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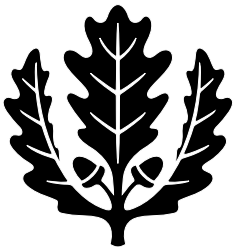

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Abstract

India's public sector banks (PSBs) are compared unfavorably with their private sector counterparts, domestic and foreign. This comparison rests, for the most part, on financial measures of performance, and such a comparison provides much of the rationale for privatization of PSBs.In this paper, we attempt a comparison between PSBs and their private sector counterparts based on measures of productivity that use quantities of outputs and inputs. We employ two measures of productivity: Tornqvist and Malmquist total factor productivity growth. We attempt these comparisons over the period 1992-2000, comparing PSBs with both domestic private and foreign banks. Out of a total of four comparisons we have made, there are no differences in three cases, PSBs do better in two, and foreign banks in one. To put it differently, PSBs are seen to be at a disadvantage in only one out of six comparisons. It is difficult, therefore, to sustain the proposition that efficiency and productivity have been lower in public sector banks relative to their peers in the private sector.

PRODUCTIVITY GROWTH AND EFFICIENCY IN INDIAN BANKING: A COMPARISON OF PUBLIC, PRIVATE, AND FOREIGN BANKS

1. Introduction

India's public sector enterprises, in general, tend to be unfavorably compared with their private sector counterparts. Apart from ideological and theoretical considerations, it is such comparisons that provide much of the impetus for the current privatization drive in India. While public sector banks (PSBs) are not yet candidates for privatization- the objective at present is merely to lower the government's holdings to 33 per cent-, there is a vocal section that would favor a push towards privatization at PSBs as well, based on their perceived inefficiency relative to the private sector. At least in the popular debate, such perceptions rest on conventional financial indicators of performance.

In this paper, we attempt a comparison between PSBs and their private sector counterparts based on measures of productivity that use quantities of outputs and inputs. There are two reasons why such an exercise would be meaningful. One, it helps validate results obtained through financial analysis. Two, given that accounting norms may vary across firms and over time within a firm, measures of productivity based on output-input quantities may be more reliable. The rest of this paper is organized as follows. Section 2 briefly discusses the measures of performance. In Section 3, we review studies that compared efficiency and productivity in the Indian context and outline the empirical procedures we have used. In section 4, we present our results. Section 5 concludes.

2. **Performance Measures**

2.1 Tornqvist and Malmquist indices of total factor productivity[1]

2.1.1 Productivity

Productivity of a firm is measured by the quantity of output produced per unit of input. In the single-output, single-input case, it is merely the ratio of the firm's output and input quantities. Thus, if, in period 0, a firm produces output y_o from input x_o, its productivity is

$$\Pi_0 = \frac{y_0}{x_0}. \qquad (1a)$$

Similarly, in period 1, when output y_1 is produced from input x_1, the productivity is

$$\Pi_1 = \frac{y_1}{x_1}. \qquad (1b)$$

Moreover, the productivity index in period 1, with period 0 as the base, is

$$\pi_1 = \frac{\Pi_1}{\Pi_0} = \frac{y_1/x_1}{y_0/x_0} = \frac{y_1/y_0}{x_1/x_0}. \qquad (2)$$

This productivity index shows how productivity of the firm has changed from the base period. The rate of productivity growth is the difference in the growth rates of the output and input quantities respectively.

When multiple inputs and/or multiple outputs are involved, one must replace the simple ratios of the output and input quantities in (2) above by quantity indexes of output and input. In this case, the index of *multi-factor productivity (MFP)* is

[1] This section is based on Ray (2004).

$$\pi_1 = \frac{\Pi_1}{\Pi_0} = \frac{Q_y}{Q_x}, \quad (3)$$

where Q_y and Q_x are, respectively, output and input quantity indexes of the firm in period 1 with period 0 as the base. Different measures of the multi-factor productivity index are obtained , however, when one uses alternative quantity index numbers available in the literature.

2.1.2. Tornqvist index of total factor productivity

By far the most popular quantity index number is the Tornqvist index measured by a weighted geometric mean of the relative quantities from the two periods. Consider the output quantity index first. Suppose that *m* outputs are involved. The output vectors produced in periods 0 and 1 are, respectively, $y^0 = (y_1^0, y_2^0, ..., y_m^0)$ and $y^1=(y_1^1, y_2^1, .., y_m^1)$. The corresponding output price vectors are $p^0= (p_1^0, p_2^0, ..., p_m^0)$ and $p^1= (p_1^1, p_2^1, ..., p_m^1)$ respectively. Then, the Tornqvist output quantity index is

$$TQ_y = \left(\frac{y_1^{\,1}}{y_1^{\,0}}\right)^{v_1}\left(\frac{y_2^{\,1}}{y_2^{\,0}}\right)^{v_2} \ldots \left(\frac{y_m^{\,1}}{y_m^{\,0}}\right)^{v_m}; \sum_1^m v_j = 1. \quad (4)$$

Here,

$$v_j = \frac{p_j y_j}{\sum_1^m p_k y_k} \quad (4a)$$

is the share of output *j* in the total value of the output bundle. Of course, the value shares of the individual outputs are, in general, different in the two periods. In practical applications, for v_j, one uses the geometric mean of $v_j^{\,0}$ and $v_j^{\,1}$, where

$$v_j^0 = \frac{p_j^0 y_j^0}{\sum_1^m p_k^0 y_k^0} \text{ and } v_j^1 = \frac{p_j^1 y_j^1}{\sum_1^m p_k^1 y_k^1}. \qquad (4b)$$

It may be noted that in the single output case, the Tornqvist output quantity index trivially reduces to the ratio of output quantities in the numerator of (2). This is also true when the quantity ratio remains unchanged across all outputs.

