

THE UNIVERSITY OF HULL

RISK PERCEPTION, PROFIT EFFICIENCY IN COMMERCIAL BANKING:
MULTICOUNTRY EMPIRICAL EVIDENCE
OVER 2000 - 2013

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Abstract:

This thesis aims to evaluate and discuss two important aspects of commercial banks performance, implicitly underlying the process of profit generation and its sustainability. Namely, behaviour towards risk, based on data from the UK, the U.S., Japan and profit efficiency, based on data from the UK, the U.S., Japan and Switzerland. In addressing those issues, I used a relatively large data set covering 13 years, divided by the pre-crisis (2000-2006), the financial crisis (2007-2009) and the post-crisis (2010-2013) intervals.

Contrary to the neoclassical perspective on risk taking behaviour commonly applied in economics, *my research in chapter three* introduces an alternative approach - the propositions of Prospect Theory (PT) (Kahneman & Tversky, 1979). In line with PT, Bank's choices under risk and uncertainty are seen as a result involving subjective judgement, sensitive to the way the problem of choice is framed relatively to a performance target, labelled as a status quo. Examination of risk behaviour in the context of PT did not find the significant recognition by previous researchers within commercial banking, therefore the current work aims to fill that identified gap.

My next important contribution is *in chapter four*. There, I established new empirical evidence on profit efficiency. The research incorporates variables not considered before by the literature on profit efficiency in commercial banking, like bank assets liquidity and a consumer confidence index.

Overall results indicate that subjectivity bias was an important element of commercial bank risk's behaviour in pre-crisis. As consistent with the predictions of PT I have found evidence for the presence of non-constant risk preferences.

The findings on profit efficiency analysis show that all analysed commercial banks over the crisis period experienced a considerable drop in their ability

to generate profits efficiently. Rise of bank assets illiquidity was the most important, significant driver of profit inefficiency over all of the analysed periods. Consumer positive expectations to the state of the economy contributed to improvement of bank profit efficiency. Negative association between market concentration and profit efficiency levels for the pre-crisis period confirms banks' discretion in profit efficiency maximization.

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CHAPTER 1. Introduction

1.1 Context of the Research

Conceptually, according to the theory of competition, if firms have profits above the average, then competitors motivated by opportunity to gain profits will enter the market. That process continues until the profitability in the market equals the competitive rate. However, pointing out the specific character of the banking sector, the financial market regulations create a certain level of market imperfections that in practice are likely to carry some elements of inefficiency or even a substantial waste of economic resources.

Taking another angle, banks, unlike other firms perform their services on both side of their balance sheet, on the loan and deposit market simultaneously (a.k.a. dual competition Berger, Humphrey (1997)). That property makes a bank particularly exposed on the process of competition and changeable conditions on the financial market (financial and non-financial risk). What distinguishes banks from other firms is that banks need to focus their activity not on the profit maximization alone. The financial character of performed services requires from banks also placing equal attention on intermittent maintenance of financial liquidity at the given level of risk.

In that respect outcomes of performance that are likely to secure bank's long-term presence on the market are the ones that reflect bank's managerial success in choosing targets of risk-return trade-offs and efficiency levels optimality. In the context of banking industry's optionality in the wider sense they can be seen as actions to balance the level of the aforementioned targets, allowing a fulfilment of its commercial as well as its economic functions at the same time. For example, banks that put a greater weight on their commercial function at the given level of the economic

one, sooner or later give rise to the development of excessive risk taking behaviour and accumulation of bank's financial risk. On the other hand, banks' actions that tend to place a greater emphasis on economic function while supporting stability of financial sector as a whole fail to generate profits for their own shareholders and to ensure that the redistribution of risk meets market agents' different liquidity preferences.

The perspective of the recent financial crisis draws to a close a problem existing within the banking sector itself. Banks become the ones to be blamed for exhibiting a tendency in approaching a risk too easily and taking a sub-optimal attitude towards its performance outcomes in efficiency terms. Considering the above, the re-evaluation and re-consideration of bank's behaviour over the pre-crisis, the crisis and the post-crisis period constitutes not only a new and important research direction but also valuable source of inquiry for economic policy purposes. In particular, regarding the latter the role of empirical evidence built on the analysis of the recent period will help to identify and address what potentially can be done to improve sustainability of banking sector on the market in the post-crisis era.

