

IMPACT OF CAMEL VARIABLES ON COST EFFICIENCY OF INDIAN SCHEDULED COMMERCIAL BANKS

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Abstract

The purpose of this paper is to investigate determinants of Cost efficiency of Scheduled Commercial Banks operating in India. The paper considers all Scheduled Commercial Banks operating in India over the period of 22 years from 1991-92 to 2012-13. Data Envelopment Analysis (DEA)- a non-parametric technique is used to calculate the cost efficiency scores of banks. Due to the censored nature of dependent variable, i.e. Cost efficiency scores range between 0 and 1, Panel Data Tobit regression is employed to identify the determinants. The results indicate that Capital Adequacy Ratio (CAR), Net Non-Performing Assets to Net Advances (NPANA), Total Loans and advances to Total Deposits (TATD), Total Expenses to Total Income (TETI), Return on Assets (ROA), Spread to Total Assets (STA), Liquid Assets to total assets (LATA), Size (LNTA), Private Dummy (PUBD) and Inflation (INF) reveal a negative relationship with cost efficiency scores. Equity to Total Assets (ETA), Total Investments to Total Assets (TITA), Operating Expenses to Total Expenses (OETE), Business per Employee (BPE), and Non-Interest Income to Total Income (NIITI), Cash Deposit Ratio (CDR), Time Dummy (TD), Public Dummy (PUBD) and Log of Gross Domestic Product (LNGDP) disclose positive relationship for cost efficiency. The previous studies consider only limited factors. To overcome the limitation of literature structured framework namely CAMEL have been used in the paper to find strong implications for banks.

Keywords –Cost Efficiency, Bank specific variables, Industry specific variables, Data envelopment analysis, Panel Tobit Regression, Indian Scheduled Commercial Banks

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Introduction

Efficiency is defined as the choice of alternatives that produce the largest output with the application of given resources or the one that uses the minimum inputs to produce the given output (McKevitt and Lawton, 1994). Efficiency is supposed to be attained when a bank is not in a position to reduce the quantity of inputs to produce the same level of output (Resti, 1997). Cost Efficiency, a foremost component of efficiency is defined as the effective choice of inputs together with input prices which aims to minimize production cost. Cost Efficiency measures the relative performance of the firm as against the best practice firm which is managing its operating cost at the lowest for producing the same output under the similar technological conditions as faced by the concerned firm. It helps to know how close a firm's cost is to what best practice firm's cost would be for producing the same level of output (Weill, 2004). It suggests possibility to trim down the cost further so that the firm can operate efficiently at the minimum cost. The cost efficiency of banking system is imperative for various stakeholders especially the bank management. Information about cost efficiency assists bank management to determine if the level of cost incurred exceeds or meets the acceptable standards. Banks can take the advantage of competitive environment only if these perform efficiently in the market by maintaining their cost at minimum level. The Cost Efficiency score of the given firms can vary between 0 and 1. Firm achieving efficiency value of 1 is said to be the most efficient firm while firm having a score of less than 1 is supposed to be an inefficient firm. A firm is considered to be inefficient in cost when with the given input prices and inputs-outputs quantities, it does not reach its minimum level of costs.

Several researchers have studied the factors affecting cost efficiency of banks. Variables as size (Niazi, 2003; Hassan, 2005; Burki and Niazi, 2006; Pasiouraset al., 2007; Uddin and Suzuki, 2011; Gulati, 2011b; Raina and Sharma, 2013), Return on Assets (Niazi, 2003; Hassan, 2005; Pasiouraset al., 2007; Ioanniset al., 2008; Gulati, 2011b; Raina and Sharma, 2013), Non-Performing Assets (Burki and Niazi, 2006; Brack and Jimborean, 2010; Staubet al., 2010), Operating Expenses to Total Expenses (Niazi, 2003), Loan to Total Assets (Hassan, 2005; Ioanniset al., 2008), Interest to Total Assets (Niazi, 2003), Equity to Total Assets (Pasiouraset al., 2007; Ioanniset al., 2008; Brack and Jimborean, 2010), Ownership dummy (Staubet al., 2010; Uddin and Suzuki, 2011; Gulati, 2011b), Market share of bank (Ioanniset al., 2008; Staubet al., 2010), Gross domestic product

per capita (Pasiouraset *al.*, 2007; Brack and Jimborean, 2010) and Inflation (Brack and Jimborean, 2010) have been covered in literature. **A synoptic view of these studies explaining the above mentioned variables is given in Table: 1 as follows:**

Table: 1 Synoptic View of Studies on Factors affecting Cost Efficiency Scores of Banks

Author (Year)	Sample (Country)	Independent Variable	Results	
			Positive and Significant Variables	Negative and Significant Variables
Niazi (2003)	23-40 commercial banks (Pakistan)	<ul style="list-style-type: none"> • Number of Branches • Natural Log of Assets • Time Trend • Earning Assets to Total Assets • Total Expenditure to Total Income • Total Income to Total Employees • Operating Expenses to Total Employees • Operating Expenses to Total Expenses • Net Profit to Total Assets • Interest Income to Earning Assets • Total Income to Total Assets • Loans to Deposits Ratio 	<ul style="list-style-type: none"> • Total Income to Total Employees • Operating Expenses to Total Employees • Net Profit to Total Assets • Loans to Deposits Ratio 	<ul style="list-style-type: none"> • Number of Bank Branches • Time Trend • Operating Expenses to Total Expenses • Interest Income to Earning Assets • Total Income to Total Assets
Hassan (2005)	43 Islamic Banks (21 Countries)	<ul style="list-style-type: none"> • Total Assets • Return on Assets • Return on Equity • Loans to Total Assets 	<ul style="list-style-type: none"> • Total Assets • Return on Assets • Return on Equity • Loans to Total Assets (Scale Efficiency) 	_____
Burki and Niazi (2006)	23-40 commercial banks (Pakistan)	<ul style="list-style-type: none"> • Logarithm of Bank Total Assets • Interest Income to Earning Asset • Loans to Deposits Ratio • Private Bank Dummy • Foreign Bank Dummy • Non-Performing Assets to Total Loans • Number of Bank Branches 	<ul style="list-style-type: none"> • Logarithm of Bank Total Assets • Interest Income to Earning Asset • Loans to Deposits Ratio • Private Bank Dummy • Foreign Bank Dummy 	<ul style="list-style-type: none"> • Non-Performing Assets to Total Loans • Number of Bank Branches

