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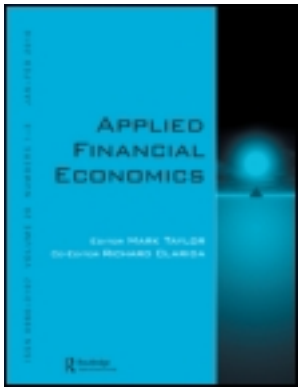

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Economic reforms and bank efficiency in developing countries: the case of the Indian banking industry

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Economic reforms and bank efficiency in developing countries: the case of the Indian banking industry

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Using the Indian banking industry as a case study, this paper proposes and tests hypotheses regarding the possibility of a relationship between three elements of the Economic Reforms (ERs) – namely, fiscal reforms, financial reforms, and private investment liberalisation – and bank efficiency in developing countries. Bank efficiency is measured using data envelopment analysis (DEA); the relationship between the measured efficiency and various bank-specific characteristics and environmental factors associated with the ERs is examined using the OLS and the GMM estimations. Our results show an improvement in the efficiency of banks, especially that of foreign banks, after the ERs. We find a positive relationship between the level of competition and bank efficiency. However, a negative relationship between the presence of foreign banks and bank efficiency is found, which we attribute to a short-run increase in costs due to the introduction of new banking technology by foreign banks. Furthermore, we find that fiscal deficits negatively influence bank efficiency.

I. Introduction

There now seems to be a general consensus that financial intermediaries play a vital role in the process of economic growth by intermediating scarce financial resources in the economy (see Levine, 1997). A key stylised fact of developing countries is that most of financial intermediation is carried out by commercial banks; other financial institutions and markets play a relatively insignificant role (see Fry, 1995). Therefore, it is vital for authorities in developing countries to create an environment that enhances the efficiency of commercial banks, which, in turn, could lead to a higher volume of intermediation and improved financial services and products.

A large number of recent empirical studies have found considerable inter-temporal and intra-temporal variations in the efficiency of banks in both developed and developing countries (see Berger and Humphrey, 1997). As Berger and Mester (1997) point out, an essential next step is to explore factors that could explain the measured variations. This is particularly important for developing countries, which initiated economic reforms (ERs)[1] in the late

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[1] The economic reforms primarily include: fiscal reforms, investment liberalisation, financial reforms, and trade and foreign exchange liberalisation (see Williamson, 2000).

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1980s to eliminate inefficiencies and distortions created by the years of excessive state-determined resource allocation. However, little research has gone into the examination of factors – especially those associated with the ERs – that could explain variations in the efficiency of banks in developing countries.

Following recent studies on developed countries, a few studies have attempted to examine the impact of one element of the ERs – namely, the financial reforms – by measuring the efficiency of banks before and after the initiation of the reforms. An improvement (or a lack of improvement) in the efficiency is then attributed to the success (failure) of the reforms to encourage/enable banks to utilise their resources more efficiently (see Leightner and Lovell, 1998; and Ataullah *et al.*, 2004). Some studies have extended this literature by employing the 'two-step procedure' in which the impact of the financial reforms is assessed by regressing the measured efficiency scores on a variable representing the reforms – such as a dummy variable distinguishing pre- and post-reforms periods – along with a few bank-specific variables (Hao *et al.*, 2001; and Isik and Hassan, 2003).

Using the commercial banking industry in India as a case study, the present paper contributes to the nascent literature on bank efficiency in developing countries in two important ways. First, instead of using an all-encompassing dummy variable for the financial reforms, we examine the relationship between bank efficiency and two components of the financial reforms, namely, an increase in the level of competition and an increase in the presence of foreign banks. Second, we argue that the existing studies have not considered the possibility of a relationship between the bank efficiency and other elements of the on-going ERs that have transformed the economic environment facing the banking industry. In this regard, we propose and test hypotheses regarding the impact of fiscal deficits and private investment liberalisation on the efficiency of banks. These two environmental factors are associated with the fiscal reforms and private investment liberalisation, which are arguably the key elements of the ERs.

Towards this end, we first employ the non-parametric data envelopment analysis (DEA) to measure the efficiency of banks operating in India during 1992–1998, a period characterised by far-reaching changes due to the implementation of the ERs in the early 1990s. In the second stage, we use the ordinary least squares and the generalised method of moments estimations to examine the relationship between the DEA efficiency and the four above-mentioned factors, as well as, various internal bank-specific characteristics (e.g. bank size and profitability). Although our empirical analysis is based on the banking industry in India, insights from this paper could be useful for other developing countries, which implemented very similar ERs during the 1990s.

In addressing these issues, the rest of the paper is structured as follows: Section II outlines the relationship between bank efficiency and the three key elements of the ERs mentioned above. Section III describes the methodology and data. Section IV presents the empirical findings. Section V concludes.

II. Factors Explaining Variations in the Efficiency of Banks in Developing Countries

The traditional textbook version of the theory of the firm reveals little curiosity regarding its efficiency because, by assumption, the firm *always* operates at the production frontier.[2] Since the early 1960s, however, economists have extended this view by recognising the firm as a nexus of contracts among 'opportunistic' individuals (see Cyert and March, 1963; Leibenstein, 1979; and Alchian and Demsetz, 1972). These frameworks shed light on how the efficiency of the firm could vary over time and space due to internal firm-specific factors and external environmental factors that influence capabilities of and incentives for managers/employees to coordinate and monitor inputs. On the empirical front, parametric and non-parametric frontier techniques have been employed to construct the best-practice production frontier for a sample of firms and then measure the efficiency of each firm in the sample relative to the determined frontier (see Coelli *et al.*, 1998).