In correspondence with the aforementioned argumentation, the research presented in this thesis, brings together the two important aspects of banks' market behaviour; namely risk perception and profit efficiency.

The first research providing an empirical insight into patterns of bank risk behaviour takes a perspective that has been so far largely overlooked by banking literature on banks' choices under risk and uncertainty and it is known as a Prospect Theory. In that light, using the data for commercial banking sectors across the UK, the US, Japan and Switzerland, the research addresses the problem of evaluation by the decision maker (commercial bank) the prospects as positive or negative values (gains or losses) relatively to the status quo and importance of that process in shaping her risk behaviour. . By the same token, the research introduces a conceptual alternative

to Expected Utility Theory, defining the risk behaviour in marginal and not absolute terms. Following that reasoning, risk preferences are not constant and depend on how the problem of choice is described.

In the view of Prospect Theory agent's choices involving risk are described as they actually are, not how they should be¹, as in line with the normative prescriptions of EUT. Consequently, the current research allows for the empirical perspective on risk choices, where the decision making process under risk is not perfect and is usually weighted down by a presence of perception bias or fallacy. Therefore, the incorporation of the aforementioned context constitutes a great opportunity to present the problem of risk taking, especially in the banking sector reflecting the actual sub-optimality and inconsistency of decisions that we could actually observe analysing the information on banks' actions and their implications for banks' performance outcomes over the last decade.

The second research reflects on the important subject of a profit efficiency generation in the commercial banking sector in the UK, U.S. and Japan. It highlights the empirical insight into the role of a managerial ability in adjusting output prices and input quantities towards the profit efficient use of banks' internal resources. Within the analysis a stochastic frontier framework is applied and enables us through decomposition of residuals between symmetric error and asymmetric inefficiency component to separate the exogenous factors, that are beyond the control of economic agent (here average commercial bank) from actual (in)efficiency effect. Correspondingly, the latter provides a more accurate method of efficiency evaluation (parametric procedure) than for example DEA (Data Envelopment Analysis) that offers deterministic calculations, based on linear programming. In that respect DEA does not formulate the random error component,

¹ Consistent with the presence of the ideal conditions of decision-making process such as full access to information and rationality.

which results that all possible factors that are outside the DMU (Decision Making Unit) are counted towards the (in)efficiency outcomes.

1.2 Guiding Research Questions

In this dissertation on the basis of the conducted research the author has been investigating the answers to the following questions.

In chapter two:

1. What are the main characteristics of the analysed commercial banking sectors that are country specific ?
2. What were the main trends that characterized the performance of the commercial banking sectors in the pre-crisis (2000-2006) and the crisis period and post-crisis period (2007-2013) ?
3. How do those main trends in commercial banks' performance reflect decisions that potentially contributed to the development of recent financial crisis ?

In chapter three:

1. Does Prospect Theory describe bank's risk behaviour in commercial banking sectors located in the UK, the U.S., Japan and Switzerland over the pre-crisis (2000-2006), the crisis (2007-2009) and the post-crisis period (2010-2013) ?
2. Among the selected the bank specific variables of interest, which are the most significant in explaining the analysed banks' shortfall risk over the pre-crisis, the crisis and the post-crisis-period ?

3. In what direction the identified variables of interest are correlated with commercial banks' shortfall risk ?
4. What are the implications of the obtained evidence on managerial risk behaviour in the context of Prospect Theory for the future performance of commercial banks ?

In chapter four:

1. What are the average trends in evolution of profit efficiency outcomes for the analysed commercial bank over the pre-crisis, the crisis, the post-crisis period and over the full sample (2000-2012) ?
2. What are the potential determinants of the efficiency in profit generation across the analysed commercial banking sectors over the pre-crisis, the crisis and the post-crisis period ?
3. What can the obtained evidence suggest about the overall commercial banking sector ability to generate market profits efficiently over the period between 2000-2012 ?
4. What implications for the future bank market profitability and its efficiency can we infer from the conducted analysis?