<p>Pasiouras et al. (2007)</p>	<p>16 Banks (Greek)</p>	<ul style="list-style-type: none"> • Equity Capital to Total Assets • Logarithm of Total Assets • Number of Branches • Number of ATMs • GDP Per Capita • Unemployment Rate • Disposal Income of Households In The Region to Total Disposal Income of Households In Greece • Total Gross Fixed Capital Formation to GDP 	<ul style="list-style-type: none"> • Equity Capital to Total Assets (Technical Efficiency) • Logarithm of Total Assets • Number of ATMs (Technical and Cost Efficiency) • Disposal Income of Households In The Region to Total Disposal Income of Households In Greece (Cost Efficiency) 	<ul style="list-style-type: none"> • Number of Branches (Technical and Cost Efficiency) • GDP Per Capita • Unemployment Rate (Technical and Cost Efficiency)
<p>Ioannis et al. (2008)</p>	<p>34 banks, varying across years (Greek)</p>	<ul style="list-style-type: none"> • Equity to Total Assets • Profits to Total Assets • Loans to Assets Ratio • Each Bank's Assets to The Total Assets of All Banks • Herfindahl - Hirshman Index, Provisions to Total Loans Ratio • Number of Bank Employees to Assets Ratio • Rate of Change In GDP Per Capita 	<ul style="list-style-type: none"> • Equity to Total Assets • Profits to Total Assets • Each Bank's Assets to Total Assets of All Banks. 	<ul style="list-style-type: none"> • Loans to Assets Ratio • Provisions to Total Loans Ratio • Number of Bank Employees to Assets
<p>Brack and Jimborean (2010)</p>	<p>10 biggest banks (European and American Banks)</p>	<ul style="list-style-type: none"> • Equity to Total Assets • A Dummy For A Bank Having More Than 30% Foreign Share • Dummy For New Banks I.E. Bank Established After 1990 • GDP Per Capita • Tier 1 Capital Ratio • Market Capitalization • Inflation 	<ul style="list-style-type: none"> • Equity to Total Assets • Dummy For New Banks • Tier 1 Capital Ratio 	<ul style="list-style-type: none"> • GDP Per Capita
<p>Staubet et al. (2010)</p>	<p>Unbalanced panel data of 127 banks (Brazil)</p>	<ul style="list-style-type: none"> • Non-Performing Loans to Total Loans • Market Share In The Loans Market • Log of Equity • Dummy Variables For Bank Activity Like Complex, Credit, Treasury and Business, Retail • Bank Size Dummy As Large, Micro and Medium 	<ul style="list-style-type: none"> • Market Share In The Loans Market • Complex Dummy • Medium and Domestic Private Dummy (Allocative Efficiency) • State Owned Banks (Cost and Allocative Efficiency) 	<ul style="list-style-type: none"> • Non-Performing Loans to Total Loans (Allocative Efficiency) • Log of Equity (Allocative Efficiency)

		<ul style="list-style-type: none"> •Bank Ownership Dummy For Foreign, Domestic Private, State -Owned Banks 		
Uddin and Suzuki (2011)	4 Nationalized Commercial Banks (NCBs), 30 domestic Private Commercial Banks (PCBs) 4 Foreign Commercial Banks (FCBs) (Bangladesh)	<ul style="list-style-type: none"> •Foreign Banks Dummy •Private Banks Dummy •Islamic Banks Dummy •Non-Interest Income to Total Income •Unutilized Funds By Deducting Sum of Loans and Investments From The Total of Deposits and Borrowings •Asset Size of A Bank to Total Banking Assets •Banks' Number of Year on Operation 	<ul style="list-style-type: none"> • Foreign Banks Dummy 	<ul style="list-style-type: none"> • Private Banks Dummy • Non-Interest Income to Total Income • Unutilized Fund s By Deducting Sum of Loans and Investments From The Total of Deposits and Borrowings • Banks' Number of Year on Operation (Age)
Uddin and Suzuki (2011)	4 Nationalized Commercial Banks (NCBs), 30 domestic Private Commercial Banks (PCBs) 4 Foreign Commercial Banks (FCBs) (Bangladesh)	<ul style="list-style-type: none"> •Foreign Banks Dummy •Private Banks Dummy •Islamic Banks Dummy •Non-Interest Income to Total Income •Unutilized Funds By Deducting Sum of Loans and Investments From The Total of Deposits and Borrowings •Asset Size of A Bank to Total Banking Assets •Banks' Number of Year on Operation 	<ul style="list-style-type: none"> • Foreign Banks Dummy 	<ul style="list-style-type: none"> • Private Banks Dummy • Non-Interest Income to Total Income • Unutilized Funds By Deducting Sum of Loans and Investments From The Total of Deposits and Borrowings • Banks' Number of Year on Operation (Age)
Gulati (2011b)	73 to 77 Scheduled Commercial Banks (India)	<ul style="list-style-type: none"> • Logarithm of Assets •Return on Assets •Net NPA/Net Advances •Non-Interest Income to Total Assets •Public Sector Banks Dummy •Private Sector Banks Dummy 	<ul style="list-style-type: none"> • Non-Interest Income to Total Assets (Cost, Allocative and Technical Efficiency) • Logarithm of Assets (Cost and Allocative Efficiency) • Return on Assets (Technical Efficiency) 	<ul style="list-style-type: none"> • Return on Assets (Cost and Allocative Efficiency) • Net NPA/Net Advances (Cost and Allocative Efficiency) • Private Sector Banks Dummy (Cost Efficiency)
Raina and Sharma (2013)	64 Scheduled Commercial Banks (India)	<ul style="list-style-type: none"> •Ratio of Rural to Total Branches •Urban to Total Branches •Return on Assets •Size of The Banks •Advertisement Expenses to Total Expenses 	<ul style="list-style-type: none"> • Ratio of Rural to Total Branches (Cost and Technical Efficiency) • Urban to Total Branches (Cost and Technical Efficiency) • Size of The Banks • Advertisement Expenses to Total Expenses 	<ul style="list-style-type: none"> • Urban to Total Branches (Allocative Efficiency) • Return on Assets (Allocative Efficiency)