In the context of banking firms, efficiency may refer to the ability of banks to intermediate between savers and borrowers with given resources: a higher

[2] In this paper, the efficiency refers to the ability of a firm to utilise its inputs. In the empirical literature, this is usually known as technical efficiency. Our analysis could be extended to include allocative efficiency as well. However, in the case of developing countries, as the data on input prices are usually not available or are distorted due to restriction on wages and interest rates, we restrict the analysis to the technical efficiency of banks only.

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efficiency may reflect that banks are able to intermediate more funds with given resources. Recent empirical studies on developed countries find various internal bank-specific factors and external environmental factors to have significant relationship with the efficiency of banks (see, for example, Berger and Mester, 1997; and Casu and Molyneux, 2003). Broadly speaking, the internal bank-specific variables include, *inter alia*, bank size, ownership/organisation structure, asset/liability structure, age, and cost/earning ratios. External factors that have been found to be significantly related to the efficiency of banks include the level of competition in the banking industry, growth in demand for financial services provided by banks, and government regulations. For example Casu and Molyneux (2003) find that most of the efficiency differences found across European banks seem to be due to country-specific aspects of the banking technology, which can reflect different banking regulations and managerial strategies implemented to face challenges brought about by greater competition within the European banking market. Girardone, Molyneux and Gardener (2004) find that the deregulation resulting from the EU's 1992 Single Market Programme may have had a positive impact in improving the overall cost efficiency of the Italian banking system. Although this research on developed countries may be instructive, it is imperative to investigate factors, especially those associated with the ERs, which could explain variations in the efficiency of banks in developing countries.

The ERs and the efficiency of banks in India

Like many other developing countries, India initiated the ERs in the midst of soaring fiscal deficits, declining foreign exchange reserves, and deteriorating real and financial sectors (see Ahluwalia, 1999). In 1991 fiscal deficits of the central and local government reached around 10% of GDP, the rate of inflation was nearly 14%, and GDP grew at the rate of less than 1%. To finance its deficits, the Government of India appropriated a large share of loanable funds of the commercial banking industry through Statutory Liquidity Ratio (around 38.5%) and Cash Reserve Ratio (around 15%). In addition, restrictions on private investors (domestic and foreign) limited the options available to banks to transform their funds into earning assets. Competition in the banking industry was limited as the government introduced controls on the operations of private banks. Furthermore, public sector banks were required to open branches in rural and sub-urban areas that provided limited opportunities to generate earning assets. The implementation of ERs in the early 1990s gradually transformed the economic environment facing banks in India: competition in the industry increased, the government of India planned to cut its reliance on banks' funds, foreign banks' participation increased, interest rates were gradually liberalised, and so forth. Ataullah *et al*. (2004) find that the overall technical efficiency of the Indian banking industry was higher in the period after the financial liberalization compared with the period before that. Similarly, Shanmugam and Das (2004) find that the reform period witnessed a relatively high efficiency. Can the financial liberalization be attributed to such improvement in efficiency in the Indian banking industry? Do other elements of the ERs also have any relationship with bank efficiency?

What do banks do? Before presenting the hypotheses regarding the relationship between the ERs and bank efficiency, it is essential to recognise the complexity surrounding a precise specification of banks' production process. In this paper, we follow the widely used 'intermediation approach' that views banks as firms that intermediate funds between savers and borrowers (see Isik and Hasan, 2003). This process of intermediation creates earning assets (e.g. loans and advances), which generate revenues for banking firms. In this context, we specify two different, *albeit* related, models that represent banks' production process. In Model A (the loan-based model), we postulate that banks in India incur operating and interest expenses to produce earning assets including loans and advances, and investments. Model B (the income-based model) postulates that banks in India incur operating and interest expenses to produce interest and non-interest income. The efficiency of banks in the context of these models refers to their ability to utilise operating expenses and interest expenses to generate earning assets (Model A) and income (Model B).

Fiscal deficits, fiscal reforms and bank efficiency. In this paper, we hypothesise that there is a negative relationship between government's fiscal deficits and the efficiency of commercial banks in developing countries like India. At least three reasons could be forwarded for this negative relationship. *First*, due to an underdeveloped debt market, governments in developing countries finance their fiscal deficits by making it mandatory for commercial banks to hold a large amount of low-return government

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securities (Fry, 1995),[3] which could negatively influence banks' ability to channel their investible funds to higher earning assets. *Second*, the presence of high fiscal deficits acts as a key constraint on government's ability to lower high cash reserve requirement imposed on banks.[4] This persistently high cash reserve requirement may act as a cost imposed on banks because it restricts their capacity to produce maximum earning assets with their mobilised funds.