1.3 Motivation behind the Choice of Countries Analysed in Thesis

The thesis consists of the two independent researches that utilize the analysis of the two slightly different multicounty datasets. Namely, research presented in chapter three, on the analysis of commercial bank's risk behaviour in context of Prospect Theory, employs a sample of commercial banking sectors located in the UK, the U.S., Japan and Switzerland. Whereas the research presented in chapter four, on the profit efficiency analysis, uses sample of commercial banking located in the UK, the U.S, and Japan but excludes Switzerland.

Through the selection of the sample of commercial banks located in UK, Japan, the U.S. Switzerland, for the analysis on risk behaviour chapter three wants to provide empirical evidence on the banking sector for an economically advanced group of countries that are globally recognized as having long-lasting economic and financial interconnections. Furthermore, due to these connections, the selected countries were particularly exposed to the international transmission of the market shocks that originated during the recent financial crisis; a key episode whose consequences for commercial banks' risk behaviour are addressed in the chapter.

Further to the above, the selection of the aforementioned countries raise an issue of the issue of their economic and financial connections, highlighting the importance of those countries in the international transmission of the shocks.

The process of global transmission of the recent financial crisis proved to be a complex, multidimensional process involving different types of shocks that were affecting the markets of advanced economies with unequal strength. The liquidity shocks have been confirmed as playing a major role in the international propagation of the recent financial crisis ([Chudik, Fratzscher, 2011](#)). Further to the above, the banking

sector is recognized as an important channel of crisis propagation and as the recent financial crisis had its origins within banking sector, that argument is finding even greater support. Considering the fact that the countries selected for analysis are also characterized by the highest World levels of financial deepening measured by ratio of private credit to GDP (World Bank), confirms that in domestic context banks and other financial institutions have a strong position in supplying money to the countries' economies.

The recent financial crisis generated an increase in stock market volatility across the major stock markets, mainly across advanced economies. Equity prices reacted quickly, creating the source of financial contagion. In developed economies, like the UK, the USA, Japan and Switzerland, a market volatility reached record highs negatively affecting the value of banks' equity at the presence of growing constraints on capital availability. (Min, Hwang, 2012)

On the other hand, the idea behind the selection the UK, the U.S and Japan (excluding Switzerland) for the research on profit efficiency was based on the premise of having a representative nation from each of the three main regions of the World. In that regard, the UK, the U.S and Japan provide empirical evidence on profit efficiency in commercial banking for Europe, America and Asia, respectively.

In addition, the selected countries maintained a stable position as global financial leaders; their major cities such as London, New York, Tokyo for example, belong to the top five World's financial centres in terms of global financial competitiveness (according to The Global Financial Centres Index (GFCI) published by commercial think-tank Z/Yen Group). The selected countries being the promoters of financial integration (reflected for example by their high level of participation in global volume of cross-border transactions (Lane, Milesi-Ferretti, 2008; Lane, 2013)) have experienced, almost at the same time crisis related market shocks transmitted by the financial and/or

international trade channel (Claessens, Dell’Ariccia et al., 2010). They are also among the economies that have been most heavily affected by the recent financial crisis. (Lane, Milesi-Ferretti, 2011) In that respect, the analysis of commercial banks performance in efficiency context building the sample on the aforementioned set of countries provides a common ground for better understanding the factors associated with variations in profit efficiency level.

1.4 Structure of the Dissertation

The remainder of the dissertation consists of three chapters.

Chapter two provides a setting for the empirical research that will be presented in the further part of the dissertation. Chapter two aims to demonstrate the recent changes on banking market across all countries selected for the analysis: the United Kingdom, the United States, Japan and Switzerland.

