The Pakistan Development Review
45 : 4 Part II (Winter 2006) pp. 1085–1102

Impact of Regulatory Reforms on Labour Efficiency in the Indian and Pakistani Commercial Banks

SHABBAR JAFFRY, YASEEN GHULAM, and JOE COX

1. INTRODUCTION

Efficiency plays an important role in the operation of firms. If firms are pursing a policy of shareholder wealth maximisation, this implies that maximum efficiency is extracted from a firm's resources during the production process, or that the minimum quantity of inputs are used to achieve a desired level of output. This is especially true in the case of labour demand and labour usage, as wage expenditure constitutes a significant portion of the average firm's cost structure.

Knowledge of relative inefficiencies in labour usage will therefore be of great interest to firm and, as such, academic studies on efficiency of labour demand in firms have been relatively forthcoming. These include work on the Indian farming industry [Kumbhakar (1996), Swedish social insurance offices [Kumbhakar and Hjalmarsson (1991)], Tunisian Manufacturing [Haouras, *et al.* (2003) and Kalimantanian rice production [Padoch (1985)].

However, there is relatively little in the way of research conducted on efficiency within the banking sector, and even less on the banking sectors of developing economies [Berger and Humphrey (1997)], despite an increase in research activity in such areas over the last ten years. This is unfortunate, as banks and financial institutions are the most important organisations in overall financial intermediation and economic acceleration of a country, in no small part due to their significant role of converting deposits into productive investment. [Podder and Mamun (2004)].

The process of liberalisation and modernisation is vitally important in this particular case. Because of the unique position that it occupies within the framework of an economy, the banking industry tends to be more heavily regulated and scrutinised than other industries. This trend is particularly apparent in developing economies, where banks tend to exhibit poor performance as a result of overly prohibitive regulation [Kumbakhar and Sarkar (2003)]. Thus, tests of labour demand efficiency can be made more meaningful by including some comparison of efficiency both pre and most modernisation. Not only will this paper seek to make comparisons of labour demand efficiency between India and Pakistan, but will also examine changes in the efficiency of labour demand in both the pre and post deregulation periods.

Shabbar Jaffry <shabbar.jaffry@port.ac.uk> is Reader in Economics, Yaseen Ghulam <yaseen.ghulam@port.ac.uk> is Director of Postgraduate Programme in Economics, and Joe Cox <joe.cox@port.ac.uk> is Lecturer, Department of Economics, Portsmouth Business School, University of Portsmouth, UK.

2. CASE STUDIES

A major component of this study will be an examination of the banking sectors of developing economies, and their response to changes in the regulatory environment. In the 1980s and 1990s, a large number of developing economies undertook extensive processes of liberalisation and modernisation, particularly with respect to financial and banking industries. The developed world led the way in this respect, with most notably the USA experiencing productivity and efficiency increases as a result of the relaxation of the country's regulatory environment.

A number of studies have documented this phenomenon within various American industries, including air transportation, telecommunication and freight transportation. Theory does not dictate a clear expected result of deregulation and modernisation in the banking sector in terms of labour efficiency gains (or losses), as the consequences of deregulation may depend on industry conditions prior to the deregulation process, as well as the type of deregulation employed [Berger and Humphrey (1997)].

Bonnaccorsi di Patti and Hardy (2005) examined the efficiency of the Pakistani Banking sector in isolation. Over the period of modernisation, they observe an increase in efficiency as a result of the new competitive environment resulting from the first round of deregulation. It was also found that new private banks sometimes outperformed foreign banks in terms of efficiency.

As a result of this, studies of efficiency in banking, however have not displayed as clear-cut trends as are illustrated in the above examples. Expectations upon the result of the modernisation and deregulation of the banking industries in the countries of the Indian sub-continent are therefore unclear.

2.1. The Indian Banking Sector

India is a country in the heart of the Indian sub-continent of South Asia and has the second largest population in the world. The country was a part of the British Empire until it was recognised as a republic shortly after the end of the Second World War. Owing to its large population India's GDP purchasing power per capita works out to be just US$3,262, ranked 120th in the World by the World Bank. India has shed its dependence on agriculture since it has become a republic. Now, some of the fastest growing industries include IT, textiles and mining.

Banking has also become an emerging industry in the modern era. The Bengal Bank was the first British patronised modern bank in India, and was established in 1784. There are currently a total of 361 different banks in India—27 Nationalised commercial banks, 30 local private banks, 40 foreign commercial banks, 196 regional rural banks and 68 Co-operative banks. The banking sector in India has historically been highly regulated, but gradually the restrictions imposed by such a regime are being lifted. The first 'wave' of reform began in 1969, when fourteen major banks were nationalised. Six more commercial banks were nationalised in 1980. A number of new reforms were introduced during the period 1992-1997. These include a reduction in reserve requirements, privatisation of public sector banks, interest rate deregulation, and an effort to remove barriers to market entry. As such, the Indian banking sector is currently in a transitional phase. Public sector banks are also trying to reduce manpower, non-performing assets and government equity. Foreign direct investment ceilings have also increased under the reforms.

However, since the early 1990s, public sector banks have found it extremely difficult to compete against private sector banks and foreign banks. In response to this, public sector banks are in the process of cutting excessive use of manpower and non-performing assets, as is their right under the new reforms. Other responses to deregulation and modernisation have included an increase in the volume of merger and acquisition activity, an increase in the use of technology, an increased usage of diversification and more sophisticated risk management techniques.

Looking to the future, there has been (and continues to be) an attitude towards the gradual reduction of interest rates by India. GDP growth is expected to continue rising at a rate of around 6 percent per annum. Foreign banks are also likely to meet with more success due to their use of innovative technology and increased freedom afforded by reforms. Indian banks are also expected to move towards a more streamlined and efficient workforce over the coming years.

2.2. The Pakistani Banking Sector

Pakistan also gained independence from the British Empire at the same time as India, with a Pakistani central bank established in 1948. Currently, there are a total of 45 different banks in Pakistan—5 Nationalised commercial banks, 16 local private banks, 19 foreign commercial banks and 5 specialised development banks. Whilst initially the country was very poor, with a significant portion of national wealth generated from agricultural activities, in the modern era the country growth rat has been consistently above the world average.