Similarly, let the input vectors in the two periods be $x^0=(x_1^0, x_2^0,...,x_n^0)$ and $x^1=(x_1^1, x_2^1,...,x_n^1)$. The corresponding input price vectors are $w^0=(w_1^0, w_2^0,...,w_n^0)$ and $w^1=(w_1^1, w_2^1,...,w_n^1)$. Then, the Tornqvist input quantity index is

$$TQ_x = \left(\frac{x_1^1}{x_1^0}\right)^{s_1}\left(\frac{x_2^1}{x_2^0}\right)^{s_2}....\left(\frac{x_n^1}{x_n^0}\right)^{s_n}; \sum_1^n s_j = 1. \qquad (5)$$

Here,

$$s_j = \frac{w_j x_j}{\sum_1^n w_k x_k} \qquad (5a)$$

is the share of input j in the total cost of the input bundle. Again, in practice, one uses the average of the cost share of any input in the two periods.

The Tornqvist productivity index is the ratio of the Tornqvist output and input quantity indexes. Thus,

$$\pi_{TQ} = \frac{TQ_y}{TQ_x}. \qquad (6)$$

When $TQ_y > TQ_x$, output in period 1 has grown faster (or declined slower) than input as a result of which productivity has increased in period 1 compared to what it was in period 0.

It may be noted that the Tornqvist productivity index can be measured without any knowledge of the underlying technology so long as data are available for the input and output quantities as well as the shares of the individual inputs and outputs in the total cost and total revenue, respectively**.**

2.2.2 Malmquist Produtivity Index and its Decomposition

The Malmquist productivity index introduced by Caves, Christensen, and Diewert (CCD) (1982) is a ratio of the levels of technical efficiency of two firms measured against a reference technology characterized by constant returns to scale. The production technology of a firm can be defined by the possibility set

$$T = \{(x, y): y \text{ can be produced from } x\}. \qquad (7)$$

In the single output case the production function

$$f(x) = \max y : (x, y) \in T \qquad (8)$$

shows the maximum output that can be produced from the input x. Thus, an alternative representation of the production possibility set would be

$$T = \{(x,y): y \leq f(x)\}. \qquad (9)$$

Shephard defined the output-oriented Distance function as

$$D(x, y) = \min \lambda: (x, \tfrac{1}{\lambda} y) \in T. \qquad (10)$$

Thus, evaluated at any input-output combination (x^0, y^0),

$$D(x^0, y^0) = \frac{y^0}{f(x^0)}. \qquad (11)$$

Clearly, any input-output combination is feasible only if

$D(x,y) \leq 1.$ (12)

Hence, the production possibility set can also be represented as

$T = \{(x,y): D(x,y) \leq 1\}.$ (13)

Farrell (1957) defined the technical efficiency of a firm producing output y from the input bundle x as

$TE(x,y) = \frac{1}{\phi}$ (14)

where $\phi^* = \max \phi : (x, \phi y) \in T$. Clearly, the output-oriented Shepard Distance function is the same as the Farrell measure of output-oriented technical efficiency.

If we assume constant returns to scale, for any $k \geq 0$,

$(x, y) \in T \Rightarrow (kx, ky) \in T.$ (15)

With reference to a CRS production possibility set T^C, we can define the CRS production function as $R(x) = \max y: (x,y) \in T^C$. In this case, the CRS distance function is

$$D^C(x, y) = \frac{y}{R(x)}.$$ (16)

Note that an implication of CRS is that $R(x)$ is homogeneous of degree one. In the single input case,

$R(x) = ax,$ where, $a = R(1).$ (17)

Returning to the 1-input, 1-output case of productivity comparison between the two firms 0 and 1with input-output combinations (x^0, y^0) and (x^1,y^1),respectively, the productivity index of firm 1 relative to firm 0 is

$$\pi_1 = \frac{\Pi_1}{\Pi_0} = \frac{y_1/x_1}{y_0/x_0} = \frac{y_1/ax^1}{y^0/ax^0} = \frac{y^1/R(x^1)}{y^0/R(x^0)} = \frac{D^C(x^1, y^1)}{D^C(x^0, y^0)}.$$ (18)

Thus the Malmquist productivity index is the ratio of the Distance function evaluated at two different input output bundles.

