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great by
deeds, not by
birth"

-Chanakya

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**Banks in India- Technical and Scale Efficiency in Financing
Entrepreneurs and Small Businesses:
DEA approach**

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Banks in India- Technical and Scale Efficiency in Financing Entrepreneurs and Small Businesses: DEA approach

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Abstract

Banks are one of the mediums of implementing Government schemes that facilitate easy access to capital for small businesses and entrepreneurs. We for the first time analyze the bank's efficiency in implementing a government scheme that promotes entrepreneurship. We empirically study the relative technical and scale efficiency of 42 Indian banks including a comparative efficiency between private and public sector banks in providing loans under the Pradhan Mantri MUDRA Yojana PMMY scheme launched by the Government of India to promote entrepreneurship and facilitate easy access to capital for small and micro units including the start-ups under the scheme using data on the number of loans sanctioned and amount of loan disbursed under the scheme as on March 2016. We have used the Data Envelope Analysis (DEA) - a non-parametric technique for measuring the relative efficiencies of the Indian banks. We found that while Indian banks have been less efficient in implementing the PMMY, in comparison the public sector banks are more efficient in providing loans under the scheme and providing loans to start-ups under the scheme than the private sector banks. The study implies that the banks' efficiency scores give the policy makers a better picture of their relative performances it takes into account the differences in size, branch network, back end technology and profitability unlike the number of loans sanctioned. The efficiency levels provide information to the policy makers on how many more loans can be sanctioned by each bank with their existing resources. The lower efficiency of private sector banks mandates separate and stricter norms for implementation of PMMY for private banks.

Keywords: Bank Efficiency, Entrepreneurship, DEA, Government scheme, Start-up

JEL classification code: G21, L26, C14, M13

1. INTRODUCTION

Entrepreneurship is dynamic in nature and produces employment opportunities and brings about innovations which promote economic development and general welfare (Acs, Desai & Heessels, 2008; Baumol, 2002; Schumpeter, 1934; Wennekers & Thurik, 1999). The dynamics of entrepreneurship is however affected by the environmental factors prevailing in a country (Wilklund & Shepherd, 2003). These environmental factors also determine the role of institutions in the economic development of a country. Environmental factors together with institutional set up further define the quality of governance, access to capital and other resources like technology, infrastructure and the perception of the entrepreneurs regarding the opportunities (Acs et al., 2008). Institutions play a critical role in determining the demand and supply of entrepreneurs as they have the ability to influence economic behavior of individuals in a country (Busenitz, Gomez & Spencer, 2000; Mehlum, Moene & Torvik, 2006) and economic transactions carried out by individuals of the country (Williamson, 1998). Supportive institutional set up is perceived by the entrepreneurs as conducive for their growth and sustenance (Wilklund & Shepherd, 2003). This also increases the proportion of “Opportunity Driven” entrepreneurs which further promotes economic growth (Sternberg & Wennekers, 2015).

Stam (2015), drawing insights from World Economic Forum (2013) report on Entrepreneurial Ecosystem and Feld (2012) posits that institutions like government and financial intermediaries play a significant role in developing entrepreneurship by determining the availability of infrastructure and capital. The resource-based view of firm claims that the availability of financial resources and other resources like technology, talent and infrastructure

predicts an individual's propensity to engage in entrepreneurship (Barney, 1991). Among these the major factor that thwarts the growth of entrepreneurship is limited access to capital (Kerr & Nanda, 2009). In this connection, we usually find that the ability of an individual to become self-employed or to start a small business is enhanced if she has received large inheritances or if she has assets to her possession (Evans & Jovanovic, 1989). Therefore if Government policies that motivate the individuals to form enterprise can facilitate access to capital it will increase the likelihood of individuals starting enterprises (Gnyawali & Fogel, 1994). The objective of our study is to evaluate the bank's efficiency as a financial intermediary in supporting Government initiative to boost entrepreneurship in an emerging economy like India by reducing the financial constraints like limited access to capital.

Realizing the important role that entrepreneurship plays in the process of "Creative Destruction" (Schumpeter, 1934) resulting in economic development, Governments both in developed and developing economies are designing creative policies as part of their attempts to alleviate financing constraints for would-be entrepreneurs which also include opportunity-driven entrepreneurs (Kerr & Nanda, 2009). The developed economies like the OECD and the European Union insist their member's promote risk capital financing to foster entrepreneurship (OECD, 2004). The U.S. Small Business Administration assists the funding of loans to small businesses (SBA, 2015). Similarly, Bangladesh which is an emerging economy promotes entrepreneurship and small businesses by providing refinance facility to its banks and financial institutions on loans provided to small business through Government owned Bangladesh bank (Alam & Ullah, 2006). Among the emerging economies India launched the "Make in India" programme in September 2014 aimed at providing transparent and user-friendly systems and procedures that drive investment, foster innovation, develop skills, protect Intellectual Properties and build best-

