 C/\delta X^2 > 0$, i.e. when the values of X is greater than X^*, it is convex to the origin. It means that the slope of the curve is positive and is increasing at an increasing rate.

This gives an inverted S-shaped form for the total cost curve and hence an U-shape of the average cost curve for the Log-log inverse function. In other words it permits the prevalence of scale economies and diseconomies.

(iii) <u>Concavity in input prices</u>: Same as for the transcedental function.

1.This includes advances to agriculture, small scale industries, small trade and exports.

2. For review of ACRC study of viability of rural banking, see Desai and Namboodiri, 1996b.

3. Cash credit system is prevalent for industrial loans wherein the borrower withdraws a part or entire limit sanctioned to him for his current expenses through cheques. Repayment of the loans is ensured by routing the sale proceeds through the loan account. This cycle goes on for the borrower unlike the process for crop loans where the farmers have to apply afresh for each season.

4. Unconventional methods to promote savings have been adopted through these schemes. For example, in the Pygmy Deposit Scheme, small deposits from the farmers and traders are collected by commission agents, while in the case of Grameen Bank, the members are required to deposit one Taka every week.

5. Rural branch is defined as a branch located in an area with a population less than 10,000.

6. Semi-urban branch is a branch located in a area with population less than 100000 but greater than 10000

7. An inverse relationship between financial cost and price of miscellaneous items (P_m) was observed for two data points in both the regions. A similar relationship between total costs and price of miscellaneous items (P_m) also hold for one data point in both the regions. When the price of the miscellaneous items like stationary, telephone charges, etc. increase it may induce efficiency in the use of these and thereby reduce both financial and total costs. Similar inverse relation between each financial cost and total cost with price of staff (P_s) was observed for one data point in Garwah region. This could be because when P_s increases,the quality of portfolio appraisal and follow-up would improve with a consequent decline in loan delinquency. Transaction costs and price of capital (i.e. funds) are also inversely related in Vardhaman region. This may be because deposits and loan operations are simultaneously taken to spread these costs on larger business volume.

8. For evidence on this, see Desai and Namboodiri, 1996b.

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