The review of studies makes it clear that there exist sufficient studies on measuring the impact of various factors on cost efficiency but with specific reference to India, an evident research gap exists as only two studies namely, Gulati (2011b) and Raina and Sharma (2013) are available that have identified the factors affecting Cost Efficiency. But these studies are unable to capture the holistic impact of all bank specific, industry specific and economy specific factors on the efficiency. *Moreover*, the factors i.e. bank specific, industry specific and macroeconomic specific variables affecting cost efficiency have been selected at random by the researchers. Random selection of variables may restrict generalisation of results. As a result there is some extent of subjectivity and arbitrariness in the results obtained. Thus, there is a need to put all variables into a systematic framework and then assess their impact on cost efficiency. The present study puts these independent variables in a well-defined structure namely CAMEL framework. CAMEL Framework was developed in the U.S in 1979 and its supervisory regulators include the Federal Reserve, the Office of the Comptroller of the Currency, National Credit Union Administration and Federal Deposit Insurance Corporation. CAMEL framework is an assessment criterion or a quantitative technique used to classify banks' overall condition. It evaluates the performance of banks through some vital parameters as C- Capital Adequacy, A- Asset Quality, M- Management Soundness, E- Earning Quality and L- Liquidity Management covering prominent aspects of banking business. Thus, in the current paper the variables are selected on the basis of CAMEL covering 13 variables under 5 headings. Along with these variables the study controls the effect of size and time. Moreover, Industry specific variables as ownership dummy and market share in terms of total assets and economy specific variables as Inflation and Gross Domestic Product have also been taken. Thus the results would provide wholesome and holistic view of factors affecting cost efficiency of banks capable of generalisation of results.

Thus in the Indian context, there is a gross need to determine the factors affecting cost efficiency of the banking sector. The present article is the first to provide empirical evidence on factors affecting cost efficiency of Indian Commercial Banks from all the three aspects.

Database and Methodology

Sample of the study

The sample of the study includes all the Scheduled Commercial Banks operating in India during 1991-92 to 2012-13. The number of banks varies across time due to missing observations and **non-availability of data** for some banks for certain years.

Resultantly, an effective sample of banks varies from minimum of 72 to maximum of 84 from year to year.

Time Period of the study

The time period of 22 years from 1991-92 to 2012-13 has been taken. It represents different vital phases through which Indian Economy has travelled. The initial years witnessed prosperity for the Indian Banks as they were capitalising the benefits of various reforms introduced in the banking sector in the 1990's as Narasimham Committee Report first in 1991, second in 1998, Basel Norms in 1998, followed by Know Your Customer (KYC) and Anti-money Laundering (AML) etc. The middle years were gloomy for the banks as the US financial bubble hit the global financial sector adversely and Indian Banks too faced the heat. The latter years signify the time period when the economy was trying to recover from global financial crisis awaiting prosperity.

Data Source

The source of financial data is the official website of Reserve Bank of India (RBI) which is considered as the most comprehensive database for research in banking.

Methodology Adopted: Data Envelopment Analysis (DEA)

The article follows a two-stage analysis; in the first stage cost efficiency for each bank is calculated over the total time period of 22 years from 1991-92 to 2012-13 using Data Envelopment Analysis (DEA). Data Envelopment Analysis (DEA) is a linear programming based technique employed for assessing the relative performance of a set of firms against the best-observed performance. DEA takes the actual data of firm's operations for calculating the efficiency scores along with efficient frontier created as the piecewise linear combination of the "most efficient firms". Thus efficiency is in relation to the "best observed value", rather than an "absolute value" (Rajput and Gupta, 2011). DEA has the capability to consider multiple inputs and outputs so that performance can be best modelled. As multiple inputs and outputs are used to calculate

efficiency for this DEA tries to determine the weight using linear programming technique so as to maximize the ratio weighted output to weighted input. A firm in DEA is known as Decision Making Unit (DMU). For calculating efficiency scores, DEA requires the selection of inputs and outputs. To evaluate the efficiency of the banks, Intermediation Approach is used in the paper as it assumes that banks act as financial intermediaries whose main aim is to obtain funds from the savers and lend these funds further to the borrowers for making profit. According to Intermediation Approach, this paper uses four inputs and three outputs. Deposits, borrowings, fixed assets and numbers of employees are the inputs whereas investments, loans and advances and non-interest income are the various outputs used in the study. In addition, Prices of inputs were calculated.

Panel Data Tobit Regression

In the second stage of analysis, Panel Data Tobit Regression model is used with cost efficiency scores obtained in the first stage as dependent variables. Panel Data Tobit model is proposed by James Tobin (1958) to describe the relationship between a censored dependent variable and independent variables. The simple application of OLS estimation procedure in censored dependent variable may produce biased estimates if there is significant position of the observation equal to 1 (Saxonhouse, 1976; Resende, 2000; Kumar and Gulati, 2008; Gulati, 2011). Thus, Panel Data Tobit model is applied due to the censored nature of the dependent variable as in the current situation the efficiency scores are censored in nature lying in range of 0 to 1.

Explanatory Variables and Hypotheses development

Several bank, industry and economy specific factors may influence a particular banks' Cost efficiency. To reduce the randomness leading to arbitrariness in the selection of variables, CAMEL framework is used to pick up the bank specific variables simultaneously controlling other micro and macro factors. For building the hypotheses, theoretical as well as empirical relationship of various variables with cost efficiency is considered. These variables are summarised along with their hypotheses as follows in Table: 2.