Despite impressive rates of growth in GDP in recent years, the country experienced an economic slowdown in the early 1990s as a result of poor policy making where the activities of Pakistani banks were focused around subsidising the fiscal deficit, serving a few large corporations and engaging in trade financing [Husain (2005)]. Additionally the financial system suffered from political interference in lending decisions and also in the appointment of banking managers.

In response to some of these problems, a period of de-regulation and financial liberalisation was implemented in the early and late 1990s. These included strengthening of prudential regulations, a market driven exchange rate system, and the appointment of independent persons to the board of directors of nationalised banks and an enhanced capital adequacy requirement and a reduction in the restriction on branching.

Reform of the banking sector is now entering a second phase, where local banks are being asked to raise their paid capital, follow a maximum disclosure requirement and make full provision against non-performing loans. Foreign banks have thrived in the past due to significant investments in technology, including ATMs and credit cards. However, at the current point in time, many foreign banks are selling to local banks [Kazmi (2002)]. The fall in fortunes of foreign banks can be put down to, in part, an increased confidence in privatised domestic banks.

There are a number of factors that are expected to play a part in the development of the Pakistani banking sector, including a gradual reduction in interest rates, an increase in merger and acquisition activity, banks attempting to enter the market for consumer finance, the introduction of new technology and a reduction in non-performing loans. There has also been a rapid rise in branch networks. In 2005, thanks to the ongoing process of reform, almost 80 percent of the banking sector was in private hands [World Bank Report (2005)].

3. FINDINGS OF OTHER RESEARCH

This paper seeks to examine the labour demand efficiency of the banking sectors in India and Pakistan, using the framework outlined by Heshmati (2002), and used in his analysis of labour efficiency within Swedish savings banks. This study will focus on the time period 1985–2003, which is characterised within the Indian sub-continent as a period of significant reform, deregulation and liberalisation in both countries' respective banking sectors.

Even though this paper adopts Heshmati (2002)'s approach, it is worth noting that here are a number of alternative approaches to the measurement of the efficiency of labour demand. Kumbhakar and Sarkar (2003), for example, use TFP growth as the measure of banking performance over the period 1985-1996, including both labour and capital are the variable inputs, while equity and reserves are a quasi-fixed input. The study finds that there is a significant over employment of labour relative to capital, particularly in the public sector, both pre and post deregulation. In contrast to this, Atkinson and Primon (2002) formulate shadow distance and shadow cost systems using panel data for 43 US utilities over 37 years and diagnose an over-use of capital relative to labour and energy and the under-use of energy relative to labour.

Baltagi and Rich (2004) develop a general index time path for technical change between production and non-production labour in US manufacturing industries between 1959–1996. Their findings confirm that substantial reductions in the relative share of labour in the production process is attributable to a sustained period of non-neutral technical change. The general index approach also explains observed shifts in relative labour demand as a combination of price-induced substitution, output effects and skill-biased technical change responses.

In terms of studies focusing on banking, Gjirja uses a translog stochastic frontier input requirement model to assess efficiency in Swedish Bank's use of labour over the period between 1982 and 1998. The study illustrates how deregulation in Sweden positively affected productivity growth, but had no positive impact on the efficiency of labour use. The study also notes that banks were not able to catch up with the expansion of the labour use frontier over time.

Heshmanti (2002) also studies the Swedish banking sector over the period of deregulation in the 1980s, and banking crisis in 1992, looking at a panel of 52 savings banks. The study concludes that the process (and anticipation) of deregulation had a significant affect upon banks' choices of input and output volumes. The study concludes that very small banks tend to operate with a technically optimal size of labour, as the model output indicates a negative relationship between technical efficiency and the size of banks.

Battese, *et al.* (2000) also examine Swedish Banks covering the period from 1984 to 1995. The study concludes that inefficiency is positive over this period, and has increased—indicating that the 'average' bank did not manage to catch up with the labour use frontier. The study concludes that Sweden might have expected greater effects from deregulation and crisis on labour efficiency and points to the competitive pressure from abroad remaining weak as one of the possible reasons why this was so.

Estache and Rossi (2004) investigate the impacts of different regulatory environments upon the efficiency of firms. The study indicates that privatised firms

operating under price-cap and similar 'hybrid' schemes are more efficient in their use of labour than both public firms and privatised firms under rate-of-return regulations, and that privatised firms operating under rate-of-return regulation have, at most, similar labour efficiency as public firms.

Soderbom and Teal (2004) investigate efficiency within the developing African economies and show that the Cobb-Douglas functional form adequately captures efficiency in production technology. The study also concludes that large firms facing higher relative labour costs than smaller firms use a much more capital intensive technology and operate with costs 20–25 percent higher than those which would occur if factor prices differentials across firms of differing sizes could be eliminated.

There have also been a number of studies conducted analysing firm's response in terms of risk preference in the post-deregulation period. Just and Pope (1978), for example, say that risk adverse producers take into account both the mean and variance of output when ranking different technologies, and that this can have an effect upon relative efficiency levels. Rao (2004) investigates cost efficiencies and its relationship with risk-return behaviour of banks in United Arab Emirates by using Stochastic Frontier Analysis in both translog and flexible Fourier forms. The authors detect substantial inefficiencies. In addition, the study concludes that domestic and large banks were less cost efficient than foreign and small banks. The study also revealed a positive and significant relationship between cost efficiencies and levels of capitalisation

4. METHODOLOGY

The model to be used in this study is from Heshmati (2002), itself adapted from the work outlined in Aigner, *et al.* (1977). In this paper, Heshmati expresses the function of labour demand as:

$$h = f(y_j, w, q, t)\exp(\varepsilon)$$

$$\varepsilon = \mu + \upsilon \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where h is units of labour measured in hours, f represents the production technology and yi (j = 1,2,…, M) are services produced using labour, w is wage, q is a vector of quasi-fixed factors and t is time effects. This function estimates the minimum amount of labour required to produce a given level of output. The error term in this equation is decomposed into two distinct parts (μ and υ), representing technical efficiency and factors beyond the control of banks respectively. In addition to these two, the bank's production technology will also have an effect upon their demand for labour.

