

Factors Influencing Cost Efficiency in Leading Banks

“A Comparative Study of Banks Operating in UK and Germany Listed on London Stock Exchange”

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Abstract—This paper aims to examine factors influencing cost efficiency in leading banks operating in United Kingdom (market based economy) and Germany (bank based economy) and to compare findings of both these economies. Sample comprised of 8 leading banks of UK and 8 leading banks of Germany listed on London Stock Exchange. Data was collected from the internet, annual reports and some previous records of selected banks over the recent ten years period before, during and after the financial crisis from 2006-2015 having 80 number of observations from UK and 80 number of observations from Germany. Cost efficiency was taken as dependent variable while net interest margin, credit risk, bank size, profitability, income diversification and financial leverage were selected as independent variables. Panel data was analyzed by using pooled least square, fixed and random effects regression techniques, and Hausman specification test and redundant fixed effects tests were used to know most appropriate model. Pesaran's test of cross sectional independence was performed and descriptive and correlation analysis of UK and German banks were also executed. Results revealed that net interest margin, bank size, income diversification and profitability have significant positive relationship with cost efficiency for both economies while credit risk and financial leverage are insignificantly related with cost efficiency for Germany but positively and significantly linked with cost efficiency in case of UK banks.

Index Terms—Cost Efficiency, Leading banks, London Stock Exchange, Financial Crisis, Net Interest Margin, Credit Risk, Bank Size, Profitability, Income Diversification, Financial Leverage, Panel Data

1. INTRODUCTION

1.1 Aims and Background of Study

This research aims to investigate factors that affect cost efficiency in commercial banks operating in UK and Germany. Commercial bank is a profit making institution, acts as an intermediary between lenders and borrowers, fetch deposits from individual customers and business and then grants loans to those persons who need financial support. The German banking system is quite unique as it contains three pillars of high importance: privately owned commercial banks, including large banks with extensive branch networks; smaller, privately owned and regionally focused credit cooperatives; and public banks (or banks with government involvement) comprising the small, regionally oriented savings banks and the larger Landesbanken. Banks and building societies operating in the UK collectively known as UK monetary financial institutions and they comprise the largest banking sector in Europe and the fourth largest in the world.

Efficiency is defined as an indicator showing the ability of managers of banks and its staff to keep the rate of increase in revenues and income at the level that surpasses the rate of increase in operational costs. Cost to income ratios are important to commentators on banking, however, and bank managements are often forced to focus on them and comment on them. If banks know how to allocate resources (real and financial) in the most productive and efficient manner and are capable to know those entrepreneurs who are most innovative, then they have influence on economic development. The belief of risk managers was that, “almost thirty percent of the risk a financial organization runs is because of operational losses” [1]. Cost efficiency gives a financial institution flexibility to explore and try new markets, products or technologies, to reward its shareholders and an edge over its competitors in terms of providing its customers various services at an economic price. Unlike credit and market risk, the operational risk is largely internal to banks, difficult to assess and has the potential to wipe out the very existence of the organization. Activities which not only lead to achieving intended goals but also assure economic benefits higher than inputs are efficient activities. According to Financial Stability Report of Bank of England in 2006, “financial system of UK has

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weathered well a series of disturbances over the past months. Major UK banks' capital levels and stated profitability have remained strong, with a minor decrease in efficiency scores". Cost efficiency and profit efficiency are two general concepts in the banking sector which represent banks performance. The advantages of measurement of efficiency with a particular objective are that the performance of commercial banks can be assessed in comparison with other banks and the impacts of government policies on commercial banks are also indicated by the efficiency estimates of commercial banks. A cost efficient bank produces the given level of outputs using the mix of given inputs at minimum possible cost. German banking system was characterized by: a reduced competition; a particularly high net interest spread; high costs, specifically in the case of private banks, with 75% of gains being absorbed by internal costs [2], so this could explain the relative decreased level of efficiency scores [3]. A firm that is not operationally efficient would fail to achieve satisfactory return on owner's equity and find it difficult to survive in adverse economic conditions. As banks run in highly competitive environment where they have ambiguous survival, therefore priority is given to bank efficiency in recent decades and it appears to be one of the most essential assets for banks. Cost efficiency measures how far or near the bank's costs are from the best practice bank's costs, producing the same output in same circumstances. Lower bank efficiency levels precede greater risk in the future [4]. Global financial crisis did pose negative effects on banking systems of many countries, thus cost optimization as well as efficiency have become crucial for commercial banks in this context. Furthermore, for sustainability of economic growth, the presence of an efficient and solid banking system in emerging economies is an essential situation. The first study on efficiency and productivity at a micro level was that of Farrel [5] but the literature on cost efficiency started to be applied to banks during the 90s. Big banks had an advantage over small banks, as evidenced from most studies, regarding the effect of bank size on efficiency, however this difference was seemed to be statistically insignificant in rare cases. Much interest has been shown regarding the study of banking efficiency in Asian countries in recent years. The layout of this paper is as follows. Section 2 presents review of literature on the topic. Third section provides study's hypotheses, summarizes variables of the study, portrays conceptual framework, presents the source and type of employed data, introduces sample and population of the study, describes tools and techniques used for data analysis and provides operationalization of variables. Section 4 provides the results and discussion of the study and section 5 presents this paper's main findings and conclusions, and

provides practical implications followed by recommendations and future research.

1.2 Problem Statement

A decreasing trend in cost efficiency scores both in Germany and UK was noticed over the period 1994 to 2006, that's why there was need to conduct further study on these two economies regarding this issue covering period before, during and after crisis. Germany was the least efficient country among the 15 examined by Arthur. D Little, just behind Portugal and the Netherlands [6]. Big banks in Germany which are actually most likely to benefit from economies of scale, in comparison with other categories of banks, had lowest cost efficiency both in year 2014 (78.1%) and as a long-term average (76.4%). Increase in expenses in banks of UK after the period of financial crisis must be seen in light of acquisitions and mergers of banks that appeared after the financial crisis, the synergies of which were not always visible. Big Five UK banks had cost to income ratios among the highest at the end of year 2015. Main problems to discuss here are that; since the financial crisis, banks of UK moving more slowly than their European competitors in their recovery and despite their struggles to cut costs and restructure, they are not expected to close the gap for years and they may never be as profitable as they were before the financial crisis. The key to create value and achieve competitive edge lies in the better operational efficiency and productivity of these institutions under such conditions.

1.3 Research Questions

- I. What factors determine cost efficiency in leading banks operating in UK and Germany?
- II. How well did the leading banks operating in UK and Germany perform financially before, during and after the crisis period?
- III. How do leading and competitive banks improve their operating efficiency?

1.4 Objectives of the Study

- I. To determine factors that have significant impact on cost efficiency of leading banks operating in UK and in Germany.
- II. To analyze the financial performance of leading banks operating in United Kingdom and Germany before, during and after financial crisis period.
- III. To compare findings of both UK and Germany and to give valuable suggestions for soundness of leading banks of both UK and Germany examined in this study. .

1.5 Significance of the Study

Present research is beneficial for regulatory authorities and policymakers as this will help to assess banks' operational efficiency and will help them to take quick action if the bank is deficient in this area in order to secure depositors and to limit damage in the system. Improving efficiency may persuade financial institutions to take excessive risk in order to defend market shares. The struggle for cost reduction or profit maximization tends to send positive signals to investors and shareholders regarding the future of the bank in which they invest, so this research is also helpful for investors in taking investment decisions. This research will help banks to decide best level of interest margins to win trust of their borrowers as well as their depositors. Also, if banks implement the financial intermediation function efficiently, they will encourage the economic growth of a country. This research is also helpful for future researchers to proceed further. This research is also helpful for banks' customers in their interaction with the banks.