The opening of the chapter reflects on the most noticeable changes for bank performance on the financial market such as liberalization, globalization, presence of imperfect competitive conditions on financial market and implications for banks’ risk and profit efficiency goals. Further, chapter two focuses on commercial banking outcomes of performance which are important in the explanation of banks' cost and revenue side of the intermediation process and its implication for profitability. The analysis is enriched by a number of empirical data, extracted from different sources, for instance from Bankscope Database, OECD Statistics and World Bank.

Chapter three presents an empirical insight into the pattern of risk behaviour, utilizing a rationale developed within the Prospect Theory. The aim of the chapter is to empirically test and evaluate, if managerial risk behaviour in the commercial banking sectors of the most developed economies in the World follows the assumption

of non-constant risk preferences and the condition of loss aversion; in describing the managerial risks' perception over pre-crisis, crisis and post crisis period. Section two of the chapter provides the theoretical background of the analysis. It explains not only the main assumption of the Prospect Theory, but also, on the basis of the presented framework, formulates the main research hypothesis and the expected sign, selected as analysis variables of interest. The next section characterizes the data sample used for the analysis and in section 4 the applied empirical model in parallel, providing the rationale for variables of interest that are incorporated in the analysis and hypothesis based on the presented lines of arguments. Section four reports on the empirical evidence and provides a general discussion on the obtained results. The chapter ends with concluding discussion identifying the main meaning of the obtained findings and suggestions for a further research.

Chapter four provides an empirical analysis of profit efficiency outcomes in the commercial banking sectors, located in the UK, the U.S., Japan between 2000-2012. The sections one and two explain the importance of the analysis especially in the context of recent financial crisis and identify the prior studies, including the ones that had the greatest impact on the recent developments within banking studies on efficiency examination. Section three formulates and develops the main research hypothesis on potential determinants of profit efficiency outcomes. Section four explains the research methodology and provides argumentation underlying its selection and informs on selected data samples and identifies the variables used. Data used and detailed specification of the model are characterized in section 5. Section 6 reports results of estimation and analyses them in the light of the earlier formulated research hypothesis. The concluding part presents a research summary, and implications of the main findings.

CHAPTER 2. Banking Sectors in the UK, the U.S., Japan and Switzerland, Main Characteristics and Performance Outcomes between 2000-2013

2.1. Banking Sector and Presence of Market Imperfections

The last two decades of banking market activity have been characterized by many institutional as well as policy changes. As an aftermath of liberalization and deregulation that reached its peak during the 90's, the market environment has become more dynamic and complex. International mobility of capital sped up the process of integration across the national economies. Those changes were providing a lot of new opportunities not only for the banks' clients to diversify investment alternatives and utilize trans-border financial transactions, but also for the banks themselves. The new global character of competition changed the patterns of the banks' competitive behavior. Banks using the globally connected financial settlement and investment mechanisms became active facilitators of the multinational business collaboration. On the one hand that opened for them a new opportunity to generate economic profits from more diversified and not explored global market sources, but on the other hand made them exposed to relatively higher levels of financial risk and uncertainty.

However, the existing market environment also brings a challenge to financial regulators that needed to find a balance between the safe and the competitive banking industry. Furthermore, an adoption of global regulatory patterns became more complex

as it required a wider scale in diversity, approaching respective national markets. The adjustment of potential determinants such as concentration, efficiency, legal environment, business culture and a potential for the growth of financial innovation in a market share needs to take into consideration different levels of market structural imperfections. Building on those scenarios, an effective response of regulatory actions should be aimed to provide a reliable mechanism, ensuring an effective competition among banking firms, whereas simultaneously “just in time” eliminating the probability of the banking market failure.

To tackle such challenge there is an extensive international financial regulatory cooperation and coordination. The aforementioned has been formed within the Basel Committee on Banking Supervision and the Bank for International Settlements with advisory support from the International Monetary Fund. The issues that characterize competitive conditions in banking emphasise the importance of future policy transformations.