If the μ component of the error term is greater than or equal to zero, the firm displays a level of technical inefficiency [Aigner, *et al.* (1977)], as the firm has used more labour than was technically necessary in order to produce a given level of output. A bank, which displays s a μ value of zero, can claim to be fully efficient in the use of labour. The υ component of the error term can be both positive and negative. Due to its presence, therefore, the labour demand frontier is stochastic even when μ is set to zero.

If risk functions are also taken into account, then the model is redefined appropriately. Again, as from Heshmati (2002), Robinson and Barry (1987) and Just and Pope (1978). When doing so, the model then becomes:

$$h = f(x;\alpha)\exp(g(x;\beta)\varepsilon) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where $x = (y,w,q,t)$, with $f(x;\alpha)$ representing the demand part and $g(x;\beta)\varepsilon$ representing the variance part of the demand function. The model can also be re-specified in log linear form.

$$\ln h = \ln f(x;\alpha) + g(x;\beta)\varepsilon \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

5. DATA

Panel data is taken from a selection of Indian and Pakistani banks, covering the period 1985–2003. The data were taken from the annual reports of 73 Indian and 41 Pakistani banks, and are each provided at bank levels, rather than at the individual branch level. Any conclusions generated form this study can therefore only be made at a bank level. Unlike Das, *et al.* (2005), specific branch level analysis is not possible using the data available for this study.

The panel consists of 114 Indian and Pakistani commercial banks observed for 19 years (from 1985 to 2003), and is unbalanced as not all banks were in existence for the whole sample period. Summary statistics of the data are presented in Table 1 (below).

Table 1

Summary Statistics of the India and Pakistani (Combined) Commercial Banks, 1985–2003 (in real 2000 US dollars)

Variable	Variable Name	N	Mean	Std Dev	Minimum	Maximum
Idnr	Bank ID	1681	51.45	32.88	1	114
Period	Year	1681	1994	5	1985	2003
Lcost (c)	Labour Cost (mill.)	1681	103.39	288.34	0.07	4382.31
Hours (h)	Labour Hours (mill.)	1681	26.29	62.93	0.03	575.16
Wage (w)	Hourly wage rate	1681	5.60	5.31	0.71	57.72
Fixass (q)	Fixed assets (mill.)	1681	46.09	89.27	0.00	944.50
Loans (y1)	Loans (mill.)	1681	2582.83	7287.54	0.64	101113.76
Inv (y2)	Investment (mill.)	1681	2270.79	5562.63	0.00	63210.30
Deposits y3)	Deposits (mill.)	1681	4592.03	11331.70	3.17	155534.23
Brans (y4)	Branches	1681	595	1134	1	9089
T (t)	Time trend	1681	10.32	5.34	1	19
Size	Size of the bank	1681	2.42	1.52	1	5
Type	Type of bank	1681	1.98	0.81	1	3
Qty	Quality	1681	6.30	3.28	0.01	14.94
Lar	Risk	1681	42.82	10.57	4.91	82.27

Notes: Type of bank includes three categories: public, private, foreign.
Quality=capital to asset ratio= (capital + reserves)/total assets)*100.
Risk= loans to assets ratio= (Total loans/Total assets)*100.
Type of banks includes three categories: public, private, foreign.
Size of banks includes five categories: very small, small, medium, large and very large based on number of employees.
Labour hours= labour*2400.

Outputs and inputs are chosen as per policy objectives of the individual banks, as well as those of the regulatory reforms within the respective countries. The specific variables used in the analysis include the total quantity of labour hours used (h), wages (w), loans ($y1$), investment ($y2$), deposits ($y3$), number of branches ($y4$), fixed assets (q), and a time trend (t) representing exogenous rates of technical change. The wages, loans, deposits, investment, fixed assets and total labour costs are provided in constant 2000 prices United States Dollar (USD) values to make the data comparable between India and Pakistan. Labour is measured in hours used per year. As the data on number of hours worked for each employee is not available, we have used a rough proxy figure of 2400 considering 300 working days and eight hours per day work. The 'wage' variable is defined as hourly wages—an aggregate measure of the cost associated with the hiring of labour, including payroll taxes. The quasi-fixed variable, q, is defined as the sum of fixed assets. Quality and risk variables are used in the regression stages to control for heterogeneity in risk taking behaviour.

In this study, the variables loans, investment deposits and branches are regarded as outputs. The literature is divided as to whether certain variables are an input or an output. Berger and Humphry (1997), for example, see deposits as outputs (what is known as a value-added approach). In the case of this study, it is important to define whether total number of branches is considered to be an input or an output. In this case, as with Heshmati (2002) and Kumbhakar and Sarkar (2003), the number of branches is considered an output variable.

It is worth noting at this stage how the 'size' variable was constructed. A size distribution is calculated by the number of employees of each bank, with the following restrictions:

Table 2

Construction of 'Size' Variable

Number of Bank Employees	Resultant 'Size' Classification
Employees $\leq$ 1,000	1
1,000 < Employees $\leq$ 5,000	2
5,000 < Employees $\leq$ 10,000	3
10,000 < Employees $\leq$ 20,000	4
Employees > 20,000	5

From the total sample of data, 1 percent of observations was determined to be excessively large or small outliers, and was resultantly excluded from the model. The regression outlined below was subsequently run for the combined dataset. In order to make country specific technical efficiency scores apparent, individual bank specific efficiencies are calculated and then separated by years, size classes, types of ownership and countries.