in-class manufacturing infrastructure. Make in India is a measure to improve overall likelihood to enterprise. As part of the Government's attempts to support the financial institutions in providing loans to micro and small business entities, it started 'Micro Units Development and Refinance Agency' (MUDRA) in 2015 as a public sector financial institution. Financial intermediaries like Banks, Micro Finance Institutions (MFI) and Non-Banking Finance Companies (NBFC) provide MUDRA loan up to Rs.1 Million (15000 USD), to income generating micro enterprises engaged in manufacturing, trading and services sectors without any collateral securities under a Government scheme called Pradhan Mantri MUDRA Yojana (PMMY) launched in 2015. The borrowers of MUDRA loan do not have to pledge their assets as collateral and encumbrance is created on the assets which are created out of the loan. The loans are classified at three levels as "Shishu" which means a new born, "Kishore" which means adolescent and "Tarun" which means youth. As the name suggests, "Shishu" loans are given to start-ups and the maximum amount sanctioned per loan is Rs.50,000 (750 USD) . "Kishore" loan variant is offered to existing micro units for business expansion and the ceiling is Rs.500,000 (7500 USD) per loan . "Tarun" loan is provided to all small business units applying for a loan up to 1 million (15000 USD). We have appraised the relative efficiency of the Indian banks – both public sector and private sector in the implementation of the PMMY using the Data Envelope Analysis non-parametric method. We found that the mean overall technical efficiency of banks in providing loans to small business including start-ups is 52%, while it is 66% for pure technical efficiency and 87% for scale efficiency respectively. This is further reduced to 43%, 53% and 72% respectively in providing loans to small start-ups under PMMY.

2. REVIEW OF LITERATURE

The “Regulatory Dimension” component of the “Country Institutional Profile” conceptualized by Kostova (1997) explains the effect of laws, regulations, and government policies of a country on its institution’s ability to support new businesses. The country’s regulatory dimension of the institutional profile also determines an individual’s opportunity to make access to the available resources and privileges using the government sponsored programs and policies favoring entrepreneurship (Busenitz et al., 2000). In this connection, Minniti (2008) claims that Government policies that shape the institutional environment, in which entrepreneurial decisions are made play an important role in deciding the entrepreneurial activity of a country. Financial intermediaries like banks are a part of the institutional environment of a country and they are also affected by government schemes that promote entrepreneurship by facilitating access to capital (Black & Strahan, 2002). The financial intermediaries ability to partially negate the adverse selection problem in credit decisions by reducing information asymmetry and its ability to mobilize funds of small investors and channelize it to profitable investments makes them a suitable medium for implementing Government schemes that promote entrepreneurship (King & Levine, 1993a). Government schemes that involve financial intermediaries to facilitate access to capital to small businesses was found to have causal effect on entrepreneurship and long run economic growth (Feld, 2012; King& Levine, 1993b). The efficiency of the implementing mechanism determines the effectiveness of Government programmes (Larson, 1980). Hence efficiency of the financial intermediaries like banks will positively affect the number of entrepreneurs getting benefitted by the Government schemes that facilitates access to capital.

Even though efficiency of banks in the implementation of the government schemes that promote entrepreneurship is a pertinent area of research for entrepreneurship and banking literature, till date no study has examined this aspect. In the literature, we find various aspects of the efficiency of banks in different countries using different parametric and non-parametric methods. Benston (1972), Humphrey (1990), Berger, Hunter & Timme, (1993), Pastor, Perez & Quesada (1997), Ashton & Hardwick (2000), Casu & Molyneux (2001), Brown & Skully (2003), Berger (2007), Paradi, Yang & Zhu (2011) provide comprehensive account of the studies on efficiency of banks in the global aspect using different parametric and non-parametric methods. Similarly, the literature on efficiency of Banks in India have used both parametric techniques like stochastic cost frontier (Bhattacharyya, Lovell & Sahay, 1997; Kumbhakar & Sarkar, 2003; Rogers, 1998; Shanmugam & Das, 2004) and non-parametric techniques like Data Envelope analysis (Kumar, Charles & Mishra, 2016; Saha, & Ravisankar, 2000) for measuring efficiency. Majority of the existing studies are confined to the period of 1990s and early 2000s. These studies main focus has been financial deregulation impact on bank's productivity and efficiency, and efficiency differences across ownership groups (Gulati & Kumar, 2016). Table 1 gives the summarized literature of the recent papers that have examined new relationships studied on Bank Efficiency in India using Data Envelope Analysis.

Table 1: List of recent literature on efficiency of Indian Banks that uses DEA to measure efficiency

REFERENCE	RELATIONSHIP STUDIED	FINDING	OUTPUT	INPUT
Gulati & Kumar (2016)	Indian Bank's efficiency and impact of financial crisis of 2008.	A decline in the bank's efficiency was observed but recovery was quick with a differential effect on foreign, private and public sector banks.	Non-interest income, advances, and investments	Labor, physical capital, equity capital and funds based loans
Ray (2016)	Cost efficiency of 193 branches located in Kolkata of a public sector bank	Reducing the number of branches will improve the cost efficiency	Total amount of deposits, total amount of credit and other non-interest income	Labor and physical capital
Bhatia & Mahendru (2015)	Analyzed the revenue efficiency(RE) of Scheduled Commercial Banks in India	Public Sector Banks have higher RE as compared to their counterparts in private and foreign sectors.	Investments, loans and advances	Deposits, loanable funds, labor and physical capital
Sekhri, V. (2011)	Comparison of productivity and efficiency of foreign, private and public sector banks in India	Foreign banks have highest total factor productivity followed by private and public sector banks. The public sector banks are better in terms of pure efficiency	Loan income, investment income and non-interest income	Interest cost and operating cost
Sinha & Chatterjee (2008)	Technical efficiency with respect to generation of fee based activities	The public sector banks are less efficient compared to private sector	Other Incomes, Off Balance Sheet Exposures	Net Worth, Number of Branches
Kumar & Gulati (2008)	Effect of size and affiliation on efficiency of banks	Smaller banks and the banks affiliated to State Bank were found to be more efficient	Spread and non-interest income	Physical capital labor, loanable funds