The latter fuels the further need to analyse other important determinants of bank performance and the impact on banks’ conduct and strategic decisions on competitive industry conditions. Namely, the required analysis brings a necessary extension on fundamental issues in the banking industry such as capital requirements, financial market discipline, market transparency disclosure and the role of the informational asymmetry. Those areas attract special attention in a complex and riskier market, as reflected in current regulatory requirements. Removal of legal barriers to entry facilitates increasing competition from more efficient foreign banks that operate and increase their market share on the market segments, where local banks are relatively less efficient. Consequently, competitive behaviour of foreign banks may affect negatively a local banks’ performance, especially when the latter are characterized with permanently higher inefficiency than the former making them greatly exposed to risk of

failure.

In conclusion, considering the complexity and scale of current banking activities, there are many structural and non-structural market imperfections that limit efficient allocation and distribution of national wealth within the financial system. However, the dynamic process of financial integration changes gradually the market conditions among banking firms. The increasing participation of foreign owned banks in domestic financial markets facilitates an increase in competition that in some market segments can take a form of rivalry. The effects of dominant competitive strategies that promote objectives such as an increase in the number of customers an increase in market share, puts pressure on bank margins and operational efficiency. Consequently, bank performance constitutes a function of many economic factors that combined in an optimal way can bring in the long-run more flexible and quality driven banking sector.

The next sections provide the insight into an institutional as much as a market dimension of performance in the banking sector across the analysed countries. Their aim is to shed a light on how the commercial banking sector evolved in last decades and what the main characterises of that evolution are. The problem of the recent financial crisis and its reference to financial outcomes of banks' performance will find its examination in a further part of this chapter. The conclusion will focus on reviewing the main trends, including the country specific features of the analysed sector.

2.2. Characteristics of Commercial Banking Sectors in the Analysed Countries – Description of Selected Samples

2.2.1 The United Kingdom

The UK banking sector is large, internationally open, universal and highly developed. At the end of 2008, the share of UK banks in total cross-border lending constituted 18%, at the same time the share of US² and Japan was 8% (IFSL Research). The UK banks' share in cross –border borrowing was also significant and at the end of 2008 represented a 21% share. Over around two-thirds of overall bank assets and liabilities are denominated in a foreign currency, much of it not closely connected to the domestic non-financial activity. Only around 20% of banking establishments are UK-owned, although many of the foreign-owned banks are small. The UK owned banks account for around 40% of overall banking assets and around 60% of sterling assets, which are most closely related to the domestic economy. Many factors have contributed to the development of the financial and banking system in its current form. The prominence of London's international capital markets began in the 1960s. Restrictions on the banking system were eased substantially during the 1970s and quantitative controls largely disappeared with the abolition of the “corset” arrangement on bank balance-sheet growth in 1980. UK banks began to enter investment banking after the 1986 “Big Bang” deregulation of the equity markets. Building societies, mutually-owned savings banks that specialised in residential mortgages, were allowed to demutualise in 1986 and many became banks, undertaking a wider range of activities.

² At the end of 2004 in total foreign exposure of UK-owned banks US accounted for 34%, from which 87% were claims on non-bank private sector, largely on US households.

Since the recession of the early 1990s, the UK banking sector enjoyed a prolonged period of expansion and profitability with apparently good credit quality. Indicators of financial soundness were favourable over the boom period, perhaps giving banks and regulators a false sense of security for the future.

To deal more effectively with the post-crisis situation in the UK banking sector since 2013 the government has implemented a number of considerable changes in a financial regulatory environment. Those changes initiated the substantial overhaul of the banking sector that aimed to build more effective and sound financial intermediation of the future.³ The most significant changes so far are linked to establishing new regulatory institution and competition regulators. Accordingly, by the introduction of the Financial Services Act 2012, the former regulatory institution FSA Financial Services Authority, responsible for banking and building societies, has been replaced by the three new regulatory bodies.