1.6 Limitations

- I. The present research only focused 8 leading commercial banks operating in Germany and 8 leading commercial banks operating in United Kingdom. Future research can be carried out; by taking a larger sample from these two countries; by taking banks from whole Europe or by comparing other market based and bank based economies.
- II. The obtained data covers a short time period, which is of 10 years (2006 to 2015), due to its unavailability and time constraint. The future researchers can take a large time frame to conduct further analysis.
- III. This research preferred cost to income ratio to denote cost efficiency, future researchers can also preferred other financial indicators of cost efficiency and can also take in consideration some other variables representing financial performance of banks instead of cost efficiency.
- IV. This research is based on secondary data.
- V. Macroeconomic factors affecting banks cost efficiency have not been taken into account. The future researchers can also take in consideration these factors while studying and evaluating financial performance of banks.
- VI. No comparison has been made between the different types of banks. Future researchers can also undertake comparative study e.g. public and private banks, national and international banks, large and small banks etc.

2. LITERATURE REVIEW

This section aims to discuss various research studies and different theoretical concepts regarding factors influencing bank's liquidity and cost efficiency and presents different methods adopted by different researchers in different countries. A bank lending in high risk loans may exhibit a good cost to income ratio as deferred credit losses will not be reflected in its cost to income ratio [7]. Since for the operations and survival of banks, risk management is vital aspect, any variations in credit risk reflect on the health of banks' loan portfolio, That is, poor asset quality eventually increases the possibilities of failure of bank [8]. It was documented by Berger and DeYoung that cost efficiency is an important indicator of future problem loans. Cost inefficient banks may tend to have high non-performing loans due to bad management, bad luck, skimping or moral hazard. Fundamentally, the bad luck hypothesis reverted to exogenous factors comprising operating conditions. Also, credit risk was attributed to poor management practices reflected in reduced cost efficiency and poor underwriting and monitoring practices, skimping hypothesis dealt with the tradeoff between short term operating costs and future problem loans and the moral hazard one referred to the classical problem of excessive risk taking [9]. The efficiency of banking industry of Poland was analyzed for period 1997-2001 by using DEA and an intermediation approach. Cost efficiency estimates were calculated for a separate (domestic and foreign banks) and common multiyear frontier. The inputs included labor, deposits and capital, while the outputs included government bonds, loans and off-balance sheet items. Amazingly, neither capitalization nor the size of the bank was related to the efficiency estimates (in the second stage, a Tobit approach), but total loans to total assets was negative and significant, suggested that banks that took more risks were less efficient [10]. Naceur and Omran discussed that bank's net interest margin and cost efficiency were affected by individual bank characteristics such as credit risk and capital [11]. Phan, in his study on both developed and developing economies, employed Stochastic Frontier Analysis to estimate efficiency, and the effects of credit, operational and liquidity risks and environmental factors on bank efficiency both before and after the 2008 global financial crisis were examined by Tobit regression. The ratio loan loss reserve over gross loans that represented credit risks was found to have significant negative effect cost efficiency, at the 5 per cent level, implying that a bank with a greater loan loss reserves ratio would have lesser cost efficiency [12].

Andries [13], in line with Drake [14], stated that the increase in size of bank, measured by total assets, leads to increase in technical efficiency, but suggested that the optimal size of banks should be a topic of interest to be analyzed now more than ever, in the current context of

international economic and financial crisis and was also suggested in the same study that the differences in terms of efficiency when considering bank size have been decreasing during the last few years, as small banks (total assets lower than \$1billion) have experienced the highest growth in terms of efficiency with respect to medium sized banks (total assets greater than \$1billion but less than \$10 billion) and large ones (total assets greater than \$10billion). A positive association between efficiency of bank and entity's size for small and medium sized banks was suggested but it was insignificant in large entities [15]. Size of bank was found to be inversely linked with efficiency [16]. Many studies found results in line with the theoretical predictions of a positive link between size of bank and efficiency [17], [18] and [19] but contrary to this, very largest firms suffered from diseconomies of scale due to complexity, so that they were not as efficient as middle-sized insurers [20]. Efficiency performance of thirty two Vietnamese commercial banks was compared & estimated [21] over the period 2001 to 2005. They also investigated potential factors influencing this efficiency performance. Data Envelopment Analysis model was used to measure efficiency and slacks based model was used to measure super efficiency under variable returns to scale assumption. Efficient banks were in small number and large banks didn't guarantee high super efficiency scores relative to small banks.

It was argued that higher levels of equity can help a bank improve its cost to income ratio as equity is not only a regulatory requirement, but also a source of funds, which involves less administrative cost than the traditional deposits. Other things being equal, therefore a bank with more equity will have a lower cost to income ratio [22]. But Berger and Bonaccorsi di Patti [23] analyzed the relation between bank capital and efficiency in the US banking industry from 1990 to 1995 and in their study, lower capital ratios were linked with higher efficiency and contrary to their study, Fiordelisi, Marques-Ibanez and Molyneux [4] tried to test the link between bank efficiency and capital ratio in banking industry of Europe over the period 1995-2007 and found opposite result to that of [23]. In another study, According to the common efficiency frontier model, less capitalized commercial banks were more cost efficient as compared to well capitalized banks over period 2004-2010 [24], attributed to the idea that debt financing is cheaper than raising equity capital, hence more leveraged commercial banks appeared to be more cost efficient than more capitalized banks and this result was in line with the results found by [25], [26] & [27] and on the other hand, equity ratio positively affected efficiency of bank in new European Union states [24] and it could be said that, as capital is more expensive than debt, this imposed pressure on banks in the new European Union countries to reduce

their operating costs and this was in line with the results found by Fries & Taci [28] and by Yildirim & Philippatos [29].

The limitations of cost to income ratio have been discussed in many articles such as that by Osborne [30] who, for a sample of US banks, found no clear correlation between ROE and ratio of cost to income. In contrast, Francis [31] observed that cost to income ratio and the bank profitability were inversely related to each other. Rizvi [32] conducted a study to analyze the productivity of banking sector in Pakistan over the period 1993-1998 using Data Envelopment Analysis. According to his productivity indices the Pakistani banking sector was performing poor due to technological regress and suboptimal combinations of services and products. He suggested that this should be overcome by providing value added services and increase customer base. Alrafadi et al. [33] presented a comparative analysis regarding seventeen Libyan banks' performance over the period 2004 up to 2010 by using the Data Envelopment Analysis approach for estimating pure technical, technical and scale efficiency of sampled banks by using DEAP software, and tobit regression model was used for identifying potential efficiency's determinants in the second stage with software named Econometric Views. Their findings revealed positive link between efficiency of bank and ROA and this result is in line with the findings of Casu and Molyneux [34], indicated that lower inefficiency was exhibited by banks with higher profitability, similar to those of some earlier studies as [35], [36] and [37] etc. Generally, clients favored those banks which stated higher profitability ratios thus those banks attracted the deposits' biggest part and best prospective creditworthy borrowers as well. These situations created favorable climate for the profitable banks to be highly efficient from intermediation activities point of view [33]. Mesa et al. [15], in their study of factors influencing bank efficiency in European Union countries, summarized that the whole linear regression analysis indicated a strong direct relationship between the profitability of a bank, measured by ROAA ratio, and its efficiency ratio. Thus it could be said that the efficiency ratio is also a good indicator of banks' profitability. According to Dawood [38], in his study conducted on 23 commercial banks operating in Pakistan for the period of 2009 to 2012, cost efficiency was one of the variables that decide profitability.

An increase of non-interest income in gross revenues would increase the bank inefficiency's level and would cause a rise in variance of the effect of inefficiency, reflecting banks incapability to link the costs with the revenue from non-traditional activities, but also the lack of expertise of commercial banks from transition countries in these

activities [39]. Contrary to this, Mesa et al. [15] examined the main determinants influencing bank efficiency in European Union countries and indicated that income diversification was one of the strongest explanatory variables in the efficiency ratio; the higher the amount of other income, the better the efficiency. Diversification negatively affected bank efficiency, taking into consideration the loan diversification ratio. Banks showed a worse efficiency ratio as the proportion of non-traditional loans increases and this result was consistent with previous literature, stated that the investing diversification of banks does not balance the required increase in costs.