Finally, high fiscal deficits leads governments in many developing countries to draw on domestic savings by launching government sponsored saving schemes, which may act as a substitute to bank deposits. In the presence of these saving schemes, banks may find it more expensive to acquire scarce investible funds in developing economies like India. This, in turn, could hamper banks' ability to produce the quantity of earning assets and, hence, income. Due to these three factors, we submit, the implementation of fiscal reforms that endeavours to lower fiscal deficits, *ceteris paribus*, could create an environment that would enable and encourage banks to enhance their ability to mobilise investible funds and to generate earning assets from these mobilised funds.

Private investment liberalisation and bank efficiency. A growth in demand for the products/services of an industry could create incentives for firms to invest in new products or production processes, which, in turn, enhance their efficiency. Furthermore, a growth in demand could enable firms to enhance the utilisation of their installed capacity. In the context of banking firms, some recent empirical studies have examined the relationship between efficiency and demand for services provided by banks in developed countries. For example, Berger and Mester (1997) examine this relationship for 6000 banks in United States during 1990–1995 and find a significant positive relationship between demand for banking services and the efficiency of banks.

In this study, we seek to examine the affect of private investment liberalisation on the efficiency of banks in India. Prior to the ERs, the government of India, like that of many other developing countries, imposed restrictions on private investment (domestic and foreign) in order to protect large state-owned enterprises from competition. Consequently, besides government securities and loans to a few large state-owned enterprises (usually inefficient and loss-making), banks in India had limited options to transform their loanable funds into earning assets due to the lack of demand for bank credit.

In this context, we hypothesise that the liberalisation of private investment that enlarges the real sector augments the demand for financial services (e.g. loans and advances) provided by banks. This increase in the demand could create economic opportunities for banks to transform their loanable assets into earning assets more efficiently. In addition, with an anticipation of growth in the demand for their loans and advances, brought about by the liberalised regime, banks may engage in investing in new technologies (e.g. investment in information technology) that, in turn, could enhance their efficiency.[5]

Financial reforms, competition, and bank efficiency. Financial reforms are quintessential, and perhaps the most controversial, element of the on-going ERs in developing countries (see Caprio *et al*., 2001). An important aim of the reforms is to enhance the level of competition in the banking industry in order to encourage banks to exert greater effort to utilise their resources. Recent empirical studies on banks in developed countries provide some support for such a positive relationship between competition and the efficiency of banks (see, Berger and Mester, 1997). However, in the context of developing countries, no empirical study has explicitly evaluated the relationship between the efficiency of banks and the level of competition in the banking industry. We fill this gap by examining whether an increased level of competition, brought about by the implementation of the financial reforms, is positively associated with the efficiency of banks in India during 1992–1998.

Financial reforms, foreign bank' participation, and bank efficiency. Like in other developing countries, reduced restrictions on foreign banks have led to an increase in the scale and scope of the operations of these banks (see Arun and Turner, 2002).

[3] For example, to finance its high fiscal deficits, the government of India required commercial banks to invest more than 30% of their loanable funds in approved government securities (see Arun and Turner, 2002). Although this declined slightly after the implementation of the ERs in 1991–1992, persistently high fiscal deficits have impeded the government's ability to lower this requirement impartially (see Ahluwalia, 1999).

[4] For example, in the case of India, the cash reserve requirement was around 15% before the implementation of the ERs. This ratio was still above 10% by the end of 1998. A key reason behind this high reserve requirement, it is argued, was the government's need to finance its persistently high fiscal deficits (see Ahulwalia, 1999).

[5] Another channel through which the liberalisation of private investment can have positive impacts is entry of foreign firms that bring new technical skills that can be spilled over to other sectors including the banking sector.

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However, little research has gone into examining the impacts of the presence of foreign banks in developing countries (see Clarke *et al*., 2003). In this study, we hypothesise that an increase in the presence of foreign banks has a positive relationship with the efficiency of banks. Besides making the banking industry more competitive, an increase in the presence of foreign banks can positively influence the efficiency of banks in two ways (see Lensink and Hermes, 2004).

First, foreign banks operating in developing countries, especially those from developed economies, may introduce modern and more efficient banking techniques that may be copied by domestic banks. Second, foreign banks may contribute to the quality of human capital in the domestic banking industry by (a) importing high-skilled bank managers to work in their foreign branches in developing countries, and (b) investing in the training of local employees. This, in turn, could enhance the ability of banks to transform their inputs into outputs.

However, following Lensink and Hermes (2004) we argue that the realisation of this positive relationship between the presence of foreign banks and the efficiency of banks may depend on the level of economic development of the host developing country: at a lower level of economic development, banking markets are generally less developed, which means implementing new techniques (introduced by foreign banks) raises costs in the short-run.

III. Methodology and Data

The two-step procedure

To examine the impact of various elements of ERs on the efficiency of banks, we employ a two step procedure. In the first step, we use the data envelopment analysis (DEA) to measure the efficiency of banks in India during 1992–1998. In the second step, the measured efficiency scores are regressed on external and internal factors using OLS and GMM estimations.

Step I – The estimation of efficiency using the DEA. The contemporary empirical literature on the efficiency of banks employs 'frontier-based approaches' to measure the relative efficiency of banks (see Berger and Mester, 1997). In a frontier-based approach, input-output data of banks in a sample is used to construct a 'production frontier' that represents the optimal utilisation of resources, or the benchmark technology, relative to which the efficiency of each bank in the sample is measured.

We employ non-parametric data envelopment analysis (DEA) in which the best-practice production frontier for a sample of firms is constructed through a piecewise linear combination of actual input–output correspondence set that envelops the input–output correspondence of all firms in the sample (see Thanassoulis, 2001). Following Bhattacharyya *et al*. (1997) we construct a single 'grand-frontier' that envelops the pooled input–output data of all banks in the sample for all the post-ESRs years, i.e. 1992–1998. This grand-frontier provides a best-practice benchmark against which the efficiency of each bank in each year is calculated. The key advantage of the grand-frontier approach is that it will provide a trend in the efficiency of banks, which would not be available if we calculated the efficiency of banks using a separate frontier for each year. This approach, therefore, provides variations in the efficiency of banks over both time and space. An additional benefit of using the grand-frontier rather than annual frontiers is 'an increase in the number of observations' that are crucial for the calculation of efficiency using the DEA (Bhattacharyya *et al*., 1997, p. 335).

To measure the efficiency of banks, let the input data for commercial banks be represented by $x_r^{ft} = (x_1^{ft}, \ldots, x_R^{ft}) \geq 0$; where $f = 1, 2, \ldots, F$ indexes banks, $t = 1, 2, \ldots, T$ indexes time periods, and $r = 1, 2, \ldots, R$ indexes inputs that banks use. Let the output data be represented by $y_p^{ft} = (y_1^{ft}, \ldots, y_P^{ft}) \geq 0$; where $p = 1, 2, \ldots, P$ indexes outputs that banks produce. The pooled production possibility set $\boldsymbol{S}$ for all the years for all the banks in the sample can be expressed as:

$$
\begin{aligned}
S = \Bigg\{ (y_p, x_r) : \\
& y_p \leq \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} y_p^{ft}, \qquad p = 1, 2, \ldots, P \\
& x_r \geq \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} x_r^{ft}, \qquad r = 1, 2, \ldots, R \\
& \lambda^{ft} \geq 0, \qquad f = 1, 2, \ldots, \quad F; t = 1, 2, \ldots, T \\
& \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} = 1 \Bigg\}
\end{aligned} \tag{1}
$$

where the λ^{ft} are intensity variables allowing the creation of convex combinations of observed (y^{ft}, x^{ft}). The production technology represented by S is assumed to display variable returns to scale.

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We postulate that banks seek to maximise their outputs, given the inputs at their disposal. An output-oriented efficiency of each bank f in year t, EFF_{ft}, is calculated as the reciprocal of the solution to the DEA problem:

$$
\begin{aligned}
&Max\,\theta = [EFF_{ft}]^{-1}\\
&\quad subject\ to\\
&\quad \theta y_p^{ft} \le \sum_{f=1}^{F}\sum_{t=1}^{T}\lambda^{ft} y_p^{ft}, \qquad p = 1, 2, \ldots, P;\\
&\quad \sum_{f=1}^{F}\sum_{t=1}^{T}\lambda^{ft} x_r^{ft} \le x_r^{ft}, \qquad r = 1, 2, \ldots, R;\\
&\quad \lambda^{ft} \ge 0, \quad f = 1, 2, \ldots, F;\ t = 1, 2, \ldots, T;\\
&\quad \sum_{f=1}^{F}\sum_{t=1}^{T}\lambda^{ft} = 1 \qquad (2)
\end{aligned}
$$

The above problem is solved once for each bank in each year. The optimal value of θ is the factor by which y^{ft} must be scaled up in order for bank with data (x^{ft}, y^{ft}) to reach the convex production frontier. Since $\theta \ge 1$, $0 \le EFF_{ft} \le 1$. A bank with an efficiency score of 0.9, for instance, is considered as producing only 90% of the output that it should be producing if it were producing according to the best-practice in the industry.

Step II – Regression analysis using the OLS and the GMM estimation. Once the efficiency of banks is measured for the post-ERs period, our next step is to explore factors, including those associated with the ERs, which may explain the variations in the measured efficiency using the following model:

$$EFF_{ft} = f(B_{Qft},\ M_{Kt}) \qquad (3)$$

Where EFF_{ft} is the output-oriented technical efficiency of f-th banks in t-th time period; B_{Qft} is the set of Q bank-specific variables; M_{Kt} is the set of K macroeconomic variables. Since EFF_{ft} is a variable ranging from 0 to 1, we use the logistical functional form for the above model (see Hao *et al*., 2001):

$$EFF_{ft} = \frac{e^{\gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft}}}{1 + e^{\gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft}}} \qquad (4)$$

where γ and φ are the vectors of parameters to be estimated; μ_f are the individual bank-effects; and ε_{ft} are white-noise error term. We can rewrite (4) as follows:

$$\ln\frac{EFF_{ft}}{1 - EFF_{ft}} = \Phi_{ft} = \gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft} \qquad (5)$$

where the term $\Phi_{ft} = (\ln(EFF_{ft}/1 - EFF_{ft}))$ is called the log-odds and could be used as a proxy for the output-oriented technical efficiency of banks in India during 1992–1998.

Our primary aim is to examine the impacts of fiscal deficits, investment liberalisation, competition, and foreign banks' presence on the efficiency of banks. Towards this end, the external environmental factors (M_{Kt}) in our model include: fiscal deficits as a percentage of GDP (DEF), private investment as a percentage of GDP (PI); the Herfindahl index of concentration (HERF) based on total assets of banks representing the level of competition in the banking industry; and the share of foreign banks in total credit (FOR) representing the presence of foreign banks.

Besides the external environmental factors, the efficiency of banks may also vary due to internal bank-specific factors (see Berger and Mester, 1997; Casu and Molyneux, 2003). Therefore, we include four internal bank-specific factors: logarithm of total assets (TA) of each bank representing bank size; operating expenses as a ratio of total income (OE/TI); investments as a share of total assets (INVEST/TA); and return on assets (ROA). These internal bank-specific factors could enable us to determine the characteristics that distinguish efficient banks from the inefficient ones.

In addition, we include the efficiency of previous year (EFF1) as an independent variable. By including EFF1, we attempt to capture the dynamic nature of the efficiency of banks. We submit that the efficiency of previous year indicates a certain level of accumulated knowledge and technological endowment that may help banks to generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the ERs.

We estimate the parameters of equation (5) using the OLS and the GMM estimations. The use of the GMM is appropriate due to the possibility of endogeneity in the above model due to the inclusion of internal bank-specific factors (see Berger and Mester, 1997). The endogeneity of explanatory variables can make the coefficient estimates obtained through the traditional OLS estimation biased and inconsistent (Greene, 2000). To take into account the possibility of endogeneity, following Arellano and Bond (1991) and Blundell and Bond (1998), we apply the GMM framework to obtain first-differenced and system-GMM estimators. Using the previous observations of variables, i.e. the time-series dimension of panel data, as instruments, the GMM framework takes into account the fact that explanatory variables may be endogenous or at least weakly exogenous, and provides consistent coefficient estimates.

Table 1. Technical efficiency of banks in India during 1992–1998

	ABs		PSBs		DPBs		FBs	
	Mean	StDev.	Mean	StDev.	Mean	StDev.	Mean	StDev.
Panel I. VRS efficiency according to the loan-based model								
1992	60.10	22.65	79.07	11.65	46.82	20.30	54.42	20.05
1993	59.47	21.03	76.17	11.37	44.45	17.48	57.79	20.05
1994	69.98	21.40	83.29	10.18	51.63	23.00	75.02	19.84
1995	75.02	21.44	90.52	7.18	63.76	24.08	70.77	20.81
1996	68.71	21.36	84.51	8.24	58.51	21.51	63.10	23.67
1997	72.19	21.74	86.39	8.38	63.46	18.07	66.73	25.49
1998	75.83	25.27	89.29	7.21	67.89	19.50	70.30	25.19
1992–1994	***63.18***	***21.69***	***79.51***	***11.07***	***47.63***	***20.26***	***62.41***	***19.98***
1995–1998	***72.18***	***22.45***	***87.93***	***7.75***	***63.40***	***20.79***	***67.72***	***23.79***
1992–1998	***68.33***	***22.13***	***84.32***	***9.17***	***56.64***	***20.56***	***65.45***	***22.16***
Panel II. VRS efficiency according to the income-based model								
1992	75.80	15.80	81.83	10.81	62.54	15.76	83.05	11.26
1993	71.19	14.63	74.51	12.13	57.90	9.72	81.15	11.52
1994	73.66	13.52	77.03	8.99	60.77	10.54	83.19	10.25
1995	76.68	14.65	83.44	13.39	65.22	14.02	81.37	12.49
1996	79.40	15.06	85.67	8.62	69.20	12.81	83.33	17.23
1997	79.83	13.80	86.87	7.45	69.60	11.80	83.01	14.39
1998	80.68	6.93	85.62	6.93	71.37	12.05	85.04	12.68
1992–1994	***73.55***	***14.65***	***77.79***	***10.64***	***60.40***	***12.01***	***82.46***	***11.01***
1995–1998	***79.15***	***12.61***	***85.40***	***9.10***	***68.85***	***12.67***	***83.19***	***14.20***
1992–1998	***76.75***	***13.48***	***82.14***	***9.76***	***65.23***	***12.39***	***82.88***	***12.83***

Notes: Abs = All Banks; PSBs = Public Sector Banks; DPBs = Domestic Private Banks; FBs = Foreign Banks.
StDev. = standard deviation.

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Data

To measure the efficiency of banks, we require data on inputs and outputs of banks. Our analysis is based on the two input–output models specified in Section II. The input variables for the two models are interest expenses and operating expenses. Output variables for Model A are: loans and advances, and investments. Outputs for Model B are: interest income and operating income. Data for individual banks for the period 1992–1998 are obtained from the website of the Reserve Bank of India.[6] Our sample includes all the commercial banks in India for which data for at least three years during 1992–98 were available. The commercial banks included in our sample control over 95% of total assets, deposits, and loans of the commercial banking industry. Banks having zero recorded values for one or more outputs or inputs variables in any year are excluded from the sample for that year in recognition of the fact that the DEA is sensitive to outliers. The data on the Herfindhal index and the share of foreign banks in total credit are calculated using banks' annual accounts. The data on fiscal deficits are obtained from the Key Indicators of the Asian Development Bank (2003). Data on private investment are obtained from the Economic Surveys published by the Indian Ministry of Finance.[7] Bank-specific variables (e.g. size) are calculated from the annual accounts of banks.