For the more general multi-output, multi-input case, the Malmquist productivity index for (x^1, y^1) with (x^0, y^0) as the base is

$$M(x^1, y^1; x^0, y^0) = \frac{D^C(x^1, y^1)}{D^C(x^0, y^0)}. \qquad (19)$$

Suppose that the two input-output bundles relate to the same firm but from two different time periods, period 0 and period 1. In that case the Malmquist index above shows how the total factor productivity of the firm has changed from period 0 to period 1. Typically, there will be technical change over time. In that case, there would be two different production technologies and, correspondingly, two different Distance functions for the two different time periods. Suppose that

$D_t^C(x, y)$ is the CRS Distance function evaluated at the input-output bundle (x, y) in period t $(t=1, 2)$. We would then have two alternative measures of the Malmquist productivity index

$$M(x^1, y^1; x^0, y^0) = \frac{D_0^C(x^1, y^1)}{D_0^C(x^0, y^0)} \qquad (20a)$$

and

$$M(x^1, y^1; x^0, y^0) = \frac{D_1^C(x^1, y^1)}{D_1^C(x^0, y^0)}. \qquad (20b)$$

Except in the trivial case of one output and one input, the two alternative measures will be different. The standard practice in the literature is to take a geometric mean of the two measures. Thus,

$$M(x^1, y^1; x^0, y^0) = \left[\frac{D_0^C(x^1, y^1)}{D_0^C(x^0, y^0)} \cdot \frac{D_1^C(x^1, y^1)}{D_1^C(x^0, y^0)}\right]^{\frac{1}{2}}. \qquad (21)$$

Färe, Grosskopf, Lindgren, and Roos (FGLR) (1992) decomposed this Malmquist productivity index as

$$M(x^1, y^1; x^0, y^0) = \left[\frac{D_1^C(x^1,y^1)}{D_0^C(x^0,y^0)}\right]\left[\frac{D_1^C(x^0,y^0)}{D_0^C(x^0,y^0)}.\frac{D_1^C(x^1,y^1)}{D_0^C(x^1,y^1)}\right]^{\frac{1}{2}}. \quad (22)$$

When the true production technology does exhibit constant returns to scale the CRS Distance function is, in deed, a measure of the technical efficiency of a firm. Thus, the first factor in the FGLR decomposition shows the change in technical efficiency between the two periods and can be characterized as a "catch up" factor. A value of this factor greater than 1 implies an improvement in efficiency and contributes to productivity growth. Each of the two ratios inside the square brackets in the second factor is a measure of the shift in the production frontier evaluated at the two different input bundles. Being the geometric mean of the two, the second factor is a measure of the autonomous shift in the production frontier and represents technical change. Again, a value of this factor in excess of 1 implies an outward shift in the frontier and implies technical progress.

Färe, Grosskopf, Norris, and Zhang (FGNZ)(1994) offered the following extended decomposition for the case of variable returns to scale (VRS):

$$M(x^1, y^1; x^0, y^0) = \left[\frac{D_1(x^1,y^1)}{D_0(x^0,y^0)}\right]\left[\frac{D_1^C(x^0,y^0)}{D_0^C(x^0,y^0)}.\frac{D_1^C(x^1,y^1)}{D_0^C(x^1,y^1)}\right]^{\frac{1}{2}}\left[\frac{\frac{D_1^C(x^1,y^1)}{D_1(x^1,y^1)}}{\frac{D_0^C(x^0,y^0)}{D_0(x^0,y^0)}}\right]. \quad (23)$$

In this extended decomposition, the first term measures technical efficiency change. The second and the last terms are interpreted as technical change and scale efficiency change, respectively.

As shown by Ray and Desli (RD) (1997), the Malmquist index is correctly measured by the ratios of CRS Distance functions *even when the technology does not exhibit CRS everywhere.* But in that case the FGNZ decomposition is inappropriate.[2] Specifically, the last two factors would not represent change in technical efficiency and shift in the frontier, respectively, unless CRS holds.

It may be noted, however, that as shown by Banker, Charnes, and Cooper (BCC) the CRS Distance function can be split up into two factors as

$$D^C(x,y) = D(x,y).\left(\frac{D^C(x,y)}{D(x,y)}\right). \qquad (24)$$

The first term on the right hand side is the VRS Distance function correctly measuring technical efficiency in the absence of CRS while the second term measures the scale efficiency of the observed input-output bundle.

RD pointed out that the FGNZ's second factor captures the shift in the hypothetical CRS frontier and does not correctly measure technical change when CRS does not hold. They proposed the alternative decomposition:

$$M(x^1, y^1; x^0, y^0) = \left[\frac{D_1(x^1,y^1)}{D_0(x^0,y^0)}\right]\left[\frac{D_1(x^0,y^0)}{D_0(x^0,y^0)}.\frac{D_1(x^1,y^1)}{D_0(x^1,y^1)}\right]^{\frac{1}{2}}\left[\frac{\frac{D_0^C(x^1,y^1)}{D_0(x^1,y^1)}\frac{D_1^C(x^1,y^1)}{D_1(x^1,y^1)}}{\frac{D_0^C(x^0,y^0)}{D_0(x^0,y^0)}\frac{D_1^C(x^0,y^0)}{D_1(x^0,y^0)}}\right]^{\frac{1}{2}}. \qquad (25)$$

In both the FGNZ and the RD decomposition the efficiency change factor is the same. RD's second factor correctly measures technical change as the geometric mean of the shift in the VRS frontier at the two observed input-output bundles. The last factor can be described as a scale change factor. It is more like a residual and is not easily interpreted. Another point to note is that because they involve evaluating the Distance functions for the input-output bundles from one period against the technology from the other period, in empirical applications they may not always be estimable.