From 1st April 2013 the following new institutions have been introduced: Financial Conduct Authority (FCA), Prudential Regulation Authority (PRA) as a part of the Bank of England and Financial Policy Committee (FPC). Among them FCA has been created as an independent non-governmental institution responsible for ensuring the presence of market standards that support an efficient and competition driven performance of entities operating on retail and wholesale financial services market. Correspondingly, the FCA also supervises the consumer credit industry ensuring that the banks' customers are treated fairly. Further, PRA is responsible for the stability of the UK financial system and in its duties FPC supports it. Especially the latter is responsible for reducing the level

³ For instance, the outcomes of investigation in UK banking sector (presented in Report by Independent Competition Commission on Banking (ICB) in April 2011) had highlighted the presence of market power in UK banking sector and its limiting effects on competition and efficient utilization of banks' resources. As per ICB study the four of the most important players on the retail lending market (RBS, HSBC, Barclays, Lloyds TSB and HBOS) expanded their market share from under 50% in 2000 to over 75% in 2010. Moreover, Lloyds TSB takeover announced on 18th Sep 2008 gave also a rise to direct conflict between financial stability and competition principle, ([Vickers, 2010](#)).

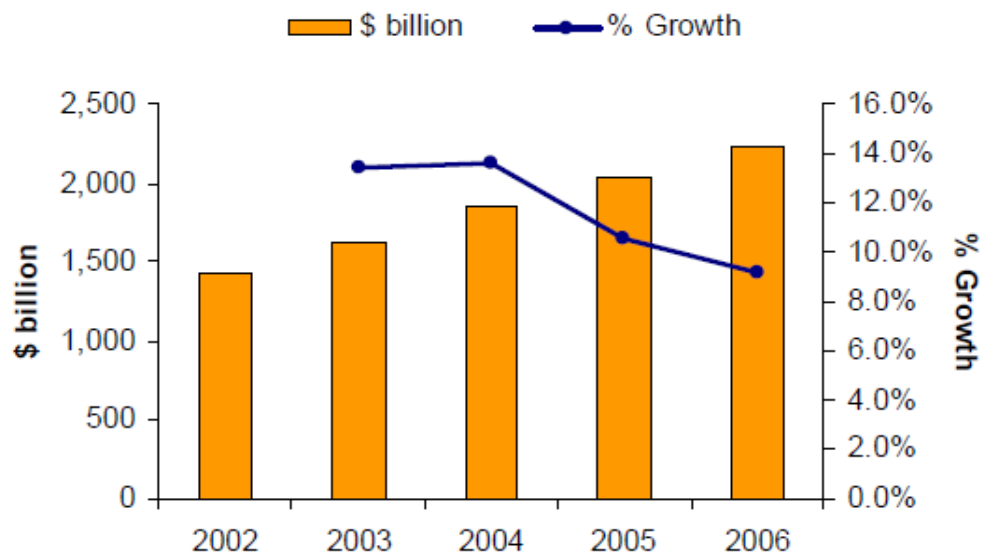
of systemic risk on the financial market and the formulation of recommendations to the aforementioned partner institutions.

The commercial banking market in the UK is defined by financial services, typically consumer lending, mortgages and banking for Small and Medium Enterprises (SME). The retail divisions of the five largest players on UK market mainly serve a commercial segment of the financial market in the UK, namely: Lloyds Banking Group (LBG), Royal Bank of Scotland Group (RBSG), Honkong Shanghai Banking Corporation (HSBC Bank), Barclays and Santander. On the UK commercial banking market there is also a number of smaller banks that because of the size of their market share are of lesser importance for that market as a whole. Similarly, to the Swiss banking sector (particularly the Swiss “big two”) banks in the UK developed the universal model to offer their financial services. In contrast to the U.S. where commercial banks are recognised as a separate category of financial institutions, in the UK the focus on servicing the distinct segments of the financial market (for example commercial) is conducted by the different divisions within the given banking institution or more often banking group. Therefore, the UK banking is characterized by the rather complex and not transparent structure. Over years, banks gained the position of financial giants involved simultaneously in many different types of financial services from private banking to corporate and retail scope.