It was suggested that a long term but continuous approach to cost cutting is what is necessary to run a successful low cost bank [40]. Finally, the focus on costs was taken even further by James et al. [41], when they argued that, "banks must reduce their cost to income ratios below the 55 to 60% level if they are to avoid being taken over", this is because higher cost competitors are relatively disadvantaged as price competition drives down margins. Factors, which influenced this ratio, were structure of balance sheet, the state of economy or interest levels [42]. There is consensus among studies that the relationship between net interest margin and operating costs is positive, and there is agreement that banks pass these costs on to customers [43], [44]. Ratio of cost to income is used as a proxy for efficiency, assesses the bank management's quality also, as argued by Maudos and Solís [45] that it represents a spent cost for a selected asset and according to them this ratio negatively influenced interest margins. Shah and Jan [46] examined private banks' financial performance in Pakistan. Data was collected from Financial Statements Analysis of Financial Sector issued by State bank of Pakistan over the period 2006-2010. As a sample, Pakistan's top ten Private commercial banks were selected for the purpose of analysis of financial performance having 60% market share at that time. Regression analysis and correlation technique along with descriptive analysis were used in the study to estimate results. Interest income and ROA were taken as dependent variables while asset management, bank size and operational efficiency were independent variables of the study. Results showed that Operational efficiency had significant negative impact on both ROA and interest income. Horvath in his study of Czech banks found that lesser margins were exhibited by more efficient banks, also no evidence was found regarding banks with lesser margins would remunerate themselves with more fees. Hypothesis, that highly efficient banking systems are cooperative for funds' allocation as well as for financial intermediation, was encouraged according to results of this study [47]. Another study on European banks discovered a strong relationship between interest margins and their cost

to income ratios, indicated that highest the interest margin, lower the cost to income ratio [48]. Net interest margin was positively related with operating cost, diversification, bank soundness and market share of bank in Pakistan, while public share in banks and liquidity have moderate impact on net interest margin [49].

The efficiency of banks of Bulgaria and its factors were evaluated for 1999 to 2007 and it was indicated that liquidity, enterprise restructuring and capitalization were positively related to efficiency, while banking reforms had a negative influence [50] and similar to this, a negative and highly significant link between the ratio of loan to asset and cost inefficiency of bank was found [24] meaning that more aggressive commercial banks (engaged in more lending activities) in the EU were more cost efficient. Similar results were found by Altunbas et al. [25], Allen and Rai [26] and Yildirim & Philippatos [29]. Also, link between efficiency of bank and risk in the G7 (group of seven) countries along with Switzerland was analyzed over the period 2001-2007 [51] and it was found, by using the SFA, that capital and liquidity risk had a significant effect on bank efficiency.

Foreign banks which were providing services to foreign & business clients realized higher cost efficiency than foreign banks which were servicing domestic clients which were at par with private domestic banks [52]. In 2003, cost and profit efficiencies were evaluated by Hasan and Marton [36] in Hungarian banking over the period 1993 to 1998. Average cost inefficiency and profit inefficiency were found to be 28.76 and 34.50 respectively by using parametric approach. Banks with foreign ownership involvement were found to be significantly less inefficient than domestic banks and according to them, "the higher the share of the foreign involvement is the more efficient the bank is". Similarly, foreign & private ownerships and bank reforms were positively related with productive efficiency [53]. Also, the influence of ownership on efficiency of bank by employing stochastic frontier approach for 11 transition countries for period 1996-2000 was studied [16] and their results revealed that, foreign banks were more cost efficient as compared to other banks and this result was in similar with Koutsomanoli-Filippaki, Margaritis and Staikouras [54], as Koutsomanoli-Filippaki et al., assessed productivity and efficiency of bank for CEE countries over 1998-2003 and they discovered, domestic private and state-owned banks were less efficient relative to foreign banks, also, strong relations of concentration and competition with efficiency of bank were suggested by them. In another study, banks' cost efficiency from fifteen East European countries for time 1994 to 2001 was investigated [28] and according to their results, state owned banks were less

efficient than private banks and nonlinear link was underlined between cost efficiency and a progress of country in banking reform. Similarly, in another study on banks from twelve transition countries for time 1993-2000, foreign owned banks, as compared to state owned and private domestic banks, seemed to be less profit efficient but more cost efficient [29]. Also, the findings of Tochkov and Nenovsky indicated that foreign banks had higher efficiency [50]. Similarly, a new empirical evidence was provided by Sufian and Habibullah [55] on the efficiency of banking sector of Malaysia nearby 1997's Asian financial turmoil. Data, on Malaysian banks, was collected for time 1995 to 2008. Results of their study revealed that technical efficiency of foreign banks was higher relative to their domestic bank counterparts.

3. Research Methodology

Based on the literature review made in last section and following the research considerations of Introduction section, this section will formulate the research structure of this paper. .

3.1 Hypotheses

1. Null hypothesis (Ho): There is insignificant relationship between net interest margin and cost efficiency.

Alternative hypothesis (H1): There is significant relationship between net interest margin and cost efficiency.

2. Null hypothesis (Ho): There is insignificant relationship between credit risk and cost efficiency

Alternative hypothesis (H1): There is significant relationship between credit risk and cost efficiency

3. Null hypothesis (Ho): There is insignificant relationship between income diversification and cost efficiency

Alternative hypothesis (H1): There is significant relationship between income diversification and cost efficiency.

4. Null hypothesis (Ho): There is insignificant relationship between profitability and cost efficiency

Alternative hypothesis (H1): There is significant relationship between profitability and cost efficiency

5. Null hypothesis (Ho): There is insignificant relationship between bank size and cost efficiency

Alternative hypothesis (H1): There is significant relationship between bank size and cost efficiency

6. Null hypothesis (Ho): There is insignificant relationship between financial leverage and cost efficiency

Alternative hypothesis (H1): There is significant relationship between financial leverage and cost efficiency

7. Null hypothesis (H0): common effect model is appropriate

Alternative hypothesis (H1): fixed effect model is appropriate

8. Null hypothesis (H0): random effect model is appropriate

Alternative hypothesis (H1): fixed effect model is appropriate

9. Null hypothesis (H0): residuals across banks are not correlated

Alternative hypothesis (H1): residuals across banks are correlated

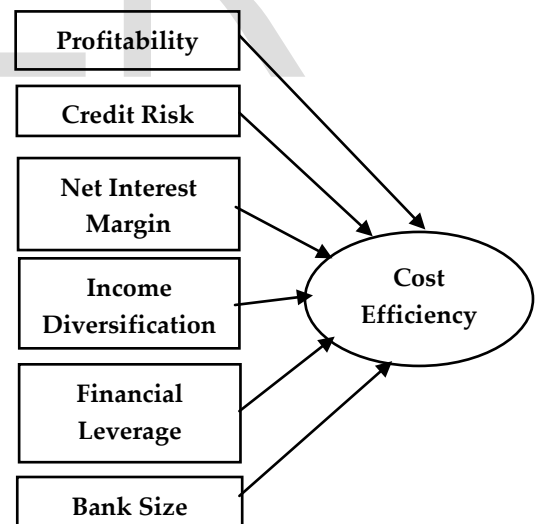


Figure 3.1: Dependent and Independent variables, (Conceptual Framework)

3.2 Econometric Models

For United Kingdom

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + e$$

Here 'y' is dependent variable (CIR)

'a' is called y-intercept or constant

"b1, b2, b3, b4, b5 and b6" are regression coefficients

"x1, x2, x3, x4, x5 and x6" are independent variables (ROA, CR, NIM, NIITI, DEBTEQUITY, and SIZE respectively)

'e' is error term or residual

For Germany

$$y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + e$$

Here 'y' is dependent variable (CIR)

'a' is called y-intercept or constant

"b1, b2, b3, b4, b5 and b6" are regression coefficients

"x1, x2, x3, x4, x5 and x6" are independent variables (ROA, CR, NIM, NIITI, DEBTEQUITY, and SIZE respectively)