Table: 2 Hypotheses of the variables used in the regression model

Framework	Description of variables representing Framework	Symbol	Studies supporting these variables	Explanation	Expected Signs
C-Capital Adequacy	Capital to risk weighted assets ratio	CAR	Bhattacharyya <i>et al.</i> , (1997), Das and Ghosh (2006), Gupta <i>et al.</i> (2008), Ghosh (2009), Kumar and Gulati (2009) and Gulati (2011a)	High CAR depicts that well -capitalized banks require less borrowing which leads to reduction in their cost of borrowing and makes them efficient (Gupta <i>et al.</i> , 2008 and Ghosh, 2009). Besides, it can absorb greater level of unexpected losses.	+
	Equity to Total Assets	ETA	Grigorian and Manole (2002), Jaffry <i>et al.</i> (2005), Pasiouras <i>et al.</i> (2007), SemihYildirim and Philippatos (2007), Ioannis <i>et al.</i> (2008), Sufian and Noor (2009), Chauhan and Pal (2009), Brack and Jimborean (2010), Sufian and Habibullah (2010), Sufian <i>et al.</i> (2012a), Sanchez <i>et al.</i> (2013), Pančurová and Lyócsa (2013) and Raphael (2013), Sufian and Kamarudin (2015)	A high proportion of equity capital would decrease the cost of capital of a bank thus enhancing the profitability and efficiency of the banks (Molyneux, 1993).	+
A-Asset Quality	Net Non-Performing assets (NPAs) to Net advances	NPANA	Caner and Kontorovich (2004), Burki and Niazi (2006), Staub <i>et al.</i> (2010), Gulati (2011b), Garza-García (2012) and Noor and Ahmad (2012)	Higher Net Non - Performing assets (NPAs) reflect rise in bad quality of loans in relation to total loans and advances indicating lower efficiency of a bank.	-
	Total Investments to Total Assets	TITA	Ataullah and Le (2006) and Ketkar and Ketkar (2008)	Investments in government securities, other approved securities, shares, debentures etc help banks to earn good returns with low risk and to protect themselves from huge NPAs, but investments are often considered as evidence of lazy banking as the primary business of the banks is to lend (Ketkar and Ketkar, 2008). The higher level of investment may also indicate poor credit off -take or conservative lending (Chisti, 2012).	+/-
	Total Loans and advances to Total Deposits	TATD	Niazi (2003), Burki and Niazi (2006), Ariff and Can (2008) and Raphael (2013)	Higher ratio depicts that higher loans and advances are formed from deposits by banks. Alternatively this high ratio indicates that the banks are at high risk due to probable failure of repayment of loan and interest from the borrowers' side.	+/-
M-Management Soundness	Total Expenses to Total Income	TETI	Ataullah and Le (2006)	A high ratio implies less efficient management suggesting that the banks are not able to maintain their expenses at the minimum (Pasiouras and Kosimidou, 2007), while a lower ratio indicates greater profitability of the banks (Makkar and Singh, 2012).	-
	Operating Expenses to Total Expenses	OETE	Niazi (2003), Das and Ghosh (2006), Sufian (2009), Sufian and Noor (2009), Sufian and Habibullah (2010), San <i>et al.</i> (2011), Garza - García (2012), Sufian <i>et al.</i> (2012a), Raphael (2013) and Sufian and Kamarud in (2015)	Decrease in operating expenses may lead to higher profitability and it also improve the efficiency of the banks.	-
	Business (Deposits + loans and advances) to total number of employees	BPE	Gupta <i>et al.</i> , (2008), Kumar and Gulati (2009), Bala and Kumar (2011), Gulati (2011a)	Higher the productivity of the workforce of a bank, higher the efficiency of a bank in providing services to the customers.	+
	Profit earned after tax to Total Assets	ROA	Caner and Kontorovich (2004), Hassan (2005), Das and Ghosh (2006), Ariff and Can (2008), Chauhan and Pal (2009), Sufian and Noor (2009), San <i>et al.</i> , (2011), Pančurová and Lyócsa (2013), Sanchez <i>et al.</i> (2013), Raphael (2013)	A higher ROA indicates superior quality of assets in generating income which leads to higher efficiency of banks (Ataullah and Le, 2006).	+