Chandrasekhar & Sonar (2008)	Examines the effects of IT investment on the efficiency of banks	Private banks were found to be more efficient than public sector banks by a very small margin	Investment and Advances	Number of branches, Number of employees, Number of ATMs, IT Investment and Fixed assets
Kumar (2008)	Relationship between profitability and Technical efficiency of Indian Public sector banks	Based on the profitability efficiency matrix, the Public sector banks overall efficiency with respect to their profitability was 88.5%	Net interest income and non-interest income	Physical Capital, labor and loanable funds
Ray (2007)	Measures the size efficiency of Indian banks	Large Banks in size if converted into smaller units may result in the increase of output	Credit, investment and other Income	Borrowed funds, physical capital, equity and labor

3. STATEMENT OF PROBLEM

The effectiveness of the government policies depends on the efficiency of its implementation mechanism (Van Meter & Van Horn, 1975). One of the components in the implementation of PMMY is the financial intermediaries and hence effectiveness from the supply side can be studied by evaluating the efficiency of the financial intermediaries like the Banks. It is imperative to study the efficiency of banks in providing loans under PMMY in particular because of the nature of its beneficiaries. The demand for loans under the programme comes from individuals who are keen to start a small business and do not have adequate documents to prove their credibility. The beneficiaries of PMMY loan are informationally

opaque and the banks have to rely on unverifiable, soft information to evaluate their creditworthiness as most of them don't have an external credit rating. The amount and number of loans sanctioned under the programme signify the bank's ability to cater to the requirement of customers who do not have documents to prove their repayment capacity. The efficiency of banks in using their resources like number of branches, total assets, profitability and number of employees is seldom considered for evaluating their performance in implementing the programme. Instead, it is only the number of loans sanctioned that is considered for evaluating their performance in implementing the programme. In this aspect, the difference in size, profitability, back-end technology and coverage gives undue advantage to large banks. Therefore it is pertinent to study the bank's relative performance after considering the resources at their disposal as it provides a fair evaluation of the performance of the banks in the implementation of the government scheme.

4. RESEARCH QUESTIONS

This study attempts to provide an explanation to the following research questions:

1. Do Indian banks efficiently use their resources like branch network, size and profitability to implement government schemes like PMMY?
2. Is there any effect of ownership on the efficiency on the bank in providing loans under Government schemes like PMMY?
3. Are Indian banks efficient in lending to Start-ups under PMMY?
4. Is there a difference between the public and private sector bank's efficiency in providing loans to Start-ups under PMMY?

5. OBJECTIVE OF THE STUDY

In the literature, it is common to find studies that examine the Indian bank's efficiency in regarding aspects like cost and profitability. However, there is no study which tests their efficiency in implementing Government schemes that promote entrepreneurship. Hence the objective of this study is to evaluate the Indian bank's relative efficiency in providing loans under PMMY. In alignment with the main objective, the study also has the following sub objectives:

- To evaluate the relative efficiency of public sector and private sector banks in providing loans under PMMY and comprehend which among them is more efficient.
- To evaluate the public sector and private sector banks efficiency in providing loans to Starts-ups under PMMY.

6. METHODOLOGY

6.1. DATA AND DESCRIPTIVE STATISTICS

The study uses data from the bank's annual reports for the year ended March 2016. In the present attempt, a total of 42 Indian commercial banks have been included in the sample which includes 25 banks in the public sector and 17 banks in the private sector. The data on output parameters has been obtained from the website of MUDRA which provides bank wise data on total loan amount disbursed and number of loans sanctioned under the PMMY scheme. The inputs used in the analysis are return on assets, business per employee, number of branches and total assets. Number of loans sanctioned under PMMY scheme and the amount of loan sanctioned are taken as output. Analysis has been done by taking the number and amount of "Shishu" loans sanctioned as output to study the efficiency of banks to provide loans to Start-ups.

The DEAP software, version 2.1 was used to do Data Envelope Analysis. While table 2 and table 3 gives the descriptive statistics of the public sector banks' inputs and outputs, table 4 and table 5 gives the descriptive statistics of the private sector banks' inputs and outputs.