'e' is error term or residual

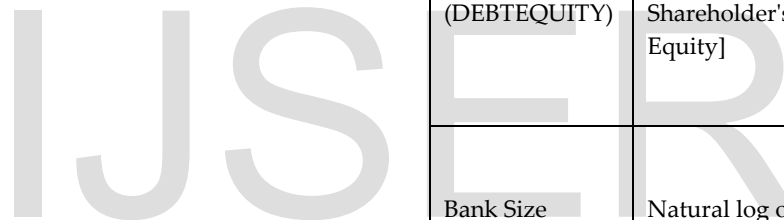


TABLE 3.1: Summary of Variables used in the research

Dependent Variable & Notation	Variable description for UK and Germany	Some Previous Researches
Cost efficiency (CIR)	[Operating expenses/Total income]*100	Berger and Moormann, 2008, Podpiera & Weill (2008), Amer et al. (2011), Dumitic & Ridzak (2012), Munteanu (2012), Hanif et al. (2012), Francis, (2013), Mesa et al. (2014), Hussain (2014) etc.
Independent Variables & Notation	Variables description for UK and Germany	
Profitability (ROA)	[Net profit/Total Assets]*100	Bentum (2012), Tabari, Ahmadi & Emami (2013), Akter & Mahmud (2014), Ping-fu Lai & Yuen-man Li (2014), Roman & Sargu (2014-15), Moussa (2015),

		Agama (2015)
Credit risk (CR)	[Loan loss provision / net interest income]*100	Munteanu (2012), Agama (2015) etc.
Net interest margin (NIM)	[(Interest income - Interest expenses)/Total assets]*100	Berger and Moormann, 2008, Fungacova & Poghosyan (2009), Horvath (2009), Dumitic & Ridzak (2012), Ping-fu Lai & Yuen-man Li (2014), Moussa (2015), Nasserinia et al. (2015) etc.
Income Diversification (ID)	[Non-interest income / Total income]*100	Cole, 1998, Lown et al, 2000, Meier, 2011, Bentum (2012), chaibi & Ftiti (2014), Mesa et al. (2014) etc.
Financial Leverage (DEBTEQUITY)	[Total debt/Total Shareholder's Equity]	Jonattan, T & Xu, X. (2011), Sarlija & Harc, (2012), Ping-fu Lai & Yuen-man Li (2014), Alshatti (2015) etc.
Bank Size (SIZE)	Natural log of total assets	Aspachs et al. (2005), Vodova (2011), Deléchat, C. et al. (2012), Tabari, Ahmadi & Emami (2013), Ping-fu Lai & Yuen-man Li (2014), Moussa (2015), Nasserinia et al. (2015).

3.3 Data Type and Sources

Instead of choosing huge number of banks, in this paper eight leading banks operating in Germany and eight leading banks operating in United Kingdom were selected and data was collected from secondary sources (the internet, annual reports and some previous records of selected banks). This paper employed quantitative data over the recent ten years period before, during and after the financial crisis from 2006-2015 for analysis having 80 number of observations from United Kingdom and 80 number of observations from Germany.

3.4 Population and Sample

The population of this research is all listed banks on London Stock Exchange. Sample selected for this research consists of 8 leading banks operating in UK and 8 leading banks operating in Germany. Sample banks from UK with

their total assets (in millions GBP) and sample banks from Germany with their total assets (in billions of euros) are given below in table 3.2.

Table 3.2: Sample banks operating in UK and Germany ranked by Assets

Leading banks in UK ranked by total assets in million GBP (2014)	Leading banks in Germany ranked by total assets in billions of euros (2014)
Barclays Bank plc (1,345,833)	Deutsche bank AG (1636.57)
RBS Group plc (1,019,934)	Commerzbank AG (574.263)
Lloyds Bank plc (862,004)	Deutsche Zentral-Genossenschaftsbank (DZ bank AG) (402.23)
Lloyds Banking Group plc (854,896)	Hypovereinsbank AG (HVB) (297.700)
Standard Chartered plc (499,100)	Landesbank Baden-Württemberg (LBBW) (285.000)
Bank of Scotland Plc (381, 225)	Bayerische Landesbanken (Bayren LB) (257.743)
HBOS plc (377,874)	Norddeutsche Landesbank (Nord LB) (197.424)
Co-operative bank (43,396)	Deutsche Post bank AG (158.434)

3.5 Tools and Techniques used for Data Analysis

Following techniques are used to analyze panel data;

- Descriptive Analysis
- Pooled Least Square, Fixed and Random Effects Regression Analysis
- Redundant Fixed Effects Test
- Hausman Test
- Correlation Analysis
- Pesaran test of cross sectional independence

3.6 Operationalization of Variables

Choice of variables is based on past relevant literature and theories supporting this research as shown in table 3.1. The variables under research are conceptualized in figure 3.1.

Dependent Variable

Cost efficiency is dependent variable of this research.

➤ Cost Efficiency

This research calculated cost efficiency, as operating expenses to total income ratio (Cost to income ratio). Total income includes both noninterest income and net interest income. Usually decrease in this ratio indicates that more efficient the bank is running. Cost to income ratios are important to commentators on banking, however, and bank managements are often forced to focus on them and comment on them. It is a ratio of overheads to the addition of net interest revenue and other operating revenue (Amer, Moustafa and Eldomiaty, 2011). This ratio is an efficiency measure, even though very high lending margins in a specific country leads to improve this ratio.

Independent Variables

Profitability, credit risk, net interest margin, income diversification, financial leverage and bank size are independent variables of this research.

➤ Profitability

The present research used Return on assets ratio to indicate profitability which is calculated by dividing bank's net profit after tax to its total assets. Return on assets ratios show how profitable the banks are relative to their total assets. The ability of management to perform their job efficiently is indicated by this ratio since it shows the ability to generate profit from bank's assets.

➤ Credit Risk

This paper calculated credit risk as, loan loss provisions to net interest income ratio. This ratio shows the relationship between interest income and provisions in the income statement for same period and lower will be the better.

➤ Net interest margin

This research calculated net interest margin as, Net interest income to total assets ratio, where net interest income is the difference between gross interest income and expenses. The higher the ratio, the cheaper the funding or the higher the margin the bank is commanding. Higher margins are desirable as long as asset quality is maintained. This ratio helps bank to determine if or not it has been making wise investment decisions. From the manager point of view, how well he/she manages bank's assets and liability also affected by the spread between the interest earned from its assets and costs from its liability, the spread here represents the net interest margin.

➤ **Income Diversification**

The ratio of non-interest income to total income was used by this research to indicate income diversification. Noninterest income is considered an important diversification source for the banks. Non-interest income represents other sources besides earnings from loans of the commercial banks. Vong et al (2009) captured the importance of fee-based services and other income resulting from diversification to commercial banks profitability by the non-interest income to gross income.

➤ **Financial Leverage**

This paper calculated financial leverage as the ratio of total debt to total shareholder’s equity. The degree of debt utilization for a bank is measured by this ratio. For its stability, debt leverage measures the degree of shareholders’ equity can cushion creditors’ claims with the financial shocks. The higher the ratio means the bank is more aggressive in financing its growth with debt and causes volatile earning from its extra interest expense. This volatile earning brings more risks for bank’s operation.

➤ **Bank Size**

This research calculated bank size by taking natural log of total assets. Demirguc-Kunt and Huizinga (2011), logarithmically measured the size of banks according to total assets called “absolute size” and liabilities over GDP called “systemic size”. They suggested, banks with a large absolute size were often much more profitable compared to banks with large systemic size which were profitless. The variable “size” is considered as a milestone for determining efficiency of bank.

4. DATA ANALYSIS, RESULTS AND DISCUSSION

This section discusses results regarding which factors have significant influence on cost efficiency for both UK and German banks.