E- Earning Quality	Spread to Total assets	STA	Raphael (2013), Sanchez <i>et al.</i> (2013)	High spread for a bank shows the ability of a bank in earning high interest on advances and paying low interest on deposits (Chisti, 2012).	+
	Non-Interest Income to Total Income	NITI	Ariff and Can (2008), Sufian (2009), Sufian and Habibullah (2010), Uddin and Suzuki (2011), Gulati (2011b), Sharma <i>et al.</i> (2012) and Raphael (2013)	Higher share of non-interest income shows that bank is less dependent on the interest income. Moreover, this diversification helps banks to earn additional profits and indicates managerial efficiency (Sufian, 2009).	+
L- Liquidity Management	Cash to total Deposit	CDR	_____	The optimal amount of cash maintained with banks will help them to maintain a balance between profitability and liquidity. Ignoring liquidity may create financial problems and result in mess with the subsequent withdrawal of deposits (Alshatti, 2015). On the other hand, a higher proportion of a bank's deposits in the form of cash and cash equivalents indicate that banks have not lent their money or invested their money to generate income.	+/-
	Liquid Assets to Total Assets	LATA	Das and Ghosh (2009) and Ghosh (2009)	High Liquid Asset to Total Asset ratio indicates incompetence on the part of bank management in organizing their resources in higher interest yielding assets (Elsiefy, 2013).	-
Bank Size	Natural Logarithm of Total Assets	LNTA	Ataullah and Le (2006), Das and Ghosh (2006), Burki and Niazi (2006), Pasiouras <i>et al.</i> (2007), Semih Yildirim and Philippatos (2007), Ghosh (2009), Sufian (2009), Sufian and Noor (2009), Chauhan and Pal (2009), Sufian and Habibullah (2010), San <i>et al.</i> (2011), Sufian <i>et al.</i> (2012), Noor and Ahmad (2012), Raphael (2013), Pančurová and Lyócsa (2013), Sanchez <i>et al.</i> (2013)	Banks larger in size are relatively better than banks smaller in size as they can easily expand their business and can compete with their counterparts (Sufian, 2009). However, increase in size may lead to decrease in profits due to complexity of the operations of larger banks (Pasiouras and Kosmidou, 2007).	+/-
	For dummy value, 1 for the Reformatory era and 0 for Post Reformatory Era is taken.	TD	_____	Time Dummy is used to incorporate the effect of introduction of reforms on the efficiency of banks.	+/-
Industry Specific	For Public Sector Banks with a value of 1 assigned to these and 0 for all other banks	PUBD	Bhattacharyya <i>et al.</i> (1997), Sathye (2003), Ataullah and Le (2006), Varadi <i>et al.</i> (2006), Chatterjee and Sinha (2006), Das and Ghosh (2006), Sanjeev (2006), Debasish (2006), Sahoo <i>et al.</i> (2007), Gupta <i>et al.</i> (2008), Ketkar and Ketkar (2008), Kalluru and Bhat (2009), Chauhan and Pal (2009), Gulati (2011a), Sharma <i>et al.</i> (2012), Prabhakar <i>et al.</i> (2012), Karimzadeh (2012)	To capture the impact of ownership, two dummies are considered as independent variables; one dummy for Public Sector Banks (PUBD) and another dummy of Private Sector Banks (PVTB) is created, while Foreign Sector Banks are considered as the reference sector.	+/-
	For Private Sector Banks with a value of 1 assigned to these and 0 for all other banks	PVTB			+/-
	Share of assets held by bank in relation to total assets of banking sector	MSTA	Grigorian and Manole (2002), Garza -Garcia (2012)	A bank having high market share is able to compete effectively in the market (Garza -Garcia, 2012).	+
Economy Specific	Wholesale Price Index is considered for computing the inflation by taking 2004-05 as base year	INF	Grigorian and Manole (2002), Jaffry <i>et al.</i> (2005); Brack and Jimborean (2010); Sufian <i>et al.</i> (2012), Pančurová and Lyócsa (2013), Sanchez <i>et al.</i> (2013) and Sufian and Kamarudin (2015)	Inflation directly affects the interest rate of banks thus directly affecting their efficiency.	-
	Natural Logarithm of Gross Domestic Product	LNGDP	Grigorian and Manole (2002), Jaffry <i>et al.</i> (2005), Sufian and Noor (2009), Sufian <i>et al.</i> (2012) and Sufian and Kamarudin (2015)	High Gross Domestic Product indicates favourable economic conditions prevailing in the economy. This enables banks to earn better returns from their loans and advances (Pasiouras and Kosmidou, 2007).	+

Results and Discussion: Panel Tobit Regression

The results of Panel Tobit Regression focusing on determinants of Cost Efficiency are presented in Table: 3. The results are based on year-wise observation of 1790 banks for a period of 22 years from 1991-92 to 2012-13.

Table: 3 Results of Panel Tobit Regression

Independent Variables		Dependent Variable: Cost Efficiency		
Framework	Symbol	Coeff.	Std. Err.	P>z
Capital Adequacy	CAR	-0.0001482	0.0004766	0.756
	ETA	0.0030656*	0.000893	0.001
Asset Quality	NPANA	-0.003494*	0.0008697	0.000
	TITA	0.0015632*	0.0005698	0.006
	TATD	-0.0001692*	0.0000515	0.001
Management Soundness	TETI	-0.0022729*	0.0004151	0.000
	OETE	0.0010241	0.0006293	0.104
	BPE	0.0006797*	0.0001034	0.000
Earning Quality	ROA	-0.0125482*	0.0030152	0.000
	STA	-0.0022854	0.0057026	0.689
	NIITI	0.0012609***	0.0006796	0.064
Liquidity Management	CDR	0.0020995*	0.0006919	0.002
	LATA	-0.0074049*	0.0007408	0.000
Bank Size Time	LNTA	-0.0032673	0.0065005	0.615
	TD	0.0364655***	0.0191009	0.056
Industry Specific	PUBD	0.0230593	0.0258513	0.372
	PVTD	-0.0010205	0.0203091	0.96
	MSTA	-0.0019776	0.0032669	0.545
Economy Specific	INF	-0.0133444*	0.0010153	0.000
	LNGDP	0.8574649*	0.0892392	0.000
	Const	-6.694423*	0.8175374	0.000
Log Likelihood		221.62775		
Wald chi2(22)		611.81*		

*, ** and *** significant at 1%, 5% and 10% level of significance respectively

As seen from Table: 3 that when Panel Tobit Regression is run with Cost Efficiency scores as the dependent variable, it is observed that contrary to our hypothesis (H_1), CAR reveals a negative, though insignificant relationship with Cost Efficiency. Equity to Total Assets (ETA) has positive and statistically significant relationship with Cost

Efficiency. This relationship is significant at 1% level of significance. Net Non-Performing Assets to Net Advances (NPANA) reveals a negative relationship and is statistically significant at 1% level of significance for Cost Efficiency. Total Investments to Total Assets (TITA) exhibit positive and significant relationship with Cost Efficiency. Contrary to the hypothesis, Total Loans and advances to Total Deposits (TATD) discloses negative and significant relation with Cost Efficiency which is significant at 1% level of significance. Total Expenses to Total Income (TETI) has negative impact, as expected, on the Cost Efficiency and is statistically significant at 1% level of significance. Operating Expenses to Total Expenses has positive relation with Cost Efficiency, but it is insignificant. Business per Employee (BPE) has positive impact on Cost Efficiency and is statistically significant at 1% level of significance. Return on Assets (ROA) reveals a negative relationship with Cost Efficiency and is statistically significant at 1% level of significance. Spread to Total Assets (STA) is expected to have positive impact but it turned out be reverse in case of Cost Efficiency although it is insignificant. Non-Interest Income to Total Income (NIITI) exhibits positive relationship with Cost Efficiency which is statistically significant at 10% level of significance. Cash Deposit Ratio (CDR) reveals a positive relationship and is statistically significant at 1% level of significance for Cost Efficiency. Liquid Assets to Total Assets (LATA) reveals a negative relationship and is statistically significant at 1% level of significance for Cost Efficiency. Size (LNATA) reveals negative relationship with Cost Efficiency although it is insignificant. Time Dummy (TD) reveals a positive relationship with Cost Efficiency and is statistically significant at 10% level of significance. Public Dummy (PUBD) reveals a positive but insignificant relationship with Cost Efficiency. Private Dummy (PVTD) has negative and insignificant relation with the Cost Efficiency. Market Share in terms of Total Assets has negative relation with Cost Efficiency but is statistically insignificant. Inflation (INF) reveals negative relationship and is statistically significant at 1% level of significance for Cost Efficiency. Log of Gross Domestic Product (LNGDP) reveals positive relationship and is statistically significant at 1% level of significance for Cost Efficiency.