Over the period before the recent financial crisis, UK commercial banking experienced a significant growth in total revenue by expanding its lending supply onto the domestic financial market. Between 2002-2006 on average the total revenue of UK commercial banks on that market has grown by 11.7% while lending in terms of market value reached in 2006, 2225.3 billion US dollars (Chart 1). However, the total revenue from the lending market continued to grow also over 2007, when the market value achieved 2589.5 billion US dollars ([Datamonitor](#)). That trend was fuelled by the

conditions of a low interest rate that influence the greater profit expectations among banks and other global financial market participants. The latter consequently promoted an attitude of an excessive risk taking. Revenue on retail lending in an absolute term in the UK banking sector significantly improved in 2010 and 2011 (Chart 2).

Chart 1. UK banking - revenue and its growth on the retail lending market over 2002-2006⁴



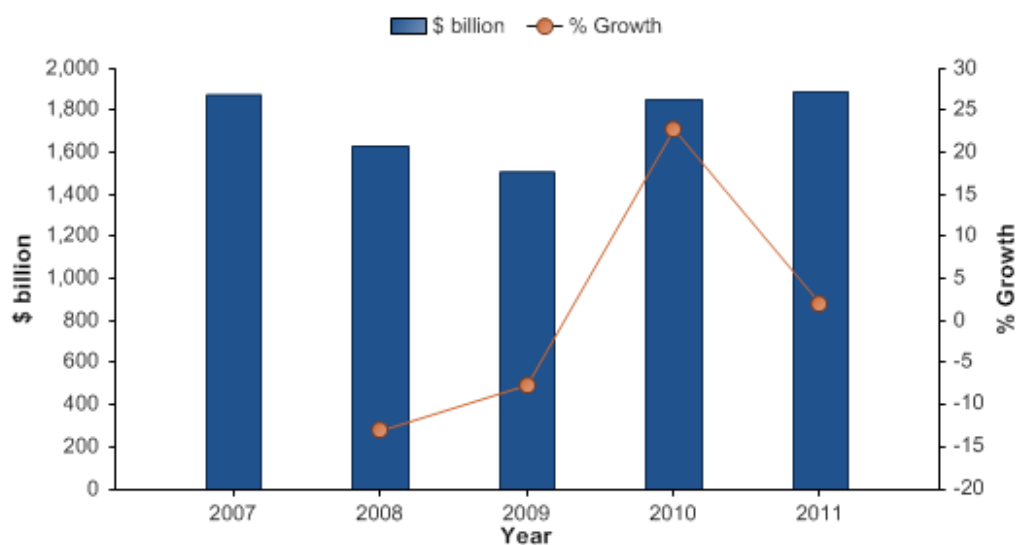
Source: Datamonitor

In the face of constantly emerging liquidity problems and resulting banks' bankruptcies in the UK and also globally including an increase in lack of customers' confidence in the banking sector as a whole, the aforementioned performance results need to be seen as a considerable success. Despite the level of revenue obtained by UK banks on the retail lending market were significantly lower than the comparable results for the US (more on that in next section 2.2.2.) the picture in relative terms (retail

⁴ The retail lending market profile covers here the mortgage and consumer credit market. The market value reflects mortgage and consumer credit balances outstanding at the end of the year (Datamonitor).

lending revenue growth) shows a better performance of UK banks. In 2010 UK banks recorded the peak average revenue growth of nearly 25% while over the same time the performance on US banks' retail lending showed a growth decline of -2.5% . The mortgage-lending segment was the most lucrative market for the UK banking sector in 2011, with total balances outstanding of more than \$1,691.9 billion, equivalent to 89.5% of the market's overall value. The consumer credit segment contributed balances outstanding of \$199.5 billion in 2011, equating to 10.5% of the market's aggregate value.