IV. Empirical Findings

The technical efficiency of Indian banks during 1992–1998

Table 1 presents the average variable returns to scale technical efficiency scores for banks in India during 1992–1998. According to the results of Model A, the average efficiency of the whole banking industry improved from 60.10% in 1992 to 75.83% in 1998. Similarly, according to the results of Model B, the average efficiency of the whole banking industry improved from 75.80% in 1992 to 80.68% in 1998.

[6] www.rbi.org.in
[7] www.finmin.nic.in

Table 2. Number of frontier banks by ownership (1992–1998)

	1992	1993	1994	1995	1996	1997	1998	*Total*
Panel I. Model A								
PSBs	1	1	2	4	5	5	3	21
DPBs	1				1	4	4	10
FBs	1	1	2	4	3	3	2	16
Total	3	2	4	8	9	12	9	47
Panel II. Model B								
PSBs	1	1	1	1	1	1	1	7
DPBs				1	2	3	1	7
FBs	3	2	3	3	5	6	7	29
Total	4	3	4	5	8	10	9	43

Notes: Abs = All Banks; PSBs = Public Sector Banks; DPBs = Domestic Private Banks; FBs = Foreign Banks.

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Our results suggest that according to the loan-based model, public sector banks were on average more efficient than private banks (see also Bhattacharyya *et al*., 1997; and Ataullah *et al*., 2004). However, the results also suggest that the gap between the efficiency of public sector banks and private sector banks declined during the post-ERs era. For example, in 1992, the loan-based efficiency gap between public sector banks and foreign banks was around 24%. This gap declined to around 18% in 1998 (in the case of private domestic banks, the gap declined from around 32% to 21%). It could be argued that during the pre-ERs era, the government of India imposed restrictions on the operations and entry of private sector banks, which might have impeded their ability to generate loans and advances, and investments (particularly investments in government securities). The changes in the economic environment brought about by the ERs enabled private sector banks to catch-up with the dominant public sector banks.

In contrast to results from Model A, Model B results show little difference between the efficiency of foreign and public sector banks. Indeed, foreign banks outperformed public sector banks in most of the years. It could be argued that that although public sector banks were relatively more efficient in generating loans and advances, they were less successful in generating income from their operations. This could be due higher non-performing loans of the public sector banks,[8] which impeded their ability to translate efficiency in generating earning assets into efficiency in generating income. This is could be due to the fact that prior to the implementation of the ERs, the key objective of public sector banks was not to produce revenues but to channel funds to the so-called priority sectors in the economy.

Table 2 presents the number of banks forming the grand-frontier for Model A (Panel I) and Model B (Panel II). In the case of Model A, out of 566 bank observations, a total of 47 are found to be radially efficient. Out of 47 efficient observations, 30 come from the final three years of the sample period. This suggests that the ERs gradually created an environment that enabled banks to improve their efficiency relative to the early years. A similar trend is apparent from the results obtained from Model B (Panel II). Out of 566 bank observations, 43 form the best practice grand-frontier for the period 1992–1998. Out of these 43 efficient observations, 27 come from the final three years of the sample period. It is also interesting to note that according to the results of Model B, foreign banks determine the best practices in the banking industry, especially during the last three years.

The correlates of banks efficiency in India during 1992–1998

Table 3 reports the estimation results using the methods of pooled OLS, first-differenced GMM and system-GMM. Compared to the first-differenced and system-GMM estimates, there is a serious upward bias in the OLS estimates of the efficiency of the previous period, i.e. EFF1. This suggests the presence of bank-specific effects and endogeneity, which are not taken into account by the OLS method.[9] The results of the specification tests, i.e. Sargan test and m_1 and m_2 statistics, for the first-differenced and system-GMM estimators confirm the possibility of endogeneity of bank-specific variables and weak exogeneity of macroeconomic variables. Furthermore, these statistics also validate the use of instruments and thus the consistency of the GMM estimators. Results from the Sargan difference test justify the additional instruments, and, thus, the advantage of the system-GMM estimator over the first-differenced GMM estimator. Comparing the first-differenced- and the system-GMM estimates, we find a substantial improvement in the precision of the latter in terms of standard errors (see Blundell and Bond, 1998). The inference in this section, therefore, is based upon the system-GMM estimates.

Table 3 shows that some bank-specific factors describe the characteristics of relatively more efficient

[8] For example, in 1997–1998, gross non-performing loans as a percentage of total advances of public sector banks, domestic private banks and foreign banks were around 16%, 6.7%, and 6.4%, respectively (RBI, 1999).
[9] See Arellano and Bond (1991).