A flexible translog functional form (which is linear in parameters) is then used to approximate $f(.)$. The model can therefore be specified as follows;

$$\ln h_{it} = \alpha_0 + \sum_j \alpha_j \ln y_{jit} + \alpha_w \ln w_{it} + \alpha_q \ln q_{it} + \lambda_t$$
$$+ 1/2\left\{\sum_j \sum_k \alpha_{jk} \ln y_{jit} \ln y_{kit} + \alpha_{ww} \ln w_{it}^2 + \alpha_{qq} \ln q_{it}^2\right\}$$
$$+ \Sigma_j \alpha_{jw} \ln y_{jit} \ln w_{it} + \Sigma_j \alpha_{jq} \ln y_{jit} \ln q_{it} + \alpha_{wq} \ln w_{it} \ln q_{it}$$
$$+ \left\{\Sigma_j \beta_j y_{jit} + \beta_w w_{it} + \beta_q q_{it} + \beta_t t\right\}[\mu_i + \nu_i] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

where *h*, *y*, *w* and *q* are variables which are defined above, *i* is an index of banks…*i* (1 . . . *N*), *t* represents an index of time…*t* (1 . . . *T*) and both *j* and *k*…*j*; *k* (1 . . . *M*) are indices of outputs. Finally, the exogenous rate of technical change is represented by λ_t.

The key to this Equation is the bank, which performs best in terms of technical efficiency within the sample. We assume that this particular bank is fully efficient (hence the μ value for this bank is equal to 0). All other banks in the sample are assumed to be inefficient to a certain degree, the extent of which is determined relative to the single, fully efficient bank.

One of the drawbacks associated with this method is that the 'fully efficient' bank may not always be the best in all of the time periods used in the study. For this reason, following Schmidt and Sickles (1984), a time variant technical inefficiency score is calculated (relative to the banks with best performances in each year) as:

$$TINEFF_{it} = g(x_{it} : \beta)(\alpha_0 + \mu_i) - \min_t[g(x_{it}; \beta)(\alpha_0 + \mu_i)]$$
$$= \left(\sum_j \beta_j y_{jit} + \beta_w w_{it} + \beta_q q_{it} + \beta_t t\right)(\alpha_0 + \mu_i)$$
$$- \min_t\left[\left(\sum_j \beta_j y_{jit} + \beta_w w_{it} + \beta_q q_{it} + \beta_t t\right)(\alpha_0 + \mu_i)\right] \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

And technical efficiency as

$$TINEFF_{it} = \exp(-TINEFF_{it}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Which, as Heshmati (2002) points out, is both bank and time specific. The expectations on the first order coefficients are as with Heshmati (2002), where α*j* and α*q* are expected to be positive and α*w* negative, which can be interpreted *s* the elasticity of labour demand with respect to output, quasi-fixed inputs and wages respectively. These expectations are only valid at the normalised data point, with the corresponding elasticities (which are both bank and time specific) for all data points derived respectively as follows.

$$E_j = \partial \ln h_{it} / \partial \ln y_{jit} = \alpha_j + \sum_k \alpha_{jk} \ln y_{kit} + \alpha_{jw} \ln w_{it} + \alpha_{jq} \ln q_{it} \quad \ldots \quad \ldots \quad (7)$$

$$E_w = \partial \ln h_{it} / \partial \ln w_{it} = \alpha_w + \alpha_{ww} \ln w_{it} + \sum_k \alpha_{jw} \ln y_{kit} + \alpha_{wq} \ln q_{it} \quad \ldots \quad \ldots \quad (8)$$

$$E_q = \partial \ln h_{it} / \partial \ln q_{it} = \alpha_q + \alpha_{qq} \ln q_{it} + \Sigma_k \alpha_{jq} \ln y_{kit} + \alpha_{wq} \ln w_{it} \quad \ldots \quad \ldots \quad (9)$$

And the time specific elasticity of labour with respect to time (the exogenous rate of technical change) is derived as:

$$E_t = \partial \ln h_{it} / \partial t = (\lambda_t - \lambda_{t-1}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

6. ESTIMATION AND EXPLANATION

The model used in this study follows the approximation outlined in Heshmati (2002) and detailed above. The model outlined in Equation (4) is firstly used to estimate labour demand function for a sample of Indian and Pakistani commercial banks observed for nineteen-year period between 1985-2003. Estimates of the demand function, (*f)* and the variance function, (*g) r*egression results are presented in Appendix A. A majority of the bank-specific variables are statistically significant from zero. The variance function, (*g),* outlined above, was estimated using the weighted non-linear method. The results can be seen in Table 3, below, and in the Appendix A.

Labour Demand Elasticity and Productivity Growth

The elasticities of labour demand with respect to different outputs, wages and fixed assets were calculated for bank and time specific. The mean values are reported in Table 3 (above) by years, bank size, type of ownership and country. At the mean data point, all elasticities with the exception of wage and time elasticities are positive and significant, indicating that there is a degree of responsiveness of labour demand to changes in the levels of outputs and wages and fixed assets. These are similar results to those provided by Heshmati (2002). Labour demand elasticity with respect to the output 'loans' is negative for a number of specific bank sizes—namely small, large, very large and public banks. It is possible that some large or small banks are leaning toward an 'arm's length' approach to banking, perhaps using less labour and more automation in order to generate new loans.

In relative terms, the sample mean elasticities of labour with respect to 'loans' and 'investments' are quite small, taking values of 0.031, 0.054 respectively (although these are still slightly higher than Heshmati's estimates of the same elasticities applied to Swedish savings banks), with standard deviations which are not unusually large in either case. Both of these elasticities are steadily decreasing over time, suggesting that loans and investment have become less labour intensive outputs for Indian and Pakistani banks over time. 'Deposits' have larger labour demand elasticity than either of these two outputs, with a sample mean elasticity of 0.175 and a standard deviation of 0.057. This means that 'deposits' are a significantly more labour intensive output than 'loans' and 'investments'.

The largest of the output elasticities is that which relates to 'branches', with a mean elasticity of 0.452 and a standard deviation of 0.009. We can conclude from this that 'branches' is the most labour-intensive banking service offered in India and Pakistan, and this degree of elasticity is very unlikely to be significantly different across the number of banks included in the sample. This is a result that is to be expected, showing that a marginal change in the number of branches will have the largest marginal effect on labour demand of all outputs.