Chart 2. UK banking - revenue and its growth on the retail lending market over 2007- 2011



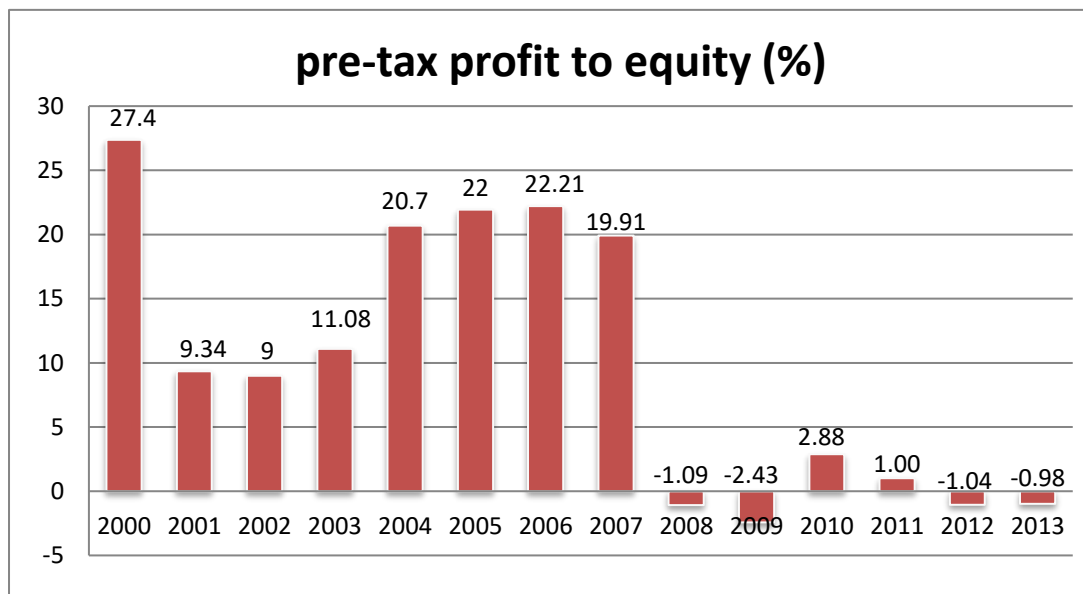
Source: Datamonitor

The UK banking sector over 2004-2006 was characterized by the strong profitability records expressed by pre-tax profit to equity ratio. (Chart 3). The low volatility of asset returns that the UK financial market experienced in the pre-crisis period-encouraged risk-taking behaviour. The low price of risk (low risk premia) influenced the increase of investor demand for riskier instruments including

US sub-prime residential mortgage-backed securities. Banks using “the originate and distribute business model” could easily improve a liquidity of their balance sheet selling the originated loan on the capital market.

However, the year 2007 despite showing also the relatively high profitability for the first time since 2004 confirmed the first signs of a decline in profitability growth. Banks increasing profits, through expansion of credit instruments mortgage based inevitably created an illusion of liquidity overestimating the market signals assuming that the investor demands will continue in the future. As quickly, as the liquidity emerged to support further lending expansion the more the banks extrapolated the present opportunity for profits boost into the future. In the face of the first symptoms of crisis, the mortgage lending expansion re-financed via securitization had been hardly hit by a decline in investor’s demand for securitized mortgage instruments.

Chart 3. Pre-tax profit to equity over 2000-2013 for UK commercial banking sector



Source: Bankscope

Due to increase in counterparty risk (associated with the decline in quality of mortgage-backed securities), the interbank money market becomes no longer a stable, source of funds. The example of the failure of Northern Rock⁵ the fifth major UK mortgage bank in 2007,(that in pre-crisis period heavily relied on securitization of its mortgage lending) was the major warning signal for the UK financial markets of the upcoming disruption on the securitization and lending business.

In the face of increasing bank performance losses and defaults, the UK government acted quickly. The package of measures to support the failing banking sector has been brought to public attention by HM Treasury in October 2008. The time of the UK government response to the crisis was expected urgently and also coincided with an announcement of similar financial intervention by the U.S. Treasury. The UK government initiative offered measures to stabilize the UK banking sector, providing among others also help to commercial banks. The main funding initiatives took place between 2008-2012 facilitating to UK banks access, assistance and overall support from a wide range of schemes including short-term lending, guarantees, and state investments.⁶ However, the scope of the UK government intervention in comparison to its US counterpart was limited. While US intervention aimed to restore bank capital, lending and liquidity was using as a tool also the write-off the toxic assets from balance sheets of supported banks, