Innovative Applications of O.R.

Efficiency dynamics in Indian banking: A conditional directional distance approach

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ABSTRACT

The paper contributes to the contemporary research on bank efficiency in India. We analyze the efficiency dynamics of the Indian banking industry from 2004 to 2012. Based on the recent methodological developments of the conditional and unconditional directional distances introduced by Daraio and Simar (2014), we apply a conditional directional distance estimator in order to analyze the dynamic effects of industry's performance levels. The results indicate that foreign banks perform better compared to national and domestic private banks. There is also evidence of technological change at the period before the Global Financial Crisis. However during and after the Global Financial Crisis these gains diminished. The evidence suggests that national banks fail to sustain their high performance levels gained after the industry's restructuring period. Finally, the findings support the view that ownership structure affects banks' technical efficiency levels.

1. Introduction

We find that despite the fact that the Indian financial system has undergone substantial changes including the negative effect of the Global Financial Crisis in last two decades there is a gap in the efficiency and productivity literature on Indian banking. In particular, there is a limited number of studies that analyze the changes within the Indian banking sector after the consolidation and liberalization process i.e. after the second half of 2000s. Most of the relative literature includes the period of 1990s and early 2000s (Bhattacharyya & Pal, 2013; Bhaumik & Dimova, 2004; Casu, Ferrari, & Zhao, 2013; Das & Ghosh, 2006; Das, Nag, & Ray, 2005; Kumbhakar & Sarkar, 2003; Ray & Das, 2010; Sahoo & Tone, 2009; Sanyal & Shankar, 2011; Shanmugam & Das, 2004; Tabak & Tecles, 2010; Zhao, Casu, & Ferrari, 2010). Eichengreen and Gupta (2013) and Fujii, Managi, and Matousek (2014) focus on the recent developments in the Indian banking sector.

By incorporating the latest developments the paper applies a time-dependent conditional directional distance function estimator and examines the efficiency dynamics of Indian banking sector for the period of 2004–2012. Based on the introduction of the time-dependent conditional full and partial frontiers (Mastromarco & Simar, 2014), the probabilistic characterization of the directional distance functions-DDF (Simar & Vanhems, 2012) and the new

developments of the operational aspects for computing conditional and unconditional directional distances (Daraio & Simar, 2014),[1] we propose an innovative application of the original range directional distance model-RDM (Portela & Thanassoulis, 2010; Portela, Thanassoulis, & Simpson, 2004). The applied methodology enriches current research since it enables time effects on the efficiency measurement over the examined time period. Specifically a data envelopment analysis (DEA) estimator of directional distance functions is applied which is conditioned on time under the assumption of variable returns to scale (VRS) using a range directional distance.[2] By conditioning on time we will be able to analyze the efficiency behavior of Indian banks over the examined period, thus taking into account the dependence of data generating process (DGP) on time effects over the period of financial crisis.[3]

We contribute to the banking literature in two distinct ways. First due to its empirical application our paper complements and extends the recent study by Fujii et al. (2014). By introducing the dynamic element into our model we will be better positioned to explore the changes in the Indian banking system. The second

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[1] Daraio and Simar (2014) have extended the work by Bădin, Daraio, and Simar (2012) by introducing the operational aspects for computing conditional and unconditional directional distances and their robust versions.

[2] As has been noted by Portela et al. (2004, p.1113–1114), strictly under the assumption of VRS the RDM model is translation invariant and unit invariant.

[3] This implies that the applied estimator does not assume that the separability condition holds between time and the boundaries of the attainable set (Simar & Wilson, 2007, 2011).

contribution of the paper lies in the applied methodological framework that has not been used in the banking literature yet. The applied DEA estimator is based on the latest advances of the conditional directional distance functions (Daraio & Simar, 2014) and on the recent introduction of time-dependent conditional DEA estimators (Mastromarco & Simar, 2014). Therefore the applied approach is able to analyze the dynamic effects of banks' efficiency levels before and after the period of financial crisis without assuming the separability condition (Simar & Wilson, 2007, 2011).

The remaining parts of this paper are organized as follows: Section 2 provides a review of the relative literature. Section 3 describes the dataset and presents the applied methodological approach. Section 4 discusses the empirical results, whereas the last section concludes the paper.

2. A review of the literature

2.1. The Indian banking sector and the financial crisis

Since the rapid growth of Indian economy over the last decade we have observed an additional increase in investment rates and savings (OECD, 2011). Herd, Koen, Patnaik, and Shah (2011) emphasized that the implemented reforms of Indian economy[4] have increased saving rates during the 1980s and especially during the early 2000s to a comparable levels with other East Asian economies.