4.1 Descriptive Analysis

Graphical representation of variables of sample banks of UK are given in Appendix A. All the figures collected from annual reports of sample banks of UK are in million pounds. All ratios were calculated in percentages except debt to equity ratio. Table 4.1 provides a summary of the descriptive statistics for the dependent and independent variables for the sample banks of United Kingdom.

Table 4.1: UK Banks

Variables	Mean	Median	Max	Min	Standard Deviation
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[Operating expenses/Total income]*100	63.22	56.05	374.16	0.56	54.97
[Total debt/Total Shareholder's Equity]	23.06	20.48	54.28	12.2	8.98
[Loan loss provision / net interest income]*100	95.06	55.81	373.91	-	14.73
Natural log of total assets	13.08	13.34	14.69	9.46	1.19
[Non-interest income / Total income]*100	40.99	43.38	81.71	-	90.71
[Net profit/Total Assets]*100	0.05	0.11	0.99	-2.15	0.69
[(Interest income - Interest expenses)/Total assets]*100	1.27	1.25	2.56	0.56	0.44

Graphical representation of variables of sample banks of Germany are given in Appendix B. All the figures collected from annual reports of sample banks of Germany are in million euros. All ratios were calculated in percentages except debt to equity ratio. Table 4.2 provides a summary of the descriptive statistics for the dependent and independent variables for the sample banks of Germany.

Table 4.2: German Banks

Variables	Mean	Median	Max	Min	Standard Deviation
[Operating expenses/Total income]*100	69.33	66.73	153.97	31.92	22.76
[Total debt/Total Shareholder's	33.19	26.94	106.47	11.22	19.92

Equity]					
[Loan loss provision / net interest income]*100	19.44	16.29	124.61	-69.42	27.61
Natural log of total assets	12.66	12.50	14.63	11.72	0.74
[Non-interest income / Total income]*100	20.90	25.51	56.98	-	125.93
[Net profit/Total Assets]*100	0.02	0.07	2.18	-1.23	0.42
[(Interest income - Interest expenses)/Total assets]*100	0.87	0.8	1.99	0.3	0.41

Redundant Fixed Effects Tests

Pool: PANEL

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	9.875727	(7,66)	0.0000
Cross-section Chi-square	57.326658	7	0.0000

Table 4.4: Hausman Test for United Kingdom (Y = CIR)

Correlated Random Effects - Hausman Test

Pool: PANEL

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	11.069129	6	0.0863

EXPLANATION

According to redundant fixed effects test, cross section F and cross section chi-square value is less than alpha of 0.05 as shown in table 4.3, but the Hausman test results can be seen to have p value greater than 0.05 as shown in table 4.4, indicating that random effect model is appropriate to use thus the research rejects hypothesis that the fixed effect model is appropriate model to use.

4.2 Estimation Results for UK Banks (Y = CIR)

Table 4.3: Redundant Fixed Effects test for United Kingdom (Y = CIR)

Table 4.5: Random Effect Regression Model for United Kingdom (Y = CIR)

Dependent Variable: CIR_?

Method: Pooled EGLS (Cross-section random effects)

Date: 01/05/17 Time: 15:02
 Sample: 2006 2015
 Included observations: 10
 Cross-sections included: 8
 Total pool (balanced) observations: 80
 Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	645.7436	99.66458	6.479168	0.0000
NIM_?	-58.41384	10.48686	-5.570192	0.0000
DEBTQUITY_?	-1.517081	0.338660	-4.479660	0.0000
SIZE_?	-31.67896	6.814999	-4.648417	0.0000
ID_?	-0.740945	0.134928	-5.491390	0.0000
ROA_?	-47.21932	5.588854	-8.448837	0.0000
CR_?	-0.277736	0.039738	-6.989153	0.0000
Random Effects				
(Cross)				
1-C	-0.215853			
2-C	-25.08141			
3-C	-43.84721			
4-C	14.72397			
5-C	31.17710			
6-C	16.83155			
7-C	1.455986			
8-C	4.955867			
Effects Specification				
			S.D.	Rho
Cross-section random			24.21366	0.5905
Idiosyncratic random			20.16452	0.4095
Weighted Statistics				
R-squared	0.775148	Mean dependent var	16.09905	
Adjusted R-squared	0.756667	S.D. dependent var	42.27327	
S.E. of regression	20.85288	Sum squared resid	31743.52	
F-statistic	41.94305	Durbin-Watson stat	1.333742	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.685616	Mean dependent var	63.21688	
Sum squared resid	75057.49	Durbin-Watson stat	0.564070	

EXPLANATION

As in table 4.5, the results suggest that there is significant negative relationship between cost to income ratio and net interest income to total asset ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable net interest income to total asset ratio, there will be about 58.41 unit decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So this research indicates that cost

efficiency is positively influenced by net interest margin in case of United Kingdom and accepts hypothesis that there is significant relationship between net interest margin and cost efficiency. Cost to income ratio affected not only by banks' costs, but also by income fluctuations.

There is significant negative relationship between cost to income ratio and bank size (natural log of total assets), as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable bank size (natural log of total assets), there will be about 31.68 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by bank size in case of United Kingdom because larger the bank in terms of its total assets, more efficient it will be as compare to small bank due to economies of scale and confidence level of its customers. This research accepts hypothesis that bank size is significantly related with cost efficiency.

There is significant negative relationship between cost to income ratio and non-interest income to total income ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable income diversification (non-interest income to total income), there will be about 0.74 unit decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by income diversification in case of United Kingdom and research accepts hypothesis that there is significant relationship between income diversification and cost efficiency. Higher the amount of other income, better will be the efficiency.

There is significant negative relationship between cost to income ratio and return on assets, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable profitability (return on assets), there will be about 47.22 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by profitability in case of UK and accepts hypothesis that there is significant relationship between profitability and cost efficiency. Profitable banks are usually preferred by clients, thus such situations create an encouraging environment for the profitable banks to be more efficient from the point of view of intermediation activities and less profitable banks are usually less preferred by clients.

There is significant negative relationship between cost to income ratio and debt to equity ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one

unit increase in explanatory variable financial leverage (debt to equity ratio), there will be about 1.52 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by financial leverage in case of UK and accepts hypothesis that there is significant relationship between financial leverage and cost efficiency. More leveraged commercial banks appeared to be more cost efficient than more capitalized banks.

There is significant negative relationship between cost to income ratio and loan loss provision to net interest income ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable credit risk (loan loss provision to net interest income ratio), there will be about 0.28 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by credit risk in case of UK and accepts hypothesis that there is significant relationship between credit risk and cost efficiency. A bank lending in high risk loans may exhibit a good cost to income ratio as deferred credit losses will not be reflected in its cost to income ratio.

The overall model is found statistically significant ($F=41.94305$, $p\text{-value} = 0.000000$) as shown in table 4.5 and explanatory variables included in the model seem explained around 77 percent variance in the dependent variable ($R^2 = 0.775148$; $R^2_{\text{adjusted}} = 0.756667$) and remaining 23 percent is due to other factors.

4.3 Pesaran CD Test

The research accepts null hypothesis that residuals across banks are not correlated because Pesaran CD test show insignificant p value (0.6219) as shown in table 4.6.

Table 4.6: UK Banks

Pesaran's test of cross sectional independence = 0.493, Pr = 0.6219
Average absolute value of the off-diagonal elements = 0.334

4.4 Correlation Analysis

There is no multi collinearity in the independent variables as shown in table 4.7.