	Return on asset (ROA)%	Business per employee ('000' Rs.)	Branches	Total Assets ('000' Rs.)
mean	0.40	152645	3531	3424087167
median	0.33	144600	2507	2270964800
Maximum	1	261200	16333	20480798000
Minimum	0	107200	1015	794689300
Standard Deviation	0.21	33590893	3094	3972717864

	Number of loans sanctioned under PMMY	Amount Disbursed under PMMY in Crore'(Rs.) (1 crore = 10 million)	Number of loans sanctioned to start-ups under PMMY	Amount Disbursed under PMMY to start-ups in Crore'(Rs.)
mean	262660	2211.84	199241	319.83
median	163854	1484.35	126826	255.47
Maximum	1031804	12281.18	11166	977.62
Minimum	19477	334.82	756098	22.98
Standard Deviation	250874	2531.24	195617	257.85

Table 4: Summary statistic Private Sector banks Inputs				
	Return on asset (ROA)%	Business per employee ('000' Rs)	Branches	Total Assets ('000'Rs)
Mean	1.31	103286	1191	848065194
Median	1.38	106792	726	518366000
Maximum	2.30	168600	4050	4619323942
Minimum	0.34	67800	154	14857600
Standard Deviation	0.53	26054057	1249	1149589120

Table 5: Summary statistic Private Sector banks Outputs				
	Number of loans sanctioned under PMMY	Amount Disbursed under PMMY in Crore'(Rs.)	Number of loans sanctioned to start-ups under PMMY	Amount Disbursed under PMMY to start-ups in Crore'(Rs.)
Mean	180449.47	1177.92	156901.47	349.33
Median	12651.00	366.53	2604.00	11.06
Maximum	1251106.00	5356.89	1167585.00	2447.37
Minimum	670.00	11.07	0.00	0
Standard Deviation	359235.91	1648.50	334279.15	748.01

The Summary statistics shows that the average return on assets of private sector banks is almost three times the public sector banks which indicate that they are more profitable than public sector banks. But the private sector bank's average number of branches and average total assets is less which shows that these are smaller in size and spread than the public sector banks. The business per employee is higher in the public sector banks. This is the ratio of total business of the bank in terms of deposits and advances, and the total employees. This implies that the "Back End Technology" (Petersen & Rajan, 2002) i.e. the number of employees available to attend to the customer needs is more in public sector banks.

6.2. RESEARCH METHOD- DEA

Sekhri (2011) describes efficiency as a comparison between actual and optimal output or input. The study classifies the efficiency estimation techniques based on the distributional assumptions which are enforced on the random error and the inefficiency as non-parametric and parametric techniques. DEA and Free Disposal Hull (FDH) are examples of non-parametric technique used for measuring efficiency and Distribution Free Approach (DFA), Thick Frontier Approach (TFA) and Stochastic Frontier Approach (SFA) are examples of parametric techniques. Non-parametric techniques like DEA have the following advantages over parametric techniques. DEA does not need a functional form assumption and hence no specific structure is imposed over the efficient frontier shape. As such the efficiency estimates derived from DEA have no functional form dependency (Drake, Hall & Simper, 2006) and the procedure performance is better in comparison to parametric techniques with respect to an individual decision-making unit's productivity efficiency estimation (Banker & Natarajan, 2008). FDH is a variant of DEA and the production possibility set created by FDH model includes only the DEA vertices and the FDH point's interior to these vertices. But FDH excludes those points which lie on the line connecting the DEA vertices and thus gives larger estimates than DEA of average efficiency (Berger et.al. 1997; Tulkens, 2006). We have used DEA in this study to estimate the bank's efficiency.

Charnes, Cooper, and Rhodes (1978) developed DEA as a linear program for public sector units' efficiency estimation by evaluating the production units or decision making units (DMUs) comparative efficiency, in this case, the banks by identifying the set of units following the best practice. This means no other set of units as much output given input or as less input given output. This is done by connecting the best unit sets through piecewise linear combinations

which ultimately yields a set of convex production possibilities. Thereafter, performance of each DMU's performance is relatively measured to the set of best practicing units. In DEA, the best practice frontier has less specification structure compared to a parametric technique. DEA also does not necessitate description of the functional form of production relationship. When compared to regression analysis which considers the average behavior of all units in order to explain the maximal amount of variance within the data, DEA focuses on the outliers and identify them as the most efficient units, thus allowing their best practices to be recognized and also identifies potential improvements and targets for inefficient units based on the best practices of the efficient units. Compared to Ratio analysis, DEA can integrate simultaneously multiple inputs and outputs to give a composite efficient score which makes it possible to rank the DMUs based on those multiple inputs and outputs. Barnes (1987) and Fernandez-Castro &Smith (1994) have also discussed methodological issues in using ratios.

In DEA, the selection of inputs and outputs can be done in accordance with a managerial focus. This has resulted in an issue regarding the usage of inputs and outputs (Sathye, 2003). Literature focuses on two approaches which guide in the selection of inputs and outputs: the production approach and the intermediation approach. In production approach, bank is viewed as producers of financial services and hence physical units like labor and capital are used as input and the type and number of transactions quantified are used as output. Whereas in intermediation approach, bank is viewed as a financial intermediary and hence the volume of loans and deposits, and similar other variables like return on assets, total assets are used as inputs and outputs. In this study, we have used the intermediary approach. We have used four input variables and two output variables. The input variables are the return on assets, total assets, the number of branches

and the business per employee. The outputs variables are the amount and number of loans sanctioned and disbursed under PMMY.