Table 3

Mean Input and Output Elasticities and Marginal Effects by Year, Size and Type of Banks (Indian and Pakistani (Combined) Commercial Banks)

	Output			Inputs					
	Loans (y1)	Investment (y2)	Deposits (y3)	Branches (y4)	*Wages (w)*	*Fixed Asst (q)*	Time (t)	TME	Efficiency
A. Labour Demand Elasticity									
1985	0.058	0.119	0.094	0.443	–0.442	–0.002	0.000	–	–
1986	0.054	0.111	0.104	0.444	–0.423	0.000	–0.004	–	–
1987	0.058	0.113	0.091	0.456	–0.419	0.004	0.005	–	–
1988	0.049	0.122	0.092	0.462	–0.419	0.001	0.054	–	–
1989	0.058	0.096	0.119	0.450	–0.411	0.003	–0.044	–	–
1990	0.059	0.084	0.133	0.450	–0.406	0.005	–0.002	–	–
1991	0.048	0.059	0.144	0.468	–0.298	0.014	–0.041	–	–
1992	0.042	0.054	0.148	0.464	–0.275	0.019	0.004	–	–
1993	0.037	0.036	0.172	0.468	–0.256	0.026	–0.026	–	–
1994	0.035	0.039	0.180	0.465	–0.269	0.019	0.005	–	–
1995	0.021	0.034	0.212	0.453	–0.263	0.010	0.027	–	–
1996	0.019	0.021	0.224	0.450	–0.239	0.015	0.007	–	–
1997	0.010	0.014	0.247	0.444	–0.233	0.012	–0.016	–	–
1998	0.003	0.019	0.237	0.452	–0.197	0.014	0.030	–	–
1999	0.003	0.019	0.242	0.441	–0.202	0.010	–0.020	–	–
2000	0.011	0.019	0.238	0.443	–0.213	0.008	–0.058	–	–
2001	0.010	0.021	0.228	0.443	–0.197	0.010	–0.045	–	–
2002	0.005	0.024	0.209	0.448	–0.144	0.014	–0.011	–	–
2003	0.010	0.026	0.203	0.444	–0.163	0.014	0.011	–	–
Very Small	0.085	0.035	0.184	0.527	–0.423	0.013	–0.007	–	–
Small	–0.001	0.068	0.169	0.456	–0.215	0.013	–0.007	–	–
Medium	0.001	0.054	0.179	0.403	–0.175	0.008	–0.005	–	–
Large	–0.003	0.070	0.149	0.385	–0.156	0.008	–0.006	–	–
Very Large	–0.037	0.054	0.209	0.329	–0.155	0.006	–0.007	–	–
Public	–0.014	0.060	0.175	0.365	–0.157	0.009	–0.006	–	–
Private	0.016	0.047	0.186	0.455	–0.197	0.010	–0.007	–	–
Foreign	0.091	0.047	0.176	0.541	–0.504	0.014	–0.007	–	–
India	0.014	0.059	0.163	0.440	–0.223	0.014	–0.007	–	–
Pakistan	0.065	0.035	0.214	0.479	–0.415	0.004	–0.007	–	–
Sample Mean	0.031	0.054	0.175	0.452	–0.288	0.010	–0.007	–	–
St. deviation	0.022	0.040	0.057	0.009	0.100	0.007	0.028	–	–
B. Marginal Variance (Risk) Effects									
1985	–0.051	–0.164	0.015	–0.209	–0.837	–0.051	–0.109	–1.406	0.400
1986	–0.036	–0.001	0.048	–0.144	–0.928	–0.039	–0.070	–1.170	0.488
1987	–0.037	–0.478	0.011	–0.084	–0.992	–0.067	–0.075	–1.722	0.486
1988	–0.066	–0.030	0.013	–2.266	–1.076	–0.061	–0.145	–3.631	0.615
1989	–0.027	–0.042	–0.012	–0.107	–0.162	–0.034	–0.058	–0.442	0.642
1990	–0.030	–0.041	–0.012	–0.132	0.404	–0.022	–0.063	0.104	0.617
1991	–0.004	–0.012	–0.001	–0.031	0.044	–0.010	–0.017	–0.031	0.377
1992	–0.004	–0.016	0.005	–0.046	0.281	–0.011	–0.019	0.190	0.751
1993	0.003	0.178	–0.002	–0.016	0.046	–0.004	–0.008	0.197	0.780
1994	–0.896	–0.008	–0.005	–0.027	0.004	–0.008	–0.012	–0.952	0.752
1995	0.003	–0.036	–0.002	–0.022	0.116	–0.008	–0.012	0.039	0.820
1996	1.536	–0.010	–0.003	–0.014	0.029	–0.004	–0.008	1.526	0.794
1997	–0.003	–0.001	–0.014	–0.009	0.018	–0.004	–0.006	–0.019	0.678
1998	0.002	–0.002	0.059	–0.010	0.015	–0.004	–0.005	0.055	0.780
1999	0.005	0.000	–0.008	0.069	0.028	–0.003	–0.006	0.085	0.623
2000	0.006	–0.009	0.414	–0.042	0.097	–0.006	–0.009	0.451	0.707
2001	–0.010	–0.001	0.025	–0.033	0.040	–0.004	–0.006	0.011	0.748
2002	0.078	–0.011	–0.024	–0.027	0.061	–0.005	–0.007	0.065	0.691
2003	0.068	0.003	–0.019	–0.039	0.087	–0.007	–0.011	0.082	0.650
Very Small	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.007	0.741
Small	–0.002	–0.097	–0.005	0.004	–0.005	–0.001	–0.001	–0.107	0.631
Medium	–0.001	0.006	0.019	–0.002	–0.050	0.000	–0.002	–0.030	0.608
Large	0.615	0.028	0.013	–0.762	–0.321	–0.008	–0.011	–0.446	0.593
Very Large	–0.380	–0.116	0.162	–0.251	–0.444	–0.104	–0.196	–1.329	0.564
Public	0.110	-0.032	0.081	-0.457	–0.367	-0.050	–0.092	–0.807	0.580
Private	0.000	-0.005	0.001	-0.001	0.016	0.000	0.000	0.011	0.665
Foreign	–0.001	–0.060	–0.003	0.002	0.009	0.000	0.000	–0.053	0.739
India	–0.085	–0.052	0.018	–0.206	–0.096	–0.024	–0.043	–0.384	0.633
Pakistan	0.314	0.013	0.048	–0.039	–0.141	–0.002	–0.005	0.168	0.721
Sample Mean	0.028	–0.036	0.026	–0.168	–0.143	–0.019	–0.034	–0.346	0.653
St. deviation	0.420	0.122	0.096	0.512	0.449	0.021	0.041	1.079	0.132

Note: TME is the total marginal effects computed as summing up input and output marginal effects.