2.2.3 The Nonparametric Methodology

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[2] See Lovell (2003) for a detailed discussion of this issue.

Suppose that we have the input-output data for N firms observed over two different time periods. Let $y_j^t = (y_{1j}^t, y_{2j}^t, ..., y_{mj}^t)$ be the output bundle and $x_j^t = (x_{1j}^t, x_{2j}^t, ..., x_{nj}^t)$ the input bundle for firm j *(j = 1,2,...,N)* in period t *(t =0, 1)*. As explained before, the free disposal convex hull of the input-output vectors observed in that period approximate production possibility set exhibiting variable returns to scale in period t *(T_t)*. Correspondingly, the *pseudo* production possibility set *(T_C^t)* showing globally constant returns is the free disposal conical hull of these points. In principle, one can evaluate the distance function at a specific input-output bundle *(x, y)* with reference to any arbitrary production possibility set. We may describe the distance function as the *same-period distance function,* if one uses the T_t (or T_C^t) to evaluate the distance function at an input-output combination observed in period *t*. On the other hand, if the distance function based on the technology from one period is evaluated at an input-output bundle from another period, it can be described as a *cross period distance function.* As noted before, the (Shephard) distance function is the same as the Farrell measure of technical efficiency and can, therefore, be obtained straightaway from the optimal solution of the appropriate BCC or CCR DEA problem. In particular, the *same period (VRS)* distance function is

$$D^t(x_k^t, y_k^t) = \frac{1}{\phi_k^*} \qquad (26)$$

where $\phi_k^* = \max \phi$

s.t. $\sum_{j=1}^{N} \lambda_j y_j^t \geq \phi y_k^t;$

$$\sum_{j=1}^{N} \lambda_j x_j^t \leq x_k^t; \qquad (27)$$

$$\sum_{j=1}^{N} \lambda_j = 1; \ \lambda_j \geq 0; (j = 1,2,..., N).$$

This, obviously, is the standard BCC model.

For the *cross period (VRS)* distance function $D^s(x_k^t, y_k^t)$, one needs to solve the BCC problem

max δ

s. t. $\sum_{j=1}^{N} \lambda_j y_j^s \geq \phi y_k^t;$

$$\sum_{j=1}^{N} \lambda_j x_j^s \leq x_k^t; \qquad (28)$$

$$\sum_{j=1}^{N} \lambda_j = 1; \;\; \lambda_j \geq 0; (j = 1,2,...,N).$$

This, it may be noted, is quite different from the usual BCC model. While the input-output quantities of firm *k* observed in period *t* appear on the right hand sides of the inequality constraints, they *do not* appear on the left hand sides of these constraints. An implication of this feature of the problem is that, unlike the BCC problem, it may not have a feasible solution. This will be true if the quantity of any individual input of firm *k* in period *t* is smaller than the smallest quantity of the corresponding input across all firms in period *s*.

For the *cross period (CRS)* distance function $D_C^s(x_k^t, y_k^t)$ one solves the problem above without the constraint that the λ_j s have to add up to unity. Note that in the case of CRS, the DEA problem will always have a feasible solution.

3. Literature review

Bhattacharyya et al (1997) studied the impact of the limited liberalization initiated before the deregulation of the nineties on the performance of the different categories of banks, using DEA. Their study covered 70 banks in the period 1986-91. They constructed one grand frontier for the entire period and measured technical efficiency of the banks under study.

The authors use advances, investments and deposits as outputs and interest expense and operating expense as inputs. They found public sector banks had the highest efficiency among the three categories, with foreign and private banks having much lower efficiencies. However, public sector banks stated showing a decline in efficiency after 1987, private banks showed no change and foreign banks showed a sharp rise in efficiency. The main results accord with the general perception that in the nationalized era, public sector banks were successful in achieving deposit and loan expansion. It should be noted, however, that the use of one grand frontier for the entire period implies that technical change is not separately accounted for.

Das (1997) analyses overall efficiency- technical, allocative and scale- at PSBs. In the period 1990-96, the study found a decline in overall efficiency. This occurred because there was a decline in technical efficiency, both pure and scale, which was not offset by an improvement in

allocative efficiency. The study, however, pointed out that the deterioration in technical efficiency was mainly on account of four nationalised banks.

In a study that covers a more recent period, Das (1999) compares performance among public sector banks for three years in the post-reform period, 1992, 1995 and 1998. He finds a certain convergence in performance. He also notes that while there is a welcome increase in emphasis on non-interest income, banks have tended to show risk-averse behaviour by opting for risk-free investments over risky loans.