DEA provides three types of efficiencies. These are the overall technical efficiency under constant return to scale (CRS) model (Charnes et al., 1978); the pure technical efficiency under variable return to scale (VRS) model (Banker, Charnes, & Cooper, 1984) and the scale efficiency which is a ratio of these two efficiency. Under the CRS model, DEA provides overall technical efficiency by estimating the inefficiency based on the size of operation and the input-output configuration. This is based on the assumption that the banks are working at their optimal scale (Coelli, Rahman, & Thirtle, 2002). However, there is one limitation of CRS model. Its assumption cannot be justified as banks have constraints on the availability of inputs. Under the VRS model, DEA provides pure technical efficiency by measuring the deviations of the DMUs from the efficient frontier through managerial inefficiency (Singh, Goyal & Sharma, 2013) and finally, the scale efficiency as the ratio of overall technical efficiency in the numerator to pure technical efficiency in the denominator. We have estimated all the three efficiencies in this study. Finally, DEA can be used to construct efficient frontiers in two ways: the output oriented that is represented by a maximum output given the input; and the input oriented that is represented by a minimum input given the output. We have used the output oriented way to examine the extent to which Indian banks can increase their output with their existing input levels.

After analyzing the relative efficiency of all the banks together in implementing PMMY we have also analyzed the efficiency of these banks separately as public and private as they have different characteristics (Bhattacharyya et al., 1997). We have also analyzed the efficiency of banks in lending collateral free loans to small start-ups by taking the number and amount of loan sanctioned by the banks under “Shishu” category as output.

6.3. RESULTS

The empirical estimates of technical efficiency with its components of the 42 banks are reported in the Table 6.

Table 6: Overall Technical efficiency, Pure Technical Efficiency and scale efficiency of Indian Scheduled Commercial Banks in financing small businesses and start-ups

Sl No.	Name of the Bank	Technical efficiency (CRS)	Technical efficiency (VRS)	Scale efficiency
1	Allahabad Bank	0.54	0.66	0.82
2	Andhra Bank	0.59	0.70	0.84
3	Bank of Baroda	0.31	0.31	1.00
4	Bank of India	0.74	0.75	0.99
5	Bank of Maharashtra	0.54	0.68	0.79
6	Canara Bank	1.00	1.00	1.00
7	Central Bank of India	1.00	1.00	1.00
8	Corporation Bank	0.42	0.52	0.80
9	Dena Bank	0.31	0.47	0.66
10	Indian Bank	0.46	0.52	0.88
11	Indian Overseas Bank	1.00	1.00	1.00
12	Punjab National Bank	0.78	0.79	0.99
13	Oriental Bank of Commerce	0.42	0.56	0.75
14	Syndicate Bank	0.64	0.67	0.96
15	Union Bank of India	0.34	0.36	0.96
16	UCO Bank	1.00	1.00	1.00
17	United Bank of India	0.59	1.00	0.59
18	Vijaya Bank	0.83	1.00	0.83
19	Punjab & Sind Bank	0.59	1.00	0.59
20	IDBI Bank Limited	0.68	0.97	0.70
21	State Bank of India	1.00	1.00	1.00
22	State Bank of Mysore	0.44	0.55	0.80
23	State Bank of Bikaner and Jaipur	0.56	0.56	0.99
24	State Bank of Hyderabad	0.42	0.42	1.00
25	State Bank of Travancore	0.19	0.34	0.56
26	Yes Bank	0.11	0.11	0.96

27	Catholic Syrian Bank	0.01	1.00	0.01
28	Axis Bank	0.40	0.47	0.86
29	Federal Bank	0.04	0.04	1.00
30	IndusInd Bank	1.00	1.00	1.00
31	Jammu & Kashmir Bank	0.26	0.26	1.00
32	Karnataka Bank	0.16	0.17	0.95
33	City Union Bank	0.13	0.18	0.73
34	Karur Vysya Bank	1.00	1.00	1.00
35	Lakshmi Vilas Bank	0.05	0.12	0.44
36	South Indian Bank	0.12	0.16	0.76
37	Ratnakar Bank	0.76	1.00	0.76
38	Tamilnad Mercantile Bank	0.30	0.39	0.77
39	DCB Bank	0.15	1.00	0.15
40	ICICI Bank	1.00	1.00	1.00
41	Kotak Mahindra Bank	0.25	1.00	0.25
42	HDFC Bank	1.00	1.00	1.00

The results show that efficient frontier has nine Banks, that is they are technically efficient which means the Overall Technical efficiency (OTE) is equal to the Pure Technical Efficiency (PTE) is equal to the Scale efficiency (SE) which is equal to the unit 1 when both the CRS and the VRS model is operated. These include 5 public sector banks which are the State Bank of India, UCO Bank, IOB, CBI and Canara bank respectively; and 4 Private sector banks which include the HDFC Bank, IndusInd Bank, Karur Vysya Bank, and ICICI Bank respectively as the most efficient banks. The output oriented approach gives the mean OTE, PTE and SE as 52%, 66% and 81.4% respectively. This shows that the banks can increase the loan under PMMY portfolio up to 48% by efficiently using the existing level of inputs.

Table 7 shows the result of DEA of the sub sample containing only the 25 public sector banks. The number of efficient banks increases by one which is the State Bank of Bikaner and Jaipur with an improvement in the mean OTE, PTE and SE to 67%, 80% and 87% respectively over the combined 42 banks by using the output oriented approach.