Bhattacharyya, Lovell, and Sahay (1997a), Bhattacharyya, Bhattacharyya, and Kumbhakar (1997b) discussed that the banking reforms started in 1955 with the setup of State Bank of India. This was later followed by the nationalization of 14 major commercial banks. This policy aimed to break the monopolistic control, spread banking services, mobilize deposits and enhance credit planning as part of national economic planning. In 1980 a second round of nationalization was implemented. However, in the 1980s it was evident that nationalized banks could not compete with private and foreign banks in terms of bank profitability and service quality.[5] Herd et al. (2011) argued that during the late 1980s more than 90% of total bank assets were owned by national (state owned) banks. This share was changed after the financial liberalization.[6] As a reaction of the deteriorated position of state-owned banks, Reserve Bank of India (RBI), based on the recommendations by of the first Narasimham Committee on Financial Sector Reforms, initiated major reforms in 1991. These reforms were aiming to enhance bank competition and increase bank efficiency and profitability. Koeva (2003, p.4) showed that this financial liberalization was based mainly on five key reforms: (1) interest rate liberalization, (2) reduction in reserve requirements, (3) entry deregulation, (4) credit policies and (5) prudential supervision. As a result during the early 2000s industry concentration has declined, bank profitability and the cost of financial intermediation has decreased and finally, the profitability of national banks have decreased compared to the private and foreign banks. After the mid 2000s and especially in the early stage of the Global Financial Crisis the authorities in India assumed that bank reforms improve bank stability and the banking should be able to withhold external shocks. However, as Eichengreen and Gupta (2013) showed there have been an increased deposit flights and in interbank borrowing rates since the mid 2008. Depositors transferred their financial funds from foreign and private banks to government owned and operated banks. Eichengreen and Gupta (2013) showed that the national banks have faced a faster deposit growth compared to the whole Indian financial system. Finally, they provided evidence that the majority of deposits directed towards the well known (largest) public banks.

Deposits reallocation caused the destabilization in the segment of small and medium-sized private and foreign banks. In addition, this affected bank stability and their performance. Bank efficiency levels dropped because of several reasons. Eichengreen and Gupta (2013) argued that bank inefficiency has increased due to the fact that other banks hold more capital for the shake of liquidity and the reassure of their depositors. In addition the belief that government protects the deposits for the largest public-sector banks decreased efficiency of the other banks and encouraged risk taking.

2.2. Empirical studies measuring the performance of the Indian banking sector

One of the first studies analyzing the performance of Indian banks during the early stages of economic liberalization is the one conducted by Bhattacharyya, Lovell, and Sahay (1997a). By combining both DEA and stochastic frontier analysis (SFA) they analyzed the efficiency of 70 Indian commercial banks over the period of 1986–1991. Their results indicated that public owned banks are most efficient, followed by foreign owned and public banks. However, they emphasized that foreign banks raised considerably their efficiency levels during the end of the examined period mainly due to their ability to extend their branch networks into metropolitan areas. Bhattacharyya, Bhattacharyya, and Kumbhakar (1997b) analyzed the productivity growth of the Indian public sector banks for the post-nationalization period (1970–1992). They provided evidence that nationalization boosted productivity growth especially during the period of economic liberalization. Furthermore the results indicated that deregulation accelerated Indian banks' technical progress by creating a competitive environment. Sarkar and Bhaumik (1998) investigated the effect of deregulation on competition in the Indian banking sector for the period of 1980–1998. They provided evidence that post deregulation in the banking industry did not revealed any significant changes of banks' efficiency either for public and private banks. Despite the more deregulated environment, the little change of industry's efficiency levels was attributed mainly to the oligopolistic dominance of public sector banks and the inability of the policy makers to control the distortions caused by the regulated interests and excessive branch expansion over the last 25 years.

Furthermore, Sarkar et al. (1998) provided evidence for the period 1993–1995 that the absence of well functioning capital markets in Indian banking sector resulted on weak ownership effects of private banks over public banks. Additionally, their results indicated greater performance levels of foreign banks compared to domestic banks. Similar results have been obtained in the study conducted by Kumbhakar and Sarkar (2003) investigating the relationship between deregulation and total factor productivity (TFP) growth in the Indian banking sector over the period 1985–1996. Their findings indicated the presence of distortion in input prices for the public banks. For the case of private banks they have found a decline of distortion in the post regulation period. Furthermore, they provided evidence that TFP growth of private bank is slighter higher than the public sector banks and was driven mainly by the scale component. However, they suggested that even though there has been a significant decline in regulatory distortions the increased levels of TFP growth were below the overall expectations suggesting that TFP growth had not materialized during the examined post regulation period.

For the period of 1992–1999, Shanmugam and Das (2004) employed a stochastic frontier function methodology examining the efficiency of 94 Indian banks. They came to the conclusion that

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[4] For an analysis on the reforms of Indian economy see Ahluwalia (2002).

[5] The Indian banking system is composed by three groups of banks: the public-sector banks (or national banks), the private banks and the foreign banks.

[6] For an extensive historical analysis of the Indian banking sector see Sarkar and Bhaumik (1998), Sarkar, Sarkar, and Bhaumik (1998), Kumbhakar and Sarkar (2003) and Fujii et al. (2014).