Table 3. Regression analysis for India using OLS and GMM estimation

	Model A			Model B		
	OLS	GMM (Level)	GMM (System)	OLS	GMM (Level)	GMM (System)
EFF1	0.540	0.326	0.396	0.610	0.091	0.376
	(0.063)***	(0.113)***	(0.105)***	(0.057)***	(0.119)	(0.085)***
TA	0.045	0.122	0.053	0.022	−0.044	0.029
	(0.008)***	(0.055)**	(0.017)***	(0.005)***	(0.081)	(0.010)***
OE/TI	−0.035	−0.003	−0.189	−0.173	0.132	−0.302
	(0.025)	(0.116)	(0.103)*	(0.116)	(0.266)	(0.104)***
INVEST/TA	0.284	0.735	0.520	0.004	−0.112	−0.220
	(0.097)***	(0.211)***	(0.182)***	(0.084)	(0.171)	(0.180)
ROA	−0.927	−2.657	−1.306	0.861	0.809	0.498
	(0.293)***	(0.958)***	(0.637)**	(0.304)***	(0.733)	(0.437)
DEF	0.017	0.00008	−0.094	−0.129	0.048	−0.182
	(0.019)	(0.062)	(0.054)*	(0.070)*	(0.147)	(0.057)***
PI	0.021	0.014	−0.011	−0.018	0.024	−0.031
	(0.006)***	(0.023)	(0.012)	(0.017)	(0.039)	(0.013)**
HERF	0.0007	0.0008	−0.0004	−0.0007	0.001	−0.001
	(0.0002)**	(0.001)	(0.0004)	(0.0006)	(0.001)	(0.0004)**
FOR	2.038	−0.391	−9.686	−11.628	5.139	−17.372
	(2.080)	(5.915)	(5.764)*	(7.502)	(14.39)	(5.999)***
Sargan test		χ^2 (76) = 51.19	χ^2 (125) = 63.47		χ^2 (76) = 50.10	χ^2 (125) = 69.62
m_1		−2.542**	−2.913***		−2.137*	−2.734***
m_2		−1.386	−1.347		−0.386	0.537
Sargan difference			χ^2 (49) = 12.28			χ^2 (49) =19.52

Notes: Asymptotic standard errors, asymptotically robust to heteroskedasticty, are reported in parentheses. Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses. m_1 and m_2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Sargan Difference is a test for the validity of the additional moment restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses.
*, **, *** suggests the coefficients are significant at 10%, 5%, and 1%, respectively.

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banks during the sample period. The efficiency of the previous year (EFF1) is significantly and positively related to the efficiency of the current year in both the models. As mentioned above, it could be argued that the efficiency of the previous year may represent a certain level of accumulated knowledge and technological endowment that may help banks to generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the ERs.

Regarding the relationship between bank size and bank efficiency, no consistent picture emerges from previous empirical studies on developing countries (see Yildirim, 2002). A positive relationship between size and efficiency is attributed to larger banks' market power and their ability to diversify credit risk in an uncertain macroeconomic environment; a negative relationship, on the other hand, is attributed to the complexity of the operations of larger banks. We find a positive relationship between the size and the efficiency of banks in both the input–output models (the relationship, however, is weaker in the income-based model). Our results, therefore, seem to support the former argument, especially for the loan-based model.

We also find that higher investments as a ratio of total assets is associated with higher efficiency in Model A and lower efficiency in Model B (although in model B this variable is insignificant). This is consistent with the prevailing condition in the Indian banking industry where there was an increase in the share of investment in riskless government securities in banks' asset portfolios during the post-ERs period. This enabled banks to generate more earning assets. However, the negative impact on the income-based efficiency might be due to the fact that an increase in investments substitutes banks' resources away from higher-earning, albeit riskier, loans and advances. Furthermore, a negative relationship between the ratio of operating expenses to income is found. Regarding the return on asset, in the case of Model A, high ROA is negatively related to bank efficiency reiterating the earlier suggestion that higher efficiency in generating earning assets may not

translate into higher profitability due to non-performing loans. On the other hand, a positive relationship is found between ROA and bank efficiency in Model B.

As mentioned earlier, the primary aim of this paper is to examine the relationship between the efficiency of banks and four external environmental factors associated with the ERs in India. As we hypothesised, we find a negative relationship between fiscal deficits as a percentage of GDP and the efficiency of banks according to both the input–output models. Therefore, as we outlined earlier, it could be argued that the government needs to strengthen its fiscal reforms that curtail the level of fiscal deficits so that it can lower its reliance on the loanable funds mobilised by the banking industry. This, in turn, would enable banks to enhance their resource utilisation to generate earning assets and income. In addition, the on-going debt market reforms could help banks to earn higher return on their holding of government securities.

Private investment as percentage of GDP does not have the hypothesised impact. It has negative, but insignificant, coefficient in Model A, and negative and significant in the case of Model B. This unexpected result, we submit, could be due to high non-performing loans of the banking industry that could have made banks reluctant to extend credit to the private sector. This should be seen in conjunction with the fact that during the sample period, banks invested more in government securities perhaps in order to shield against the risk brought about by the changes in the economic environment due to the ERs.

We find that the coefficient of the Herfindahl index (HERF) of market concentration is negative in both Models A and B, supporting the hypothesis of a positive relationship between banks' efficiency and the level of competition. The presence of foreign banks in the market is found to have a negative and significant relationship with both loan-based and income-based efficiency. The negative relationship is stronger in the income-based model. Following Lensink and Hermes' (2004) proposition, it could be argued that the Indian banking industry is still less developed where the entry of foreign banks leads to an increase in costs in the short-run. In the long-run, foreign banks' higher willingness to introduce new technology[10] could enhance the efficiency of banks in India.