Table 7: Overall Technical Efficiency, Pure Technical Efficiency and scale efficiency of Indian Public Sector Banks in providing collateral free loans to start ups and small businesses

Sl No.	Name of the Bank	Technical efficiency(CRS)	Technical Efficiency(VRS)	Scale Efficiency
1	Allahabad Bank	0.57	0.66	0.86
2	Andhra Bank	0.69	0.74	0.93
3	Bank of Baroda	0.31	0.31	1.00
4	Bank of India	0.74	0.75	0.99
5	Bank of Maharashtra	0.64	0.69	0.93
6	Canara Bank	1.00	1.00	1.00
7	Central Bank of India	1.00	1.00	1.00
8	Corporation Bank	0.42	0.52	0.79
9	Dena Bank	0.31	0.55	0.55
10	Indian Bank	0.60	0.64	0.94
11	Indian Overseas Bank	1.00	1.00	1.00
12	Syndicate Bank	0.73	0.74	0.98
13	Oriental Bank of Commerce	0.42	0.56	0.75
14	Punjab National Bank	0.80	0.82	0.98
15	United Bank of India	0.66	1.00	0.66
16	Punjab & Sind Bank	0.59	1.00	0.59
17	Union Bank of India	0.36	0.37	0.98
18	UCO Bank	1.00	1.00	1.00
19	Vijaya Bank	0.97	1.00	0.97
20	IDBI Bank Limited	0.74	0.97	0.77
21	State Bank of India	1.00	1.00	1.00
22	State Bank of Travancore	0.23	1.00	0.23
23	State Bank of Mysore	0.74	1.00	0.74
24	State Bank of Bikaner and Jaipur	1.00	1.00	1.00
25	State Bank of Hyderabad	0.64	0.65	0.99

Table 8 reveals the result of DEA done on the subsample of 17 private banks. There was no change in the composition and number of the efficient banks. But the mean OTE, PTE and SE shows an overall fall to 40% 59% and 74% respectively over the combined 42 banks by using the output oriented approach.

Table 8: Technical and scale efficiency of Indian Private Sector Banks in providing collateral free loans to Micro units(Both startups and existing Units)

Sl.No.	Name of the Bank	Technical efficiency(CRS)	Technical Efficiency(VRS)	Scale Efficiency
1	Karnataka Bank	0.16	0.17	0.95
2	Catholic Syrian Bank	0.01	1.00	0.01
3	Karur Vysya Bank	1.00	1.00	1.00
4	Federal Bank	0.04	0.04	1.00
5	Jammu & Kashmir Bank	0.26	0.26	1.00
6	South Indian Bank	0.14	0.24	0.58
7	City Union Bank	0.13	0.18	0.73
8	Tamilnad Mercantile Bank	0.30	0.39	0.77
9	Lakshmi Vilas Bank	0.05	0.12	0.44
10	ICICI Bank	1.00	1.00	1.00
11	Ratnakar Bank	0.76	1.00	0.76
12	IndusInd Bank	1.00	1.00	1.00
13	DCB Bank	0.15	1.00	0.15
14	Yes Bank	0.11	0.11	0.97
15	Axis Bank	0.49	0.49	1.00
16	Kotak Mahindra Bank	0.25	1.00	0.25
17	HDFC Bank	1.00	1.00	1.00

The efficiency of banks to provide loans to Micro start-ups was examined using output approach of DEA. The efficiency under CRS and VRS assumption was estimated using Return on Assets, Total Assets, Business per employee and Total Number of branches as input and number of loans and amount of loans sanctioned to start-up under ‘Shishu’ loan Category of PMMY was used as output. Table 9 shows the DEA results on the 42 commercial banks comprising of both private and public sector banks to find efficiency of banks to lend to start-ups.

Table 9: Overall Technical Efficiency, Pure Technical efficiency and Scale Efficiency of Indian Scheduled Commercial Banks in providing collateral free loans to Micro Start Ups

Sl.No.	Name of the Bank	Technical efficiency (CRS)	Technical Efficiency (VRS)	Scale Efficiency
1	Allahabad Bank	0.47	0.49	0.96
2	Andhra Bank	0.68	0.74	0.93
3	Bank of Baroda	0.34	0.34	1.00
4	Bank of India	1.00	1.00	1.00
5	Bank of Maharashtra	0.33	0.39	0.85
6	Canara Bank	1.00	1.00	1.00
7	Central Bank of India	1.00	1.00	1.00
8	Corporation Bank	0.58	0.67	0.87
9	Dena Bank	0.28	0.42	0.66
10	Indian Bank	0.35	0.36	0.97
11	Indian Overseas Bank	1.00	1.00	1.00
12	Oriental Bank of Commerce	0.53	0.56	0.95
13	Punjab National Bank	0.79	0.82	0.97
14	Syndicate Bank	0.39	0.39	1.00
15	Union Bank of India	0.41	0.42	0.99
16	United Bank of India	0.46	1.00	0.46
17	Punjab & Sind Bank	0.59	1.00	0.59
18	UCO Bank	1.00	1.00	1.00
19	Vijaya Bank	0.54	0.69	0.79
20	IDBI Bank Limited	0.63	0.82	0.77
21	State Bank of India	1.00	1.00	1.00
22	State Bank of Travancore	0.05	0.10	0.50
23	State Bank of Mysore	0.05	0.07	0.73
24	State Bank of Hyderabad	0.13	0.13	0.96
25	State Bank of Bikaner and Jaipur	0.13	0.14	0.93
26	Catholic Syrian Bank	0.00	1.00	0.00
27	Karnataka Bank	0.01	0.01	0.83
28	Federal Bank	0.00	0.00	0.95
29	Karur Vysya Bank	0.06	0.08	0.83
30	Jammu & Kashmir Bank	0.02	0.02	0.95
31	South Indian Bank	0.01	0.01	0.66
32	City Union Bank	0.00	0.01	0.72