The Panel Tobit Regression Analysis has been run to test the hypotheses. All variables i.e. bank specific, industry specific and economy specific for which the hypotheses have been tested are stated as follows:

i. Capital Adequacy Ratio (CAR)

H₁- There is a positive relationship between Capital Adequacy Ratio and Cost Efficiency.

Contrary to our hypothesis (H₁), CAR reveals a negative relationship with cost efficiency in our results. This negative relation implies that banks with higher Capital Adequacy Ratio tend to have lower efficiency scores. CAR provides cushion to banks against the unexpected losses. Indian Scheduled Commercial Banks are averse to risk in nature. Due to this, on one hand, they invest in safer and low earning portfolios (Bhattacharyya *et al.*, 1997 and Kumar and Gulati, 2009) and on the other tend to maintain a high CAR of much higher than the prescribed norm of 9%. As a result, there is disequilibrium between the inputs and outputs affecting efficiency negatively, thus leading to rejection of the hypothesis. The findings are consistent with earlier findings of Bhattacharyya *et al.* (1997), Kumar and Gulati (2009) and Gulati (2011a) who found that CAR had negative relation with the efficiency scores.

ii. Equity to Total Assets (ETA)

H₂- There is a positive relationship between Equity to Total Assets ratio and Cost Efficiency.

Equity to Total Assets (ETA) reveals positive relationship with Cost Efficiency suggesting that banks with higher equity tend to have higher efficiency scores. This positive coefficient of equity to total assets portrays that banks with more capital are more efficient as with their strong capital base they are able to face unexpected losses specifically as those arising from Non-Performing Assets (NPAs). They can expand their business to earn better profits. Moreover, highly capitalized banks are better capable of facing economic difficulties than thinly capitalized ones (Dietrich and Wanzenried, 2009). Our results are supported by Grigorian and Manole (2002), Pasiouraset *al.* (2007), SemihYildirim and Philippatos (2007), Ioanniset *al.* (2008), Sufian and Noor (2009), Brack and Jimborean (2010), Sufian and Habibullah (2010), Sufianet *al.* (2012), Sanchez *et al.* (2013), Pančurová and Lyócsa (2013) and Raphael (2013) who reported the positive association of ETA with efficiency of banks, thus providing support that higher capital helps banks to be less dependent on external funding resulting in higher efficiency.

iii. Net Non-Performing Assets to Net Advances (NPANA)

H₃- There is a negative relationship between Non Performing Assets (NPA) to Net Advances and Cost Efficiency.

Net Non-Performing assets to Net Advances (NPANA) reveals a negative relationship

with Cost Efficiency which depicts that high level of Non-Performing Assets adversely affect the efficiency of banks. This sign also depicts that Indian Scheduled Commercial Banks are not managing their assets properly. Increased NPAs lead to deterioration in the asset quality of the banks thus engulfing banks in the vicious circle of asset liability mismatch, resulting in input-output mismatch and hence creating inefficiency among banks. Our findings are consistent with earlier findings of Caner and Kontorovich (2004), Burki and Niazi (2006), Staubet *al.* (2010), Gulati (2011b), Garza-García (2012), and Noor and Ahmad (2012).

iv. Total Investments to Total Assets (TITA)

H₄- There is a positive/negative relationship between Total Investments to Total Assets and Cost Efficiency.

It is observed that total investments to total assets exhibit positive relationship with Cost Efficiency. This positive relation depicts that Indian Scheduled Commercial Banks are required to maintain a specific proportion of their demand and time deposits in the form of gold and government approved securities. This safeguards their customer's money as well as provides funds to government for the development of the economy. From these investments, banks get stable and consistent returns without risk. Investments help Indian Scheduled Commercial Banks to cushion themselves against bad loans and maintain high efficiency. Rather than losing their scarce resources in NPAs, it seems better for Indian Banks to invest in safer channels like government securities which generate constant returns. Our results corroborate with Atallah and Le (2006) who reported that low risk approach of banks helps them to earn steady returns and thus maintain their efficiency. However the results contradict with Ketkar and Ketkar(2008) who reported negative association of investments to total assets with efficiency. This study belongs to a time period immediately after reforms when banks were focusing more on earning high returns by lending loans and advances rather than investing in low return channels, thus leading to contradictory results.

v. Total Loans and advances to Total Deposits (TATD)

H₅- There is a positive/negative relationship between Total Loans and advances to Total Deposits and Cost Efficiency.

Total Loans and advances to Total Deposits (TATD) discloses negative and significant relation with Cost Efficiency. The negative relationship depicts that Indian Scheduled Commercial Banks lend more loans and advances out of their deposits but it turns into Non-performing Assets (NPAs) due to failure of repayment of loan and interest. As a result, they have to pay interest on their deposits devoid of receiving returns, therefore,

leading to high cost expenditure. Moreover, banks are required to incur additional expenses in terms of seizing, maintaining and ultimately disposing of securities to deal with these Non-performing loans (Karim *et al.*, 2010) thus escorting to negative sign.

vi. Total Expenses to Total Income (TETI)

H₆- There is a negative relationship between Total Expenses to Total Income and Cost Efficiency.