Sarkar, Sarkar and Bhaumik (1998) compared performance across the three categories of banks, public, private and foreign, in India, using two measures of profitability, return on assets and operating profit ratio, and four efficiency measures, net interest margin, operating profit to staff expense, operating cost ratio and staff expense ratio (all ratios except operating profit to staff expense having average total assets in the denominator). The authors attempted these comparisons after controlling for a variety of non-ownership factors that might impact on performance: asset size, the proportion of investment in government securities, the proportion of directed credit, the proportion of rural and semi-urban branches, and the proportion of non-interest income to total income.

They found that, in the comparison between private banks and PSBs, there was only a weak ownership effect. Traded private banks were superior to PSBs with respect to profitability measures but not with respect to efficiency measures. Non-trade private banks did not significantly differ from PSBs in respect of either profitability or efficiency.

There was, however, a strong ownership effect between foreign banks and private banks, with the former outperforming the latter with respect to all indicators. The authors conclude that the results showed that private enterprises may not be unambiguously superior to public enterprises in a developing economy. They ascribe the particular ordering that they found- foreign, traded private, non-traded private and public- to the link between performance and the market for corporate control. The stronger the link, they suggest, the better the performance. We believe, however, that this study suffers from an important shortcoming. It is confined to just two years after financial sector reform, 1993-94 and 1994-95. In one of these, 1993-94, the performance of PSBs was adversely impacted by the introduction of new prudential and accounting norms. Any comparison using the performance parameters for these two years is unlikely to fully reflect

differences in managerial performance. We address this shortcoming in our own analysis by using a much longer period for comparison.

Ram Mohan (2002) found a trend towards convergence in performance among the three categories of banks- public, private and foreign- using financial measures of performance. Ram Mohan (2003) found that this result was reinforced by a comparison of returns to stocks in the three categories- the evidence was that returns to public sector bank stocks were not significantly different from returns to private sector bank stocks.

4. The Empirical Analysis

As mentioned earlier, we use two measures for our comparisons: Tornqvist total factor productivity growth (TFP) and Malmquist TFP growth

For the comparison based on quantities, it is necessary to be clear about what we should regard as outputs and inputs. As Mukherjee et al (2001) point out, there is no consensus on what best measures these in the case of banks. In the production approach, banks produce loans and deposit account services, using labor and capital as inputs. (Berger and Humphrey (1992) refer to this as the 'value-added approach'.) The number of accounts measures outputs and production costs include only operating costs (although, in the literature, there are instances of the dollar value of accounts being used as outputs in the production approach.)

In the intermediation approach, banks collect funds and, using labor and capital, transform these into loans and other assets. This approach treats the dollar value of accounts as outputs and production costs include both operating and interest costs.

As Wykoff (1992) points out, the issue of whether deposits are to be regarded as inputs or outputs remains unresolved. If bank deposits are regarded as inputs and there are no associated outputs, then it is not clear why depositors spend so much time and effort to travel to banks to give them these free inputs. If deposits are outputs, then it has to be explained why their nominal prices have been comparatively stable and even falling in real times over the years. This would imply that banks have undertaken to make these outputs cheap- it is not clear why.

Mukerjee et al (2001), adopting the intermediation approach, use as outputs the following: consumer loans, real estate loan, investments, total non-interest income. As inputs they use the following: transaction deposits, non-transaction deposits, equity, labor and capital (measured by non-labor, non-interest expense).

In the Indian context, we need to be clear about which approach is most appropriate. Using deposits and loans as outputs would have been appropriate in the nationalized era when maximizing these was indeed the objective of bank but they are, perhaps, less appropriate in the reforms era. Banks are not simply maximizing deposits and loans, they are in the business of maximizing profit. Maximizing loans and deposits may not necessarily be consistent with profit maximization because the quality of bank loans, not just quantity, is crucial to profit.

Keeping in mind the above considerations, we compute Tornqvist and Malmquist total factor productivity growth for the three categories of banks, public sector, domestic private sector and foreign, using as outputs the following: loan income, investment income and non-interest income. For inputs, we use: interest cost and operating cost (which includes labor and non-labor, non-interest costs). Thus, both outputs and inputs will comprise flow items. Both inputs and outputs are deflated by the price index. For comparison, we also compute Tornqvist TFP growth using (amounts of) loans and investments and other income as outputs and deposits (rather than interest expense) and operating costs as inputs.

The period covered is 1992-2000. For the Tornqvist TFP computation, we have data for 27 PSBs, 21 old private sector banks and 14 foreign banks (Where data for some banks was available for most of the period, data for the relevant years was included in the computation.) For the Malmquist TFP computation, we have a slightly smaller sample of banks: 27 PSBs, 20 private sector banks and 11 foreign banks.[3]

4. Results

[3] The reason that the sample is slightly different in the latter case is that, for the latter, we used a balanced panel for computing the Malmquist productivity indexes.