V. Conclusion

This paper attempts to examine the impact of various elements of economic reforms on the efficiency of banks in India during 1992–1998. We find that the efficiency of the banking industry improved during the post-ERs era. This improvement was due to the improvement in the efficiency of all three ownership groups, namely: public sector banks; domestic private banks; and foreign banks. However, a negative relationship between fiscal deficits and the efficiency of banks suggest that the Government of India, by curtailing its fiscal deficits, could further enable and encourage banks to exert greater effort to improve their resource utilisation. This, in turn, would augment the process or financial intermediation in India.

We also find that a positive relationship between the level of competition and the efficiency of banks. Furthermore, the presence of foreign banks has a negative relationship with the efficiency of banks. Following Lensink and Hermes (2004), it could be argued that the banking industry in India is still underdeveloped, and, therefore, an increased participation of foreign banks has increased costs in the short-run.

References

Ahluwalia, M. S. (1999) Reforming India's financial sector: an overview, in *India A Financial Sector for the Twenty-First Century* (Eds) J. A. Hanson and S. Kathuria, Oxford University Press, New Dehli.

Alchian, A. A. and Demsetz, H. (1972) Production, information cost, and economic organisation, *The American Economic Review*, **62**, 777–95.

Arellano, M. and Bond, S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equation, *Review of Economic Studies*, **58**, 277–97.

Arun, T. G. and Turner, J. D. (2002) Financial sector reforms in developing countries: the Indian experience, *World Economy*, **25**, 429–45.

Ataullah, A., Cockerill, T. and Le, H. (2004) Financial liberalization and bank efficiency: a comparative analysis of India and Pakistan, *Applied Economics*, **36**, 1915–24.

Berger, A. N. and Humphrey, D. B. (1997) Efficiency of financial institutions: international survey and directions for future research, *European Journal of Operational Research*, **98**, 75–212.

Berger, A. N. and Mester, L. J. (1997) Inside the black box: what explains differences in the efficiencies of financial institutions, *Journal of Banking and Finance*, **21**, 895–947.

[10] A recent study by the Reserve Bank of India, substantiates our conclusion by pointing out that the average IT expenditures as a percentage of total expenses during 1996-2000 in public sector banks, domestic private banks, and foreign banks were 4.5%, 7%, and 8.6%, respectively.

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Bhattacharya, A., Lovell, C. A. K. and Sahay, P. (1997) The impact of liberalisation on the productive efficiency of Indian commercial banks, *European Journal of Operational Research*, **98**, 332–45.

Blundell, R. and Bond, S. (1998) Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, **87**, 115–43.

Casu, B and Molyneux, P. (2003) A comparative study of efficiency in European banking, *Applied Economics*, **35**, 1865–76.

Clarke, G., Cull, R., Martinez Peria, M. S. and Sanchez, S. M. (2003) Foreign bank entry: experience, implications for developing economies, and agenda for further research, *The World Bank Research Observer*, **8**, 25–59.

Cyert, R. M. and March, J. G. (1963) *A Behavioural Theory of the Firm*, Prentice-Hall, Englewood Cliffs, NJ.

Fry, M. J. (1995) *Money, Interest, and Banking in Economic Development*, 2nd edn, John Hopkins University Press, Baltimore.

Girardone, C., Molyneux, P. and Gardener, E. P. M. (2004) Analysing the determinants of bank efficiency: the case of Italian banks, *Applied Economics*, **36**, 215–27.

Greene, W. H. (2000) *Econometric Analysis*, 4th edn, Prentice-Hall, Upper Saddle River, NJ.

Hao, J., Hunter, W. C. and Yang, W. K. (2001) Deregulation and efficiency: the case of private Korean banks, *Journal of Economics and Business*, **53**, 237–54.

Isik, I. and Hassan, M. K. (2003) Financial deregulation and total factor productivity change: an empirical study of Turkish commercial banks, *Journal of Banking and Finance*, **27**, 1455–85.

Leibenstein, H. (1979) A branch of economics is missing: micro-micro theory, *Journal of Economic Literature*, **17**, 477–502.

Leightner, J. E. and Lovell, C. A. K. (1998) The impact of financial liberalisation on the performance of Thai banks, *Journal of Economics and Business*, **50**, 115–31.

Lensink, R. and Hermes, N. (2004) The short-term effects of foreign bank entry on domestic bank behaviour: does economic development matter?, *Journal of Banking and Finance*, **28**, 553–68.

Levine, R. (1997) Financial development and economic growth: views and agenda, *Journal of Economic Literature*, **35**, 688–726.

RBI–Reserve Bank of India (1999) Trend and progress of banking in India, www.rbi.org.in.

Shanmugam, K. R. and Das, A. (2004) Efficiency of India commercial banks during the reform period, *Applied Financial Economics*, **14**, 681–6.

Thanassoulis, E. (2001) *Introduction to the Theory and Application of Data Envelopment Analysis*, Kluwer Academic Publisher, London.

Williamson, J. (2000) *What Should the Bank Think About the Washington Consensus?*, http://www.worldbank.org/research/journals/wbro/obsaug00/pdf/(6)Williamson.pdf.

Yildirim, C. (2002) Evolution of banking efficiency within an unstable macroeconomic environment: the case of Turkish commercial banks, *Applied Economics*, **34**, 2289–301.

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