Total expenses to total income (TETI) have negative impact, as expected, on Cost Efficiency. The results show that increase in expenses lowers Cost Efficiency. This suggests that efficiency of banks can be improved through expense management by controlling the redundant expenditure. The study corroborates the past research as Ataullah and Le (2006) also found negative impact of total expenses to total income on the efficiency of the banks.

vii. Operating Expenses to Total Expenses

H₇- There is a negative relationship between Operating Expenses to Total Expenses and Efficiency.

As expected, Operating Expenses to Total Expenses (OETE) has positive relation with Cost Efficiency but it is insignificant. Perhaps banks employ highly qualified and professional staff on higher remuneration to compete in the market and try to squeeze efficiency out of them which leads to positive impact on the efficiency of the banks. Das and Ghosh (2006), Sufian and Noor (2009) and San *et al.* (2011) also found positive and significant impact of expenses on efficiency of the banks.

viii. Business per employee (BPE)

H₈- There is a positive relationship between Business per Employee and Cost Efficiency.

Business per employee (BPE) has positive impact on Cost Efficiency hence depicting that productivity of the workforce is important to improve the efficiency of banks. Banking services are personalised in nature. Banks offer services to customers through their employees only. Employees can create a direct impact on the minds of the customers and effect banking business. Good customer dealing increases business and brings efficiency. The findings of our study are consistent with Bala and Kumar (2011).

ix. Return on Assets (ROA)

H₉- There is a positive relationship between Return on Assets and Cost Efficiency.

Return on Assets (ROA) reveals a negative relationship with Cost efficiency. This negative sign depicts that bank managers focus on earning maximum profits, but they ignore the efficiency of banks in totality. In order to compete with the rivals, bank managers are given the profitability targets. Managers get pre-occupied in the

accomplishment of short term profit oriented targets. The vision of achieving efficiency by balancing between inputs with the outputs is lost. Our results are supported by Chauhan and Pal (2009), Gulati (2011a), Gulati (2011b) and Raina and Sharma (2013) who found negative association of ROA with Indian Banks' efficiency. Contrary to our results, Hassan (2005), Sufian and Noor (2009), Pančurová and Lyócsa (2013), Sanchez *et al.* (2013) and Raphael (2013) support a positive association with the efficiency of the banks. The contradiction perhaps is attributable to the differences in the sample size and countries.

x. Spread to Total Assets (STA)

H₁₀- There is a positive relationship between Spread to Total Assets and Cost Efficiency.

Spread to total assets (STA) has negative impact on Cost Efficiency but it is insignificant. It also represents that banks are not managing their Asset-Liability match well

xi. Non-Interest Income to Total Income to Total Assets (NIITI)

H₁₁- There is a positive relationship between Non-Interest Income to Total Income and Cost Efficiency.

It is observed that Non-Interest Income to Total Income exhibits positive relationship with Cost Efficiency. This positive relation describes that Indian Scheduled Commercial Banks are diversifying their activities to allied portfolios and non-interest income sources and thus enhance their efficiency scores. Rather, Non-interest income is more stable and less risky as compared to interest income which varies due to variation in the interest rates (Ariff and Can, 2008). Our findings are in line with Sufian (2009), Gulati (2011b) and Raphael (2013) who found positive effect of Non-Interest Income on efficiency of banks.

xii. Cash Deposit Ratio

H₁₂- There is a positive/negative relationship between Cash Deposit Ratio and Cost Efficiency.

Cash Deposit Ratio (CDR) reveals a positive relationship with Cost Efficiency. The positive association with efficiency implies that optimal amount of cash maintained with banks helps them to manage their business efficiently as they are able to fulfil the cash need of depositors timely.

xiii.Liquid Assets to total Assets (LATA)

H₁₃- There is a positive/negative relationship between Liquid Assets to Total Assets and Cost Efficiency.

Liquid Assets to total Assets (LATA) reveals a negative relationship with Cost Efficiency which implies that banks with more liquid assets are not able to manage these. Excess liquidity mars profitability which affects efficiency. Our results are supported by Ghosh (2009) who reported that liquid assets had negative impact on the efficiency of banks.

xiv.Size (LNTA)

H₁₄- There is a positive/negative relationship between Size and Cost Efficiency.

Size (LNTA) reveals negative relationship with cost efficiency. The negative sign indicates that the larger banks tend to exhibit lower efficiency scores. Larger banks are able to enjoy economies of scale by reducing their cost but extending their size beyond a point creates diseconomies (Eichengreen and Gibson, 2001 and Tariq and Arfeen, 2012). Indian Banks are going in for excessive expansion for larger coverage. Such an extent of decentralisation results in losing control with respect to administrative issues leading to inefficiency. It becomes difficult for the management to keep a close eye on the activities of banks. Large banks have problem of administration and management due to large numbers of complex operations (Pasiouras and Kosmidou, 2007). Our finding is consistent with previous studies, as Chauhan and Pal (2009), Sufian and Habibullah (2010) and San *et al.*(2011) who also found negative impact of size on the efficiency of banks.

xv.Time Dummy

H₁₅- There is a positive/negative relationship between time dummy and Cost Efficiency.

Time Dummy reveals a positive relationship with cost efficiency. This depicts that Indian Scheduled Commercial Banks (SCBs) exhibit higher Cost Efficiency Scores in Reformatory Era as compared to Post Reformatory Era. This suggests that reforms improved the performance of banks. Reforms provided banks with a liberalised environment which perhaps aided banks in adjusting their inputs and outputs in an optimum way. But in the Post Reformatory Era, banks seemed to have disturbed the inputs and output equilibrium by investing instantly and exorbitantly in the upgradation of technology without a proportionate generation of returns, leading to deteriorated efficiency during these years. In addition, the global financial crisis became a contributing factor in decelerating the performance of banks in the Post Reformatory Era.

xvi. Ownership Dummy

H₁₆- There is a positive/negative relationship between Public Dummy and Cost Efficiency.

H₁₇- There is a positive/negative relationship between Private Dummy and Cost Efficiency.