4.1 Tornqvist total factor productivity growth

Table 2 presents the results for Tornqvist TFP growth in the three categories of banks- public sector, domestic private sector and foreign banks-, using interest income, investment income and other income as outputs and interest cost and operating cost as inputs. Table 3 compares growth in the three categories, while table 4 provides the average frequency distribution of the TFP growth over the period for the different categories.

Table 2: Comparison of Tornqvist TFP growth, using income as outputs

Year	Growth rate-PSU(%)	Growth rate-Pvt(%)	Growth rate-Foreign(%)
1992-93	-8.16	-3.63	1.90
1993-94	5.69	6.76	11.27
1994-95	5.79	4.89	- 1.90
1995-96	-0.16	-1.71	-20.19
1996-97	2.22	-0.70	1.00
1997-98	1.58	0.99	-2.62
1998-99	-3.00	-8.78	-14.24
1999-00	2.99	7.18	4.06
Average	0.77	0.49	-3.07

Note: figures in the three columns represent the average for each category for a given year.

Table 3: Comparison of Tornqvist TFP growth in Indian banking

	Sample size	Mean growth rate	t-statistic (Public and pvt)	t-statistic (Public and foreign)
Public sector	27	0.77%	0.11	0.94
Private sector	21	0.49%	(0.46)	(0.18)
Foreign	14	-3.07%		

Note: 1. Means are for the period 1991-92 to 1999-00
2. Figures in brackets indicate levels of significance

Table 4: Average distribution of banks in Tornqvist TFP growth range

	PSB	% of total	Private	% of total	Foreign	% of total
<-20%	0	0.00%	0	0.00%	2	11.76%
-20-15%	0.75	2.78%	0.5	2.38%	0.75	4.41%
-15-0%	10.125	37.50%	9.875	47.02%	5.75	33.82%
0-10%	14.25	52.78%	7.5	35.71%	3.875	22.79%
10-20%	1.75	6.48%	2.75	13.10%	3.375	19.85%
>20%	0.125	0.46%	0.375	1.79%	1.25	7.35%

It can be seen from table 3 that there is no significant difference in Tornqvist TFP growth either between public and private sector banks or between public sector and foreign banks. We computed but do not report here the results for private sector banks after including new private sector banks for the limited period for which the latter have been in existence. The comparison remains unaffected although the growth rate for private sector banks rises slightly with the inclusion of new banks.

Table 5 presents the Tornqvist TFP growth for three categories of banks- public sector, domestic private sector and foreign banks- using loan, investment and other income as output and deposit and operating cost as output.

Table 5: Growth rates of Tornqvist TFP growth

(using alternative measures of output)

Year	Growth rate(PSU)	Growth rate(Pvt)	Growth rate(Foreign)
1992-93	-3.49%	-1.96%	14.35%
1993-94	-1.16%	2.13%	-8.96%
1994-95	1.31%	5.82%	-1.47%
1995-96	-4.61%	0.13%	10.19%
1996-97	-0.56%	-1.33%	-10.25%
1997-98	0.61%	-2.51%	-2.64%
1998-99	0.69%	0.79%	0.22%
1999-00	2.75%	2.98%	0.17%
Average	-0.58%	0.72%	-0.11%

Note: figures in the three columns represent the average for each category for a given year

Table 6: Comparison of Tornqvist TFP growth in Indian banks

	Mean	t-statistic (Public and pvt)	t-statistic (Public and foreign)
Public sector	-0.58%	-0.99	-0.34
Private sector	0.72%	(0.17)	(0.37)
Foreign	-0.11%		

Note:1. Means are for the period 1991-92 to 1999-00
2. Figures in brackets indicate levels of significance

Once again, as can be seen from table 6, there is no significant difference in Tornqvist TFP growth either between public and private sector banks or between public sector and foreign banks. This also applies when the results for private sector banks are computed after including new private sector banks. However, it will be noticed that the public sector shows the highest growth in TFP among the three categories in the first approach and the lowest growth in the second approach. This accords with the fact that, in the period since deregulation, PSBs' focus has been on asset quality rather than asset growth. Not surprisingly, TFP growth turns out to be low when we use loans and investments as output. However, PSBs have, as we have seen, managed to improve profitability, which means they have seen growth in revenues relative to costs. This shows up in a positive TFP growth when loan income and investment income are treated as output.

4.2 Malmquist TFP growth

Table 7 below gives the results of Malmquist TFP growth for the bank categories for each year. Table 8 compares growth among the categories, while Table 9 provides the frequency distribution. As can be seen from Table 10, PSBs are seen to do better than private banks at a 10 per cent level of significance and worse than foreign banks at an 8 per cent level of significance. [4]

Table 7 Year- wise averages for Malmquist TFP growth for bank categories

	Growth(PSB)	Growth(Pvt)	Growth(Foreign)
1992-93	-5.14%	-6.59%	1.97%
1993-94	-1.02%	3.26%	13.65%
1994-95	-1.05%	2.86%	4.59%
1995-96	3.92%	0.83%	14.06%
1996-97	5.20%	-0.25%	-13.03%
1997-98	-0.35%	-7.13%	-1.80%
1998-99	2.71%	-5.99%	15.97%
1999-00	2.10%	-1.11%	38.37%
Average	0.80%	-1.76%	9.22%

Table 8 Comparison of Malmquist TFP growth in Indian banks

[4] The foreign bank category's average productivity growth rate has been boosted by an unusually high increase in productivity at one bank in 2000. We would, therefore, interpret this finding with caution.