33	Tamilnad Mercantile Bank	0.02	0.03	0.75
34	Lakshmi Vilas Bank	0.00	0.01	0.46
35	Ratnakar Bank	0.84	1.00	0.84
36	ICICI Bank	0.77	1.00	0.77
37	Axis Bank	0.42	0.43	0.97
38	IndusInd Bank	1.00	1.00	1.00
39	Yes Bank	0.01	0.01	0.97
40	HDFC Bank	1.00	1.00	1.00
41	DCB Bank	0.00	1.00	0.00
42	Kotak Mahindra Bank	0.00	0.00	0.00

The results show that efficient frontier now has eight Banks. These include 6 public sector banks which are the State Bank of India, UCO Bank, IOB, CBI, SBBJ and the Canara bank respectively; and 2 Private sector banks which include the HDFC Bank and the IndusInd Bank respectively as the most efficient banks in providing loans to the micro start-ups under the scheme. The output oriented approach gives the mean OTE and the PTE as 43% and 53% respectively which is a further fall over the combined 42 banks. The mean scale efficiency was 80%.

The analysis was done separately for the 17 private sector banks and the 25 public sector banks to find the efficiency in lending to start-ups compared to their peers. Table 10 and table 11 gives the public sector banks and the private sector banks efficiency using output approach under the CRS and VRS assumption.

Table 10: Overall Technical Efficiency, Pure Technical efficiency and Scale Efficiency of Indian Public Sector Banks in providing collateral free loans to Micro Start Ups

Sl.No.	Name of the Bank	Technical efficiency (CRS)	Technical Efficiency (VRS)	Scale Efficiency
1	Allahabad Bank	0.53	0.60	0.89
2	Andhra Bank	0.87	0.99	0.88

3	Bank of Baroda	0.34	0.34	1.00
4	Bank of India	1.00	1.00	1.00
5	Bank of Maharashtra	0.45	0.61	0.75
6	Canara Bank	1.00	1.00	1.00
7	Central Bank of India	1.00	1.00	1.00
8	Corporation Bank	0.67	0.82	0.81
9	Dena Bank	0.28	0.55	0.51
10	Indian Bank	0.53	0.59	0.90
11	Indian Overseas Bank	1.00	1.00	1.00
12	Oriental Bank of Commerce	0.57	0.65	0.88
13	Punjab National Bank	0.87	0.89	0.98
14	UCO Bank	1.00	1.00	1.00
15	Syndicate Bank	0.46	0.46	1.00
16	Vijaya Bank	0.82	1.00	0.82
17	Union Bank of India	0.46	0.48	0.96
18	IDBI Bank Limited	0.82	1.00	0.82
19	United Bank of India	0.54	1.00	0.54
20	Punjab & Sind Bank	0.59	1.00	0.59
21	State Bank of India	1.00	1.00	1.00
22	State Bank of Hyderabad	0.38	0.46	0.83
23	State Bank of Bikaner and Jaipur	0.53	1.00	0.53
24	State Bank of Travancore	0.10	1.00	0.10
25	State Bank of Mysore	0.17	1.00	0.17

Table 11: Overall Technical Efficiency, Pure Technical efficiency and Scale Efficiency of Indian Private Sector Banks in providing collateral free loans to Micro Start Ups

Sl.No.	Name of the Bank	Technical efficiency (CRS)	Pure Technical Efficiency	Scale Efficiency
1	Catholic Syrian Bank	0.00	1.00	0.00
2	Federal Bank	0.00	0.00	0.95
3	Jammu & Kashmir Bank	0.02	0.02	0.95
4	Karnataka Bank	0.01	0.01	0.83
5	Karur Vysya Bank	0.06	0.08	0.83
6	City Union Bank	0.00	0.01	0.72
7	Lakshmi Vilas Bank	0.00	0.01	0.46

8	Ratnakar Bank	0.84	1.00	0.84
9	South Indian Bank	0.01	0.01	0.50
10	Tamilnad Mercantile Bank	0.02	0.03	0.75
11	ICICI Bank	0.77	1.00	0.77
12	Axis Bank	0.43	0.44	1.00
13	IndusInd Bank	0.00	1.00	0.00
14	Yes Bank	0.00	0.00	0.95
15	HDFC Bank	0.02	0.02	0.95
16	DCB Bank	0.01	0.01	0.83
17	Kotak Mahindra Bank	0.06	0.08	0.83

The number of public sector banks in the efficient frontier remained the same. But a small improvement in the OTE and the PTE was observed. The mean OTE, PTE and SE show an overall improvement to 64%, 82% and 79% respectively. Similarly the number of private sector banks in the efficient frontier remained the same. But the mean OTE, PTE and SE show an overall fall to 24%, 39% and 61% respectively.