Public Dummy reveals a positive relationship with cost efficiency. The positive coefficient of public dummy depicts that Public Sector Banks are better than Foreign Sector Banks throughout the study time period. Their long existence has been a major contributing factor in their performance as compared to their counterparts. Private Dummy has negative but insignificant relation with the Cost Efficiency though it is insignificant. This certainly depicts that in relation to Private Sector Banks, Foreign Sector Banks are better in controlling their cost.

xvii. Market Share in terms of Total Assets

H₁₈- There is a positive relationship between Market Share in terms of Total Assets and Cost Efficiency.

Our results show a negative sign of Market Share with the Cost Efficiency depicting that when banks expand their market it involves them extra costs thereby lowering the Cost Efficiency. Garza-García (2011) also found mixed results with Market Share in terms of Assets as the study found that it had positive relation with Technical Efficiency whereas negative association with Pure Technical and Scale Efficiency.

xviii. Inflation (INF)

H₁₉- There is a negative relationship between Inflation and Cost Efficiency.

Inflation reveals negative relationship. It highlights that inflation is unanticipated in Indian Economy. Indian Scheduled Commercial Banks are slow in adjusting their interest rates as per inflation trends. It results in increase in their costs more than their revenues, thus leading to negative impact on the efficiency parameters. Our results are in line with Grigorian and Manole (2002), Jaffry *et al.* (2005), Brack and Jimborean (2010), Sufian *et al.* (2012), Pančurová and Lyócsa (2013), Sanchez *et al.* (2013) and Sufian and Kamarudin (2015) who also reported that inflation had negative and significant impact on efficiency.

xix. Gross Domestic Product (LNGDP)

H₂₀- There is a positive relationship between Gross Domestic Product and Cost Efficiency.

Log of Gross Domestic Product reveals positive relationship with Cost Efficiency. Consequently the positive sign proposes that demand for financial services tends to grow more when economy expands and the living standard of people in the society

increases. The favourable economic conditions prevailing in an economy helps banks to earn better returns from their loans and advances. Grigorian and Manole (2002), Jaffry *et al.* (2005), Sufian and Noor (2009), Sufian *et al.* (2012a) and Sufian and Kamarudin (2015) support our results.

The results of above discussion are presented in a capsule form in Table: 4 as follows:

**Table: 4 Summary of Expected and Actual signs of the explanatory
 1. Implications and Future scope of the study**

Independent Variables		Expected Signs	Actual Signs	Reasons for Deviations
Framework	Symbol		Cost Efficiency	
Capital Adequacy	CAR	+	-	Indian Scheduled Commercial Banks have been facing chronic problem of NPAs. This forces them to maintain high CAR going beyond the prescribed limit and also make safe product portfolio. This generates mismatch between inputs and outputs resulting into negative impact on efficiency of the banks.
	ETA	+	++	
Asset Quality	NPANA	-	-*	-----
	TITA	+/-	++	-----
	TATD	+/-	-*	-----
Management Soundness	TETI	-	-*	-----
	OETE	-	+	-----
	BPE	+	++	-----
Earning Quality	ROA	+	-*	Indian Bank managers focus on earning maximum profits. Vision of matching inputs and outputs is lost. This leads to negative impact of ROA on efficiency of banks.
	STA	+	-	
	NIITI	+	+***	
Liquidity Management	CDR	+/-	++	-----
	LATA	-	-*	-----
Bank Size Time	LNTA	+/-	-	-----
	TD	+/-	+***	-----
Industry Specific	PUBD	+/-	+	-----
	PVTD	+/-	-	-----
	MSTA	+	-	-----
Economy Specific	INF	-	-*	-----
	LNGDP	+	++	-----

*, ** and *** significant at 1%, 5% and 10% level of significance respectively

The results highlights that the acronym CAMEL justifies the impact of vital parameters on cost efficiency of banks. First and foremost, capital adequacy has negative impact on cost efficiency of banks thus depicting that CAR beyond the prescribed limit creates

mismatch in assets and liabilities. In order to maintain a proper balance in outputs-inputs, asset driven strategies should be framed for correcting the mismatch focusing on shortening the duration of the asset portfolio. Similarly, liability driven strategies should also be formed basically concentrating on lengthening the maturity profiles of liabilities. Banks need to control NPAs as it affects asset quality and have deteriorated the cost efficiency. Indian Banks managers should increase focus on lending policies and credit risk management. They should follow strict credit appraisal procedure and undertake project monitoring while granting credit. Effective and regular follow up of loan and advances is required. At least after every quarter, banks should check the embezzlement or diversion of their funds leading to NPAs. The another parameter of CAMEL is Management which has mixed impact on cost efficiency as Total expenses to Total Income (TETI) has negative impact while Operating Expenses to Total Expenses (OETE) has positive impact. This suggests that banks are required to control their redundant expenditure by expense management and squeezing the best out highly qualified and professional staff. Further, earning depicted the negative impact on cost efficiency as ROA and STA both have negative sign. In order to improve the efficiency of banks, bank managers should not only focus on earning profits rather they should choose their input-output mix taking into consideration their prices. Furthermore, Liquidity Management is important parameters to boost the efficiency of the banks. Indian Banks need to more focus on Asset Liability Management. As, one of the measure of liquidity i.e., Cash Deposit Ratio has positive relation with efficiency but when all liquid assets were considered i.e. Liquid Assets to Total Assets, the relation turns to be negative. This somewhere depicts that Indian Scheduled Commercial Banks are not managing their liquid assets except cash properly thus leading to mismatch in the outputs and inputs. In order to maintain a proper balance in outputs-inputs (assets-liabilities), Indian Bank managers should have to utilize their liquid assets in the best possible alternative. They should seriously consider the risk assessment and risk management criteria by balancing their assets and liabilities.

For future research scope, the work can further be extended by considering revenue and profit efficiency parameters as dependent variables. Various risks faced by banks and off-balance sheet activities too can be taken into consideration. India is proposed to head towards merger of banks in Public Sector. The efficiency can be reevaluated after the merger.

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