	Sample size	Mean growth rate	t-statistic (Public and pvt)	t-statistic (Public and foreign)
Public sector	27	0.80%	1.35 (0.1)	
Private sector	20	-1.76%		
Foreign	11	9.22%		-1.45 (0.08)

Note:1. Means are for the period 1991-92 to 1999-00
2. Figures in brackets indicate levels of significance

Table 9 Distribution of banks by Malmquist TFP growth ranges

	PSB	% of total	Private	% of total	Foreign	% of total
<-20%	0.5	1.85%	1.5	7.50%	2	18.18%
-20-15%	0.625	2.31%	1.375	6.88%	0.75	6.82%
-15-0%	12.75	47.22%	8.875	44.38%	2.625	23.86%
0-10%	9	33.33%	5	25.00%	1.75	15.91%
10-20%	2.75	10.19%	2	10.00%	1	9.09%
>20%	1.375	5.09%	1.25	6.25%	2.875	26.14%

As explained above, one can extract the contribution of change in technical efficiency over time from the Malmquist productivity index. In Table 10 below the contributions of technical efficiency change and the residual factor consisting of technical change and scale change in the Malmquist productivity index are separately reported. One problem of the technical efficiency change factor is that when a firm is already at a high level of efficiency, there is little room for further improvement and its rate of increase in technical efficiency will be low. To address this problem, we also report the average levels of technical efficiency for the different ownership categories.

Table 10. Group-wise Average Levels and Annual Rates of Change in Technical Efficiency

	Public Sector Banks	Private Sector Banks	Foreign Banks
Technical Efficiency Change	-0.075%	-3.416%	0.331%
Level of Technical Efficiency	0.8787	0.6473	0.9403
Contribution of Technical and Scale Change	1.5596%	1.8914%	8.9819%

Only foreign banks show an improvement in technical efficiency while both public and priva5te firms show a decline – marginal in the case of public sector banks and quite pronounced for private banks. Also the average level of technical efficiency is significantly higher for foreign banks compared to the PSBs. At the same time, PSBs operated at a higher level of efficiency than the private banks.

4.4 Summary of comparisons between bank categories

We are now in a position to summarize the results obtained in the comparison of the three categories of banks using both financial measures and input-output quantities. These are summarized in Table 11 below.[5]

Table 11 Summary of comparison of performance in bank categories

Measure/comparison	Result
1. Tornqvist TFP growth	
i. PSBs and old private sector banks	No difference
ii. PSBs and foreign banks	No difference
2. Malmquist TFP growth	
i. PSBs and old private sector banks	PSB better at 10 per cent level of significance
ii. PSBs and foreign banks	Foreign better at 8 per cent level

Out of a total of four comparisons we have made, there are no differences in two cases, PSBs do better in one, and foreign banks in one. To put it differently, PSBs are seen to be at a disadvantage in only one out of four comparisons. It is difficult, therefore, to sustain the proposition that productivity is lower in public sector banks relative to their peers in the private sector.

[5] Annual average rates of productivity change (Malmquist as well as Tornqvist) along with levels of technical efficiency for individual banks are reported in an appendix Table for the interested reader.

5. Concluding remarks

We have compared efficiency and productivity of PSBs relative to private sector banks, both domestic and foreign. This comparison is attempted over a nine year period (1992-00), out of which eight years belong to what might be called the post-deregulation period, if we use the generally accepted year of 1992-93 as the cut off date for the big push in bank deregulation. Our results are interesting given the general belief that deregulation would expose the inefficiencies inherent in government ownership and result in a huge gap between private banks and PSBs. This has not happened. We are unable to uncover any significant differences in productivity growth between the public and private sectors in the period under study. The findings of this study thus reinforce those of Ram Mohan (2002) and Ram Mohan (2003) that failed to uncover any significant differences between PSBs and other categories of banks using financial measures of performance or returns to stocks.

It is possible to speculate on why this is so, that is, why the expectation of superior private performance that one finds in both the theoretical and empirical literature on privatization has not been borne out in the Indian banking sector. One explanation could be that there has been a change in orientation in PSBs from social objectives towards an accent on profitability, especially given that some of these have come to be listed on the exchanges and have private investors. Another is that PSBs enjoy a huge advantage in terms of scale of operations over private sector banks and these advantages offset any inefficiency that could be ascribed to government ownership.

Those who advocate privatization of PSBs could contend that a transfer to private control could improve productivity at PSBs even further. But that is quite different from arguing that there is a performance differential between PSBs and their private sector counterparts today that justifies privatization.