Table 4.7: UK Banks

	CIR	ID	LEV	SIZE	ROA	CR	NIM
CIR	1						
ID	-0.4902	1					
LEV	-0.0539	-0.3412	1				
SIZE	-0.4371	0.3366	0.1292	1			
ROA	-0.5802	0.3036	-0.2481	0.03	1		
CR	0.0436	0.0251	0.1801	0.062	-0.5785	1	
NIM	-0.0554	-0.298	-0.1647	-0.587	0.4245	-0.2626	1

4.5 Estimation Results for German Banks (Y = CIR)

Table 4.8: Redundant Fixed Effects Test for Germany (Y = CIR)

Redundant Fixed Effects Tests

Pool: PANEL

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	9.316059	(7,66)	0.0000
Cross-section Chi-square	54.973019	7	0.0000

Table 4.9: Hausman Test for Germany (Y = CIR)

Correlated Random Effects - Hausman Test

Pool: PANEL

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	64.400585	6	0.0000

EXPLANATION

According to redundant fixed effects tests, cross section F and cross section chi-square value is less than alpha of 0.05 as shown in table 4.8, also the Hausman test results can be seen to have p value less than 0.05 as shown in table 4.9. As both redundant fixed effects and Hausman tests indicating

that fixed effect model is most appropriate model, thus the research accepts hypothesis that fixed effect model is appropriate model to use.

Table 4.10: Fixed Effect Regression Model for Germany (Y = CIR)

Dependent Variable: CIR_?
Method: Pooled Least Squares
Date: 01/05/17 Time: 15:16
Sample: 2006 2015
Included observations: 10
Cross-sections included: 8
Total pool (balanced) observations: 80

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	560.2196	108.7554	5.151191	0.0000
NIM_?	-32.80995	9.913906	-3.309488	0.0015
DEBTEQUITY_?	0.189552	0.145703	1.300944	0.1978
SIZE_?	-35.94969	8.371257	-4.294420	0.0001
ID_?	-0.607670	0.051143	-11.88170	0.0000
ROA_?	-9.408304	3.786695	-2.484568	0.0155
CR_?	-0.027343	0.056073	-0.487641	0.6274
Fixed Effects (Cross)				
1-C	-36.97722			
2-C	32.04875			
3-C	69.06383			
4-C	8.457499			
5-C	-28.04135			
6-C	19.80326			
7-C	-15.72963			
8-C	-48.62514			
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.813955	Mean dependent var	69.32750	
Adjusted R-squared	0.777310	S.D. dependent var	22.76365	
S.E. of regression	10.74218	Akaike info criterion	7.743861	
Sum squared resid	7616.028	Schwarz criterion	8.160715	
Log likelihood	-295.7544	Hannan-Quinn criter.	7.910990	
F-statistic	22.21179	Durbin-Watson stat	1.954968	
Prob(F-statistic)	0.000000			

EXPLANATION

As in table 4.10, the results suggest that there is significant negative relationship between cost to income ratio and net interest income to total asset ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable net interest income to total asset ratio, there will be about 32.81 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So this research indicates that cost efficiency is positively influenced by net interest margin in case of Germany and accepts hypothesis that there is significant relationship between net interest margin and cost efficiency. This is due to that prediction that larger volume of lending will increase banking efficiency.

There is significant negative relationship between cost to income ratio and bank size (natural log of total assets), as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable bank size, there will be about 35.95 units decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by bank size in case of Germany because larger the bank in terms of its total assets, more efficient it will be as compare to small bank due to economies of scale and confidence level of its customers. Study accepts hypothesis that bank size is significantly related with cost efficiency.

There is significant negative relationship between cost to income ratio and non-interest income to total income ratio, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable income diversification (non-interest income to total income), there will be about 0.61 unit decrease in dependent variable cost to income ratio which leads to increase cost efficiency. So the research indicates that cost efficiency is positively influenced by income diversification in case of Germany and research accepts hypothesis that there is significant relationship between income diversification and cost efficiency. Once a bank has already established a network of clients, personal bankers can distribute additional products at almost no extra cost.

There is significant negative relationship between cost to income ratio and return on assets, as p-value is less than 0.05 and regression coefficient is negative as if there is one unit increase in explanatory variable profitability (return on assets), there will be about 9.4 unit decrease in dependent variable cost to income ratio which leads to increase cost

efficiency. So the research indicates that cost efficiency is positively influenced by profitability in case of Germany and accepts hypothesis that there is significant relationship between profitability and cost efficiency. Higher the returns on total assets, higher will be the bank efficiency.

Credit risk (Loan loss provision to net interest income ratio) and leverage (debt to equity ratio) are insignificantly related with cost to income ratio as their p values are greater than 0.05, thus research rejects hypotheses that credit risk and financial leverage have significant impact on cost efficiency.

The overall model is found statistically significant (F=22.21179, p-value = 0.000000) as shown in table 4.10 and explanatory variables included in the model seem explained around 81 percent variance in the dependent variable (R2=0.813955 =; R2adjusted =0.777310) and remaining 19 percent is due to other factors.

4.6 Pesaran CD Test

The research accepts null hypothesis that residuals across banks are not correlated because Pesaran CD test show insignificant p value (0.0956) as shown in table 4.11.

Table 4.11: German Banks

Pesaran's test of cross sectional independence = 1.667, Pr = 0.0956
Average absolute value of the off-diagonal elements = 0.323

4.7 Correlation Analysis

There is no multi collinearity in the independent variables as shown in table 4.12.

Table 4.12: German Banks

	CIR	ID	LEV	SIZE	ROA	CR	NIM
CIR	1						
ID	-0.5172	1					
LEV	0.4356	0.0493	1				
SIZE	0.2241	0.2156	0.2727	1			
ROA	-0.2973	0.2873	-0.1177	-0.009	1		
CR	0.1667	-0.4244	0.0857	-0.130	-0.423	1	
NIM	0.1099	0.0519	0.0118	-0.384	0.144	-0.0059	1

4.8 Discussion

These results are similar with some previous studies and some past studies had contradictory results as well. As cost efficiency is positively influenced by net interest margin for

both economies, this is in line with Berger and Moormann, 2008, who in their study of European banks, revealed a strong relation between interest margins and their cost-income ratios, indicating that highest the interest margin, lower the CIR. A decrease in income will cause an increase in the cost to income ratio for any given level of cost relative to bank's assets (Tripe, 1998).

As cost efficiency is positively influenced by income diversification for both economies, this is in line with Baele et al. (2007), argued that noninterest income can increase efficiency of bank and this was in line with Rogers and Sinkey, 1999; DeYoung and Rice, 2004a, b; Elsas et al, 2010, who in their study found that insurance activities offer cross-selling opportunities and have potential to build economies of scope and scale. But contrary to this, Spulbar and Nitoi 2014, concluded that an increase of non-interest income in gross revenues will increase the bank inefficiency's level and will lead to an increase in the variance of the inefficiency effect, reflecting the banks incapability to link the costs with the revenue from non-traditional activities, but also the lack of expertise of commercial banks from transition countries in these activities.

As cost efficiency is positively influenced by bank size for both economies, this is in line with Cummins and Zi, 1998; Drake, 2001; Luhnén, 2009; Eling and Luhnén, 2010b; Andries, 2011 etc. But Matousek and Taci, 2004 and Havrylychuk, 2006 etc found an insignificant relationship between size and efficiency.

As cost efficiency is positively influenced by profitability for both economies, this is in line with Francis (2004) who in his study, observed that there is an inverse relationship between the cost to income ratio and the bank profitability. This relationship was further supported by Miller & Noulas in 1996, Isik & Hassan in 2002, Casu & Molyneux in 2003, Hasan & Marton in 2003, Fries & Taci in 2005, Zajc in 2006, Hermes & Nhung in 2010 and Alrafadi et al., 2014 etc. Contrary to this, Osborne (1995) found no clear correlation between ROE & ratio of cost to income for US banks.

As cost efficiency is positively influenced by financial leverage in case of UK, this is in line with Altunbas et al (2007), Allen and Rai (1996), Sun and Change (2011) and (Janoudi, 2013, p.16). But according to Wall in 1983, a bank with more equity will have a lower cost to income ratio. Cost efficiency is positively influenced by credit risk in case of UK, this is in line with Toevs & Zizka (1994). While, credit risk and debt to equity ratio (leverage) has no significant influence on cost efficiency in case of German banks.

5. CONCLUSIONS

Present research concludes that net interest margin, bank size, income diversification and profitability are significantly and positively related with cost efficiency in case of both United Kingdom and Germany. Cost efficiency is positively influenced by bank size for both economies meaning that larger the bank size is in terms of total assets, higher will be the bank efficiency. Larger the bank in terms of its total assets, more efficient it will be as compare to small bank due to economies of scale and confidence level of its customers but very large banks can have inverse influence on efficiency due to complexities (bureaucratic and some other reasons etc.). Cost efficiency is positively influenced by net interest margin for both economies meaning that higher the net interest income, higher will be the efficiency. Decrease in income might be a reflection of incompetence of bank in generating income, this decrease in income may also due to change in competitive conditions decreasing the margins available to bank thus leads to inefficiency and increase in income might also reflect an economic upturn, increasing opportunities for banks to undertake profitable business from which to earn fees and interest etc. Cost efficiency is positively influenced by income diversification for both economies meaning that higher the amount of other income, better the efficiency. Once a bank has already established a network of clients, personal bankers can distribute additional products at almost no extra cost. Banks that earn more insurance income are associated with a lower ratio of salaries per employee. Larger more diversified banks will have informational advantages that will allow them to more accurately price credit and achieve more consistent returns if they can offer full-service banking to its customers and encourage one stop shopping. Cost efficiency is positively influenced by ROA for both economies meaning that higher the returns on total assets, higher will be the bank efficiency. Clients usually prefer those banks that have higher profitability, thus those banks attract the best potential creditworthy borrowers as well as the biggest share of deposits. Such situations create an encouraging environment for the profitable banks to be more efficient from the point of view of intermediation activities. Credit risk and financial leverage have insignificant impact on cost efficiency in case of Germany while significantly and positively related with cost efficiency in case of UK. Cost efficiency is positively influenced by financial leverage in case of UK banks, attributed to the idea that debt financing is cheaper than raising equity capital, hence more leveraged commercial banks appeared to be more cost efficient than more capitalized banks. Cost efficiency is positively influenced by credit risk in case of UK banks meaning that, a bank lending in high risk loans may exhibit a good cost to income ratio as deferred credit losses will not be reflected in its cost to income ratio. While credit risk and financial

leverage are not significant factors in determining cost efficiency for German banks.

6. PRACTICAL IMPLICATIONS

6.1 Recommendations

1. There should be increasing opportunities for banks to undertake profitable business in order to win customers' trust and enhance cost efficiency.
2. Banks should make an effort in reducing operating expenses, and in increasing diversified sources of revenue in order to become cost efficient.
3. Optimal size of banks should be of considerable importance to improve cost efficiency.

6.2 Future Research

1. This research considers suitable to study the link between the efficiency of the banks operating in EU countries and their overall liquidity level in a future research, because this will help the regulatory authorities to better develop their monetary and macro-prudential policies.
2. Present research considers appropriate to study in a future research the determinants of cost efficiency as well as interest margins for the banks that are operating in countries that have joined European Union in 2004, 2007 and in 2013 etc., in this way future researchers will be able to underline if the determinants of banks' cost efficiency and interest margins are common or country specific.
3. Future research can be carried out by taking a larger sample for larger time period from these two countries or by taking banks from whole Europe.
4. In future, it would be useful to examine other countries with bank-based and market-based economies to generalize the empirical results.
5. Also, it may be worth elaborating on the study of factors influencing cost efficiency by using different statistical tools.
6. Further research in this context would reveal the industry and macroeconomic factors that are also important in determining cost efficiency.
7. The future researchers can compare different types of banks operating in same country.

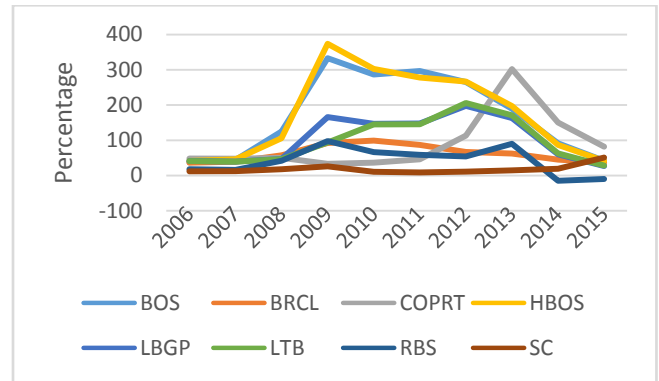
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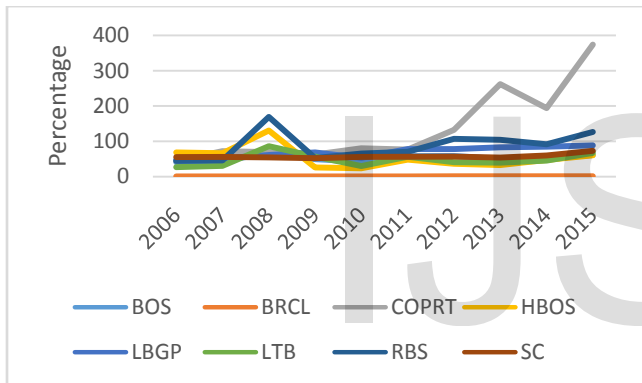
Appendix A.3 Loan loss provision to net interest income ratio



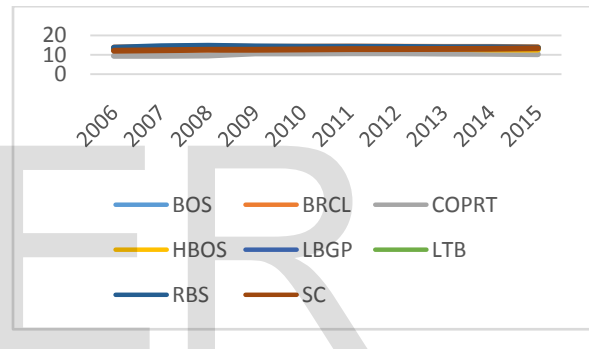
APPENDIX

Appendix A Graphical Representation of Variables from United Kingdom

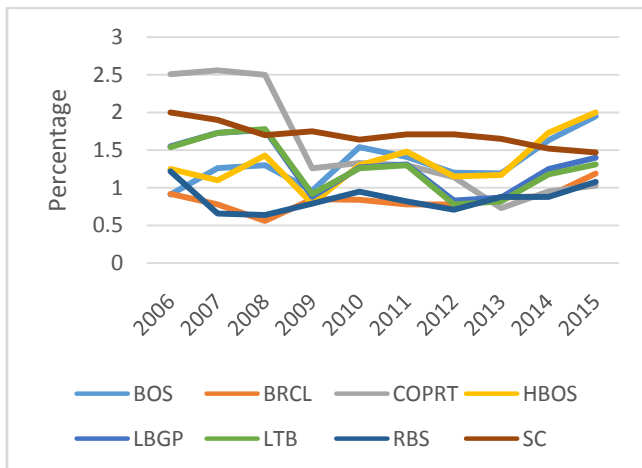
Appendix A.1 Operating expenses to total income ratio



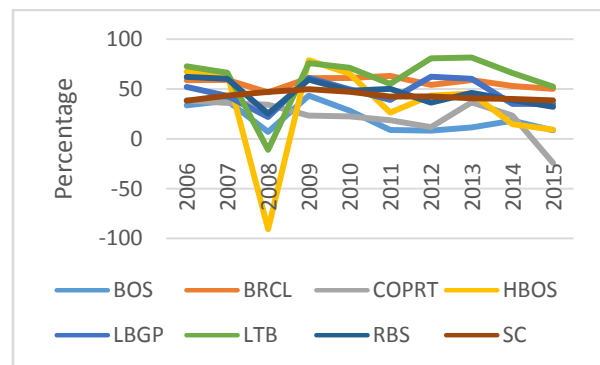
Appendix A.4 Natural log of total assets



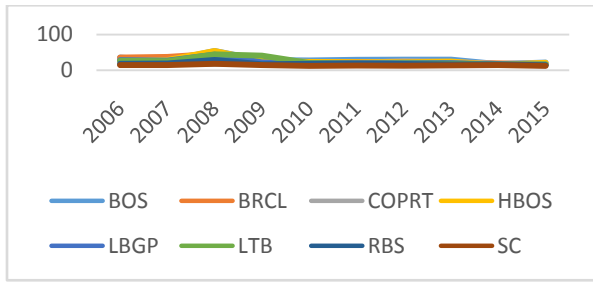
Appendix A.2 Net interest income to total assets ratio



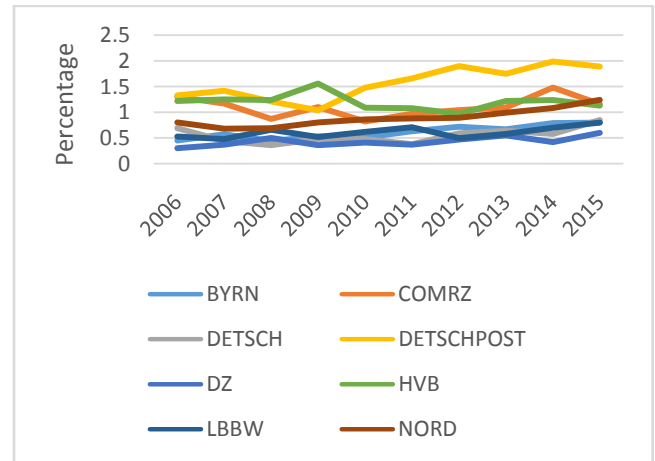
Appendix A.5 Non-interest income to total income ratio



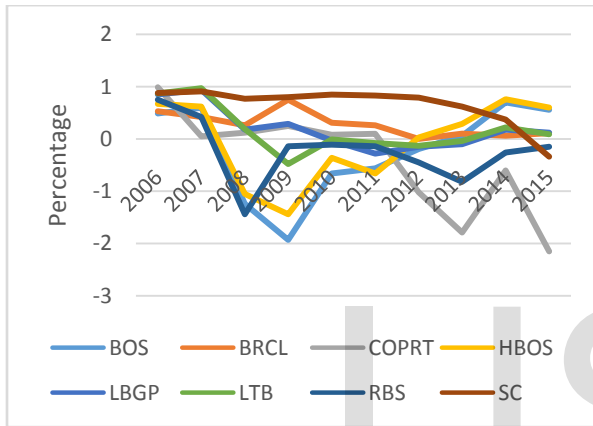
Appendix A.6 Total debt to total shareholder's equity ratio



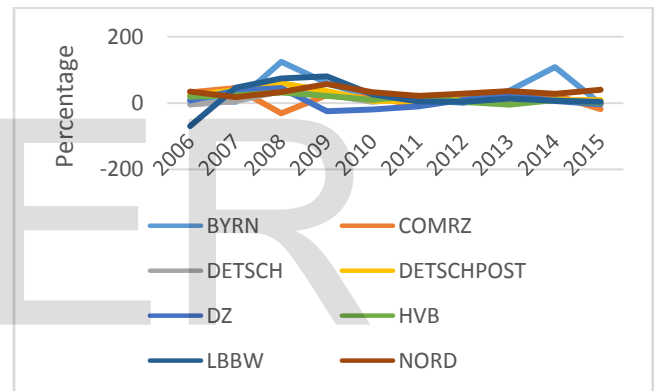
Appendix B.2 Net interest income to total assets ratio



Appendix A.7 Net profit to total assets ratio

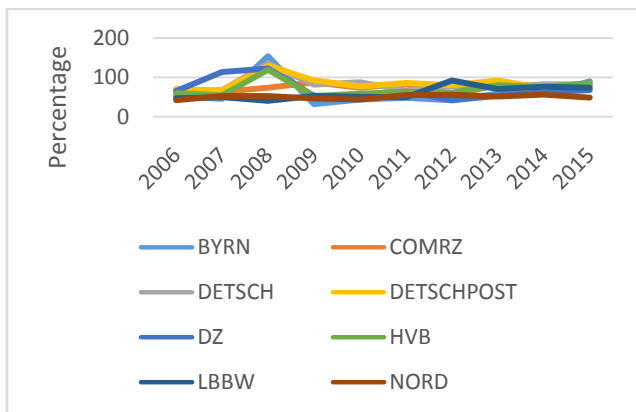


Appendix B.3 Loan loss provision to net interest income ratio

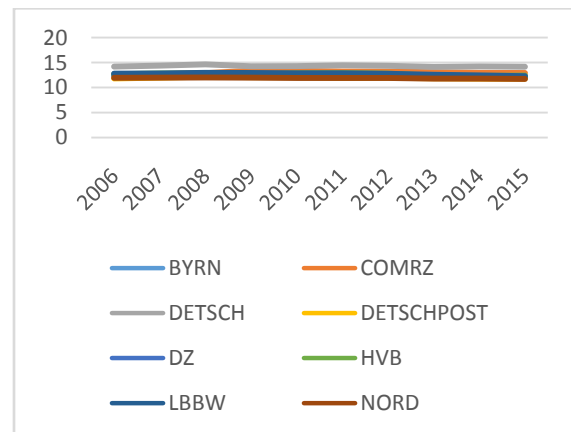


Appendix B Graphical Representation of Variables from Germany

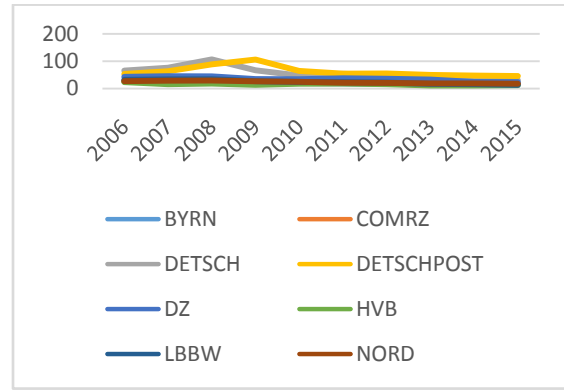
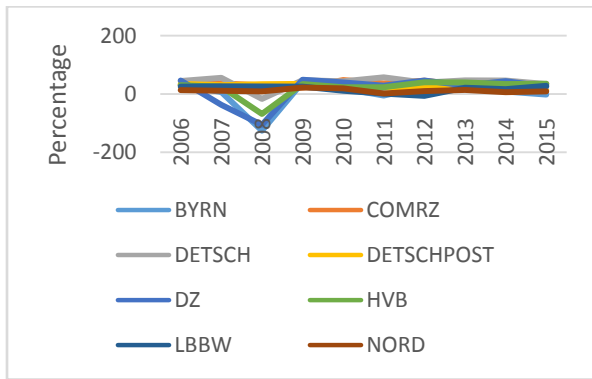
Appendix B.1 Operating expenses to total income ratio



Appendix B.4 Natural log of total assets

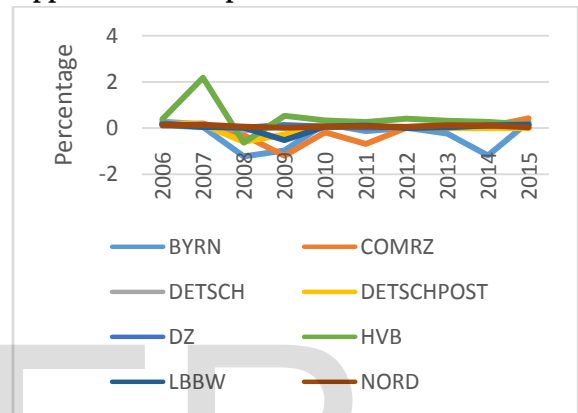


Appendix B.5 Non-interest income to total income ratio



Appendix B.6 Total debt to total shareholder's equity ratio

Appendix B.7 Net profit to total assets ratio



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