Finally, in table 12, we present number of banks in four quartiles of efficiency scores

Efficiency (%) Quartiles	Loans to start ups and existing- Number of banks in each quartile of efficiency						Loans to start ups Number of banks in each quartile of efficiency					
	Overall Technical Efficiency	%*	Pure technical Efficiency	%*	Scale Efficiency	%*	Overall Technical Efficiency	%*	Pure technical Efficiency	%*	Scale Efficiency	%*
0-25	9	21	6	14	2	5	16	38	14	33	3	7
25-50	12	29	8	19	2	5	9	21	8	19	2	5
50-75	9	21	9	21	6	14	6	14	4	10	6	14
75-100	12	29	19	45	32	76	11	26	16	38	31	74
Note: % - Percentage of banks under each quartile of efficiency												

Considering the efficiency of banks in providing loans under PMMY, 29% of the banks had overall technical efficiency more than the 75% quartile, 46% had pure technical efficiency more than the 75% quartile. But when the efficiency of the banks in providing loans to Micro start-ups is considered, it reduces to 26% of the banks having overall technical efficiency more than the 75% quartile and 38% of the banks having pure technical efficiency more than the 75% quartile respectively.

7. FINDINGS AND DISCUSSION

From the efficiency scores it is evident that the Indian banks are not utilizing their branch network, back end technology, size and profitability efficiently for providing loans under PMMY. This shows that the banks have significant scope for increasing the number of loans sanctioned under the PMMY scheme. The mean OTE and PTE were more for public sector banks. These banks also had a better mean efficiency for sanctioning loans to start-ups. The private banks were found to be inefficient in sanctioning 'Shishu' loans to Start-ups. Only 2 private banks were found to occupy efficient frontier. The most disturbing finding from this study was that around 30-35 % of the banks studied had less than 25% efficiency in providing loans to start-ups. The mean OTE and PTE of the private sector banks for giving Shishu loans was very low at 29% and 39% which shows that private bank management is shying away from giving loans to small entrepreneurs even when refinance facility is available. The high efficiency of public sector banks compared to private sector may be attributed to the increased control of Government in the internal management of the banks.

This study also finds that some public sector banks like Punjab National Bank which has reported more number of accounts and more amount of loan disbursement compared to CBI and

UCO bank was not as efficient as CBI or UCO Bank. Similarly, private bank like the ICICI bank which had less number of accounts sanctioned in comparison to 20 other banks in the sample was found to be in the efficient frontier and more efficient than 13 of those 20 banks. This shows that the performance of the banks in the implementation should not be judged merely by the number of loans sanctioned. The outputs should be judged in comparison to the inputs used for generating those loans to get a better picture of the efficiency.

8. LIMITATION AND FUTURE RESEARCH

The study suffers from some limitations. We have not considered all the commercial banks. Compared to all the public sector banks, we analysed with a limited number of private sector banks.. The period of study is a single year because only one year has elapsed after the launch of PMMY. Also, we have used only four input and two output variables to appraise the banks efficiency. In general, DEA are very subtle to data changes, the number of input variables and factors, the number of output variables and factors, the type of input variables and factors, the type of output variables and factors in appraising efficiency scores. We have analyzed the efficiency of the banks assuming that people perceive the scheme as an opportunity to start business or expand their existing business and they are aware they can approach freely to the bank for loans. This may not be true always as there may be individuals who are unaware of the benefits of the scheme.

Future studies may attempt to incorporate more input factors that are more closely related to the bank's ability to provide collateral free loans to micro units may be used. The inputs and outputs may also be observed for more number of years to compute the efficiencies in the

coming years of its implementation. Studies may also be undertaken to find the reason for lower levels of efficiency and to find what can be done to improve the efficiency of banks.

9. CONCLUSION AND IMPLICATIONS

The study aimed at measuring the efficiency of Indian Banks in providing loans under PMMY which is a scheme launched by the Government of India to promote entrepreneurship. DEA, a non-parametric technique was used to measure the bank's efficiency. Business per employee, total assets, total number of branches, and return on assets as on March 2016 was used as input parameters and number of loan sanctioned and the amount of loan disbursed by the banks as on March 2016 was used as output parameters. It was found that India banks were not efficient in providing loans under PMMY and they will have to double the output with the existing inputs to become efficient. Public sector banks compared to private banks were more efficient in providing credits to small businesses and start-ups under the scheme. The study has policy implications. Unlike the number of loans sanctioned, the efficiency scores of the banks give the policy makers a better picture of their relative performance of banks as it takes into account the differences in size, branch network, back end technology and profitability. The efficiency level provides information to the policy makers on how many more loans can be sanctioned by each bank with their existing resources. The study shows lower efficiency of private sector banks which mandates separate and stricter norms for implementation of PMMY. The efficiency of banks in providing loans to start-ups is very low. Policy makers should investigate and find the reasons for such low levels of efficiency and take necessary actions to improve the entrepreneurial activities in the country.

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