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Appendix

Average Annual Measures of Indexes of Productivity and Efficiency Change

Bank	TEChange	Malmquist	TE	Tornquist
State Bank of India	1	1.00075	1	0.970703
State Bank of Bikaner & Jaipur	0.98875	0.970875	0.830667	1.009767
State Bank of Hyderabad	0.9785	0.989625	0.895	0.986047
State Bank of Indore	1.014375	0.993625	0.749889	0.988834
State Bank of Mysore	1.011375	0.97475	0.761444	0.997632
State Bank of Patiala	1.00075	0.999125	0.842333	0.97631
State Bank of Saurashtra	1.0235	0.966375	0.771333	0.976373
State Bank of Travancore	0.983875	0.98925	0.885	1.03408
Allahabad Bank	1.00025	1.055375	0.885889	1.002104
Andhra Bank	0.9595	0.9655	0.792556	1.006234
Bank of Baroda	0.992	1.0085	0.989556	1.011966
Bank of India	1.00075	1.03625	0.974778	0.976003
Bank of Maharashtra	0.982	1.03225	0.844444	0.98457
Canara Bank	0.985125	1.0045	0.985889	0.995877
Central Bank of India	0.990625	1.033625	0.894	0.98965
Corporation Bank	0.950875	0.944375	0.907889	1.043432
Dena Bank	0.9655	0.963875	0.831556	1.022248
Indian Bank	1.02475	1.074	0.937778	0.961052
Indian Overseas Bank	1.00925	1.05	0.908667	0.984308
Oriental Bank of Commerce	0.965125	0.95025	0.927444	1.033885
Punjab & Sind Bank	0.991625	1.01725	0.773667	0.995943
Punjab National Bank	1.007125	0.982125	0.993556	1.000218
Syndicate Bank	0.9885	1.029	0.856111	1.006196
UCO Bank	0.99675	1.077125	0.905444	0.994588
Union Bank of India	0.99425	1.0225	0.893556	1.006812
United Bank of India	0.986125	1.0485	0.916778	0.971677
Vijaya Bank	1.006375	1.03575	0.769111	0.963907
Public Sector	***0.992505***	***1.007968***	***0.878679***	***0.995941***
Bank of Madura Ltd.	0.975125	0.978125	0.709	1.008771
Bharat Overseas Bank Ltd.	1.0265	1.017875	0.571333	0.969282
City Union Bank Ltd.	0.91575	0.944875	0.633556	1.001098
Lord Krishna Bank Ltd.	0.905625	0.977	0.598667	1.060654
Tamilnad Mercantile Bank Ltd.	0.955375	0.9965	0.681	1.017618
The Bank of Rajasthan Ltd..	1.036375	0.971375	0.628889	1.020387
The Benares State Bank Ltd.	0.939	0.989125	0.467111	1.013591
The Catholic Syrian Bank Ltd.	1.000875	1.002	0.616	0.996939
The Dhanalakshmi Bank Ltd.	0.90625	0.931625	0.561778	1.053675
The Federal Bank Ltd.	0.97275	0.948625	0.860778	1.062209
The Jammu and Kashmir Bank Ltd	1.001375	1.024	0.891444	0.980062
The Karnataka Bank Ltd.	0.971875	0.97975	0.740556	1.005232
The Karur Vysya Bank Ltd.	0.963625	0.961125	0.647	0.997068
The Lakshmi Vilas Bank Ltd.	0.954875	0.959875	0.607556	1.005058
The Nainital Bank Ltd.	0.916875	1.067875	0.363	0.973176
The Nedungadi Bank Ltd.	0.989125	1.006375	0.508333	1.011317

The Sangli Bank Ltd.	0.986875	1.010625	0.508	0.97628
The South Indian Bank Ltd.	0.981625	0.99575	0.669556	1.02149
The United Western Bank ltd.	0.936	0.918	0.732667	1.000906
The Vysya Bank Ltd.	0.966875	0.967125	0.950222	0.998734
Private Banks	***0.965138***	***0.982381***	***0.647322***	***1.008677***
ABN-AMRO Bank N.V.	0.966125	1.055375	0.966444	1.089579
ANZ Grindlays Bank Ltd.	0.991375	1.110625	0.918889	0.9874
Abu Dhabi Commercial Bank Ltd.	1.109125	1.08575	0.928778	0.949985
American Express Bank Ltd.	1.007875	1.017	0.950333	1.144692
Bank of America NT & SA	1.03525	1.190375	0.950333	1.03168
Barclays Bank PLC	1	1.09925	1	1.180569
Citibank N.A.	1.002375	1.09	0.985778	0.97304
Credit Lyonnais	0.94125	1.042375	0.868111	1.111307
Deutsche Bank AG	1.001375	1.048375	0.966	1.010692
Oman International Bank S.A.O.G.	0.981625	1.121	0.808444	1.224363
The Bank of Nova Scotia	1	1.1545	1	0.90401
Foreign Bank	***1.003307***	***1.092239***	***0.940283***	***1.055211***

Notes: 1. TE Change, Malmquist, and Tornqvist are indexes. A value greater (less) than unity Implies an increase (decrease) compared to the previous year.

2. TE is the level of technical efficiency.