The wage elasticity is on average –0.288 (the largest of the input elasticities) with a relatively small standard deviation of 0.10. In contrast to the results of Heshmati (2002), the elasticity of wages is decreasing over time, from –0.442 in 1985 to –0.163 in 2003. Although the sign of this variable is consistent with theory, such changes in elasticity over time contradict Heshmati (2002) and indicate that labour demand is becoming less and less responsive to changes in the wage rate. This seems to indicate that banking reforms within the Indian sub-continent have not had the desired effect of making labour use more efficient.

The elasticity with respect to fixed assets has a mean value of 0.010 with a relatively high standard deviation of 0.007. There is an upward trend in the elasticity of this input, starting at –0.002 in 1985 and ending at 0.014 in 2003. Again, these results contrast with Heshmati (2002), and indicate an increasing demand for labour with the accumulation of fixed assets. There must be significant differences in the degree to which the crowding out of labour as a result of changes in wage levels in the sub-continent as compared to Sweden.

The exogenous rate of technical change (consisting of only a neutral component) changes only over time. The sample mean value is –0.007, indicating very slight positive technical change (due to a slight reduction in labour usage). Technical change fluctuates from positive to negative before the turn of the 21st Century, with no clear trend established for more than a few tears at a time. However, from 1999, there is a consistent positive technical change. It would be interesting to see if this trend has continued post 2003, and further study might seek to establish whether or not this apparent trend towards positive technical change is consistent throughout the decade. However, when taking the overall sample into account, it appears that there has been no definite trend in terms of technological progress or regress in the sub-continent over the years included in the study.

The magnitude of the different output elasticities also appear to vary with the size of the individual bank in question. Labour demand elasticity with respect to wages seems to fall as bank size increases. This illustrates that increased wage levels do not serve as great a deterrent to the hire of additional labour for larger banks as opposed to their smaller counterparts. The elasticity with respect to branches decreases with size of bank, showing that larger banks are better able to expand their branching network without having the large effect on labour demand experienced by smaller banks across the sub-continent. Labour demand elasticity with respect to fixed assets seems to fall very slightly with the size of the bank in question (showing that increasing volumes of fixed assets requires less additional labour for larger banks). Finally, the time trend shows very consistent amounts of technical change for all sizes of bank, meaning that the very small technical progress shown over the sample period has not been limited to banks of specific sizes. Aside from these, there does not appear to be a definite trend with respect to the other input or output labour demand elasticities as bank size increases.

In terms of elasticity differentiated by bank ownership, public banks have negative labour demand elasticities with respect to loans, while foreign banks have by far the largest elasticity with respect to this output. It seems that public banks in the sub-continent are leading the way in reducing the labour intensity associated with marginal increases in the production of this output. Other differentials of note include foreign

banks having significantly more labour demand elasticity with respect to branches; while public banks have the lowest. This means that it is publicly owned banks that are able to expand their branch network with the smallest marginal impact on labour demand. This may be due to more efficient management and organization, or to economies of scale. Public banks also have the largest elasticity with respect to wages, with foreign banks having almost half the labour demand elasticity with respect to wages than their public counterparts. Private, domestic banks are fairly close to public banks with regard to elasticities applicable to this particular input. This means that domestic banks in the sub-continent are far more responsive in their demand for labour when the wage rate changes than their foreign competitors.

The Employment Variance

The figures representing the following can be found in Appendix A (Section B). The beta coefficients with respect to 'investment' (y2), 'deposits' (y3) and 'branches' (y4) are all positive and statistically significant. The coefficient for 'loans' (y1) is however negative but statistically insignificant at the 5 percent level of significance. Of all of the input variables, the wage coefficient is by far the largest, and, as with Heshmati (2002) is both negative and strongly significant. Time specific dummy variables have a mixed signs and few of them statistically significant. The coefficient applying to fixed assets is positive, but not significant.

In common with Heshmati (2002), the employment variance elasticity or marginal risk effects are calculated with respect to the dispersion factors of 'Outputs', 'Wages', 'Fixed assets' and 'Time Trend', with mean values being estimated separately for each year, size of bank, type of bank and country. These results, together with the overall sample mean, are reported in second part of Table 3. Marginal variance (risk) effects evaluated at the mean of the data with respect to 'loans', 'investment', 'deposits' and 'branches' are generally negative. Positive marginal effects are observed for wages in post deregulation period. In all cases the standard deviations are large and, for some variables, are in excess of the mean value itself. Thus, generally for banks with production levels close to the sample means, the employment variance decreases if the bank produces more output.

The variables 'Wages' and 'Branches' are the most important factors contributing to the variance of employment in terms of marginal effects. The signs of marginal effects are, on the whole, as expected. Significantly more variation in the estimated marginal effects seems to take place almost uniformly as bank size increases. Some of the inputs and outputs seem to demonstrate significant variation in their respective marginal effects over time (notably loans, branches and wages), while the remaining inputs and outputs display fairly consistent marginal effects over time.

Technical Efficiency

The efficiency measured here is a relative efficiency, as it is measured relative to the bank demonstrating 'best-practice' in each year. This individual bank is assumed to be 100 percent efficient. The mean values of estimates of technical efficiency obtained from Equation (6) are reported in Table 3 by year, bank size, type of bank and country.

Technical efficiency is both bank and time-specific. The overall mean technical efficiency is 65.3 percent with a standard deviation 0.132. This means that, on average, banks in the sub-continent could have reduced their labour usage by 34.7 percent with output remaining constant. This is indicative of a relatively low level of mean labour use efficiency displayed by banks in the sub-continent over the sample period.

However, what is apparent from investigating the changes in labour use efficiency over time is that the financial reforms initiated in the 1990s have helped to improve the efficiency of labour demand within banks, as the mean technical efficiency over time is increasing. In 1985, the average commercials bank in the sub-continent showed only 40 percent labour use efficiency, compared with 65 percent in the final year of the sample period, and a high of 82 percent in 1995. The year on year change is largest between 1990 and 1992 (despite a small adjustment 'blip in 1991), which is indicative of the success of the round of reforms introduced in 1992. There appears to be a noticeable variation in technical efficiency over the bank size. As was concluded in the study of Heshmati (2002), there is found to be a negative relationship between the level of technical efficiency and the size of banks. In a relative sense, very small banks operate with a more technically optimal size of labour than do very large banks. The results indicate that the largest banks could reduce their labour demand on average by 43.6 percent. Therefore, there is a very significant gap between the optimal level of labour efficiency, and that, which is observed in the largest banks within the sub-continent. The very smallest sub-continental banks were found to be slightly inefficient in labour usage, and could have reduced labour usage by 25.9 percent.

Among banks of different ownership types, it was found that foreign banks were the most efficient in terms of labour usage, followed by private domestic and public domestic commercials banks respectively. Foreign banks could have reduced their labour usage by 26.1 percent, private banks by 33.5 percent and public banks by 42 percent, indicating that publicly owned commercials banks in the sub-continent are employing far more labour than is technically necessary given output levels, and still have some way to go in improving technical efficiency levels in the future. The frequency distribution of technical efficiency is reported in Table 4. A significant number of banks are found in the intervals of between 60 percent and 80 percent labour usage efficiency.

Table 4

Frequency Distribution of Technical Efficiency

Percentage Efficiency Interval	Frequency	Percentage
10–50	273	16.24
50–60	243	14.46
60–70	428	25.46
70–80	459	27.31
80–90	206	12.25
90–100	72	4.28

The correlation coefficients of ranking of efficiencies are reported in Table 5. This study concludes that there is a negative correlation between efficiency and the size of bank, while a positive relationship is found between efficiency and time. We find a positive association between both the input and output variance effects and time, which is significant for the former, but not for the latter. We also find a negative relationship between the input and output variance effects and bank size where input and output variance effects refer to the sum of total marginal effects with respect to input and output variables.

Table 5

Pearson Correlation Coefficients (Figures in Brackets are Significance Levels)

	Characteristics			Marginal Variance (Risk Effects)		
	Time	Size	TME	Output	Input	Efficiency
Time	1.000					
	(0.002)					
Size	–0.075	1.000				
	(0.002)	(0.017)				
TME	0.028	–0.058	1.000			
	(0.255)	(0.017)	(0.000)			
Output	0.019	–0.057	0.991	1.000		
	(0.444)	(0.019)	(0.000)	(0.774)		
Input	0.148	–0.129	0.142	0.007	1.000	
	(0.000)	(0.000)	(0.000)	(0.774)	(0.000)	
Efficiency	0.475	–0.447	0.023	0.017	0.146	1.000
	(0.000)	(0.000)	(0.351)	(0.499)	(0.000)	(0.000)

7. CONCLUSION

This paper has sought to examine the efficiency of labour use in both India and Pakistan during a period of modernisation and deregulation. Data from 73 Indian and 41 Pakistani banks have been analysed over the period 1985–2003. A flexible translog functional form is used where demand for labour is a function of wages, fixed inputs and a time trend. Of those outputs and inputs elasticities are largely as expected. The largest elasticity is with respect to wages, which have a strong negative elasticity. Of outputs, branches have the most effect upon labour demand, with a strong, positive elasticity.

The most interesting conclusions from this study are those that illustrate technical efficiency levels. The average level of technical inefficiency across the sample was relatively low, as was expected. It was found that, on average, banks in the sub-continent could have reduced their labour usage by 34.7 percent with output remaining constant. However, the sub-continent was generally experiencing increases in labour efficiency across the nineteen years of the study, indicating that policies enacted in the early and late 1990s to assist banks in the reduction of their labour use were reasonably successful. This level of efficiency varies inversely with bank size as expected. The results indicate that the largest commercial banks could reduce their labour demand on average by 43.6 percent. The very smallest banks were found to be slightly more efficient on average in

terms of labour usage, which could have been reduced by 25.9 percent. Among banks of different ownership types, it was found that foreign banks were the most efficient in terms of labour usage, followed by private domestic and public domestic commercial banks respectively.

It would appear that the significant financial reforms of the last decade in the Indian subcontinent over the last decade have reduced the degree of over-usage of labour in its banking sectors. There still exists, however, a fairly large degree of inefficiency in terms of labour usage, particularly among the very large banks of the subcontinent. It appears that the number of branches that are owned by a bank have the greatest impact on the demand for labour and, if the outcome of more efficient labour usage is to be achieved, more emphasis needs to be placed on those large banks with an extensive network of branches. These are most likely to be the banks that have previously been publicly owned, and therefore may have encountered difficulties meeting the challenges of the new competitive environment. It may be deemed that additional effort needs to be made to streamline these large banks if the desired efficiency gains are to be made.

Appendix A

GLS Parameter Estimates of the Labour Demand and Nonlinear Least Square Estimates of the Variance Function (Combined)

A. Labour Demand Function								
a0	1.8769**	0.1418	d12	–0.8053**	0.0885	d68	–2.8301**	0.2421
ay1	–0.0241	0.0315	d13	–0.9500**	0.0725	d69	–3.0724**	0.2429
ay2	0.0901**	0.0232	d14	–1.1713**	0.0957	d70	–2.8792**	0.2429
ay3	0.0612*	0.0344	d15	–1.2362**	0.1120	d71	–2.0926**	0.2493
ay4	0.4912**	0.0441	d16	–1.1402**	0.1131	d72	–3.0830**	0.2403
aw	–0.1204**	0.0290	d17	–0.9401**	0.1039	d73	–2.4219**	0.2375
aq	0.0083	0.0101	d18	–1.0788**	0.0990	d74	–1.9263**	0.1396
ay11	0.0269	0.0236	d19	–1.4766**	0.1016	d75	–1.8993**	0.2411
ay22	0.0149**	0.0033	d20	–1.2957**	0.1155	d76	–2.1077**	0.2357
ay33	0.0278	0.0235	d21	–1.5890**	0.1455	d77	–2.2246**	0.2312
ay44	0.0121	0.0066	d22	–1.6336**	0.1557	d78	–1.7513**	0.2366
aww	0.0744**	0.0175	d23	–1.4813**	0.1374	d79	–2.7398**	0.2297
aqq	–0.0003	0.0031	d24	–1.5322**	0.1220	d80	–2.5103**	0.2401
ay12	–0.0211	0.0184	d25	–1.4590**	0.1212	d81	–2.0333**	0.2449
ay13	0.0556	0.0428	d26	–1.4947**	0.1284	d82	–3.0176**	0.2299
ay14	–.0316*	0.0141	d27	–.5407**	0.1410	d83	–.8897**	0.2664
ay1w	–.0533	0.0312	d28	–.9401**	0.1717	d84	–.0300**	0.1887
ay1q	–.0706**	0.0141	d29	–1.9097**	0.1681	d85	–2.6177**	0.2400
ay23	–0.0803**	0.0219	d30	–2.0338**	0.1728	d86	–2.2349**	0.2331
ay24	0.0512**	0.0098	d31	–1.9453**	0.1749	d87	–2.6660**	0.2469
ay2w	0.1384**	0.0195	d32	–2.1090**	0.1715	d88	–1.8077**	0.2421
ay2q	0.0111	0.0087	d33	–2.0121**	0.1874	d89	–2.2207**	0.2429
ay34	–0.0812**	0.0183	d34	–2.2942**	0.1908	d90	–2.9928**	0.2360
ay3w	–0.2123**	0.0409	d35	–2.1664**	0.1749	d91	–2.3572**	0.2374
ay3q	0.0555**	0.0176	d36	–2.2752**	0.1787	d92	–2.4372**	0.2388
ay4w	0.1189**	0.0137	d37	–2.1646**	0.1799	d93	–2.7708**	0.2285
ay4q	0.0014	0.0046	d38	–2.3285**	0.1983	d94	–2.4817**	0.2425
awq	0.0290**	0.0116	d39	–2.4739**	0.1895	d95	–1.2751**	0.1003
C2	0.0127	0.0154	d40	–2.1861**	0.1903	d96	–2.4669**	0.2393
C3	0.0088	0.0162	d41	–2.3707**	0.2170	d97	–3.1033**	0.2462
C4	0.0508**	0.0169	d42	–2.6330**	0.1982	d98	–2.8417**	0.2385
C5	0.0213	0.0177	d43	–2.5258**	0.2081	d99	–2.8174**	0.2381
C6	0.0198	0.0185	d44	–2.3914**	0.2050	d100	–1.7112**	0.1179
C7	–0.0002	0.0235	d45	–2.3704**	0.1959	d101	–1.4452**	0.1106
C8	–0.0042	0.0245	d46	–2.8769**	0.2137	d102	–2.7886**	0.2345
C9	–0.0205	0.0264	d47	–2.3685**	0.2146	d103	–2.6981**	0.2393
C10	–0.0197	0.0262	d48	–2.6190**	0.2175	d104	–2.4645**	0.2339
C11	–0.0009	0.0270	d49	–2.8671**	0.2154	d105	–2.7785**	0.2387
C12	–0.0108	0.0282	d50	–3.1282**	0.2481	d106	–3.0457**	0.2368
C13	–0.0367	0.0294	d51	–1.3382**	0.2422	d107	–2.8658**	0.2443
C14	–0.0233	0.0307	d52	–1.3213**	0.2179	d108	–2.6618**	0.2367
C15	–0.0369	0.0309	d53	–1.2972**	0.2309	d109	–1.9528**	0.2382
C16	–0.0858**	0.0310	d54	–1.3505**	0.2452	d110	–2.8477**	0.2476
C17	–0.1330**	0.0319	d55	–1.7387**	0.2474	d111	–2.2803**	0.2309
C18	–0.1493**	0.0331	d56	–1.2204**	0.2286	d112	–1.4467**	0.1092
C19	–0.1426**	0.0329	d57	–1.9500**	0.2483	Quality	–0.0089*	0.0046
D2	–1.4880**	0.1400	d58	–1.9285**	0.2399	Risk	0.0417	0.0298
D3	–1.4960**	0.1470	d59	–2.3957**	0.2408	**B. Variance Function**		
D4	–1.4838**	0.1467	d60	–2.1982**	0.2411	by1	0.0025	0.0035
D5	–1.3719**	0.1417	d61	–2.6138**	0.2419	by2	0.0006	0.0028
D6	–1.4947**	0.1538	d62	–2.9448**	0.2419	by3	–0.0049	0.0051
D7	–1.5394**	0.1685	d63	–3.0255**	0.2433	by4	–0.0036	0.0037
D8	–1.7031**	0.1687	d64	–1.9438**	0.2433	bw	0.0552**	0.0039
D9	–0.9720**	0.0836	d65	–2.9248**	0.2398	bq	0.0029	0.0030
D10	–0.8144**	0.0667	d66	–2.9842**	0.2444	bt	0.0050**	0.0003
D11	–0.8615**	0.0840	d67	–2.9127**	0.2404	σ_{2v}	5.7433	

Note: ** Significant at 1 percent, * 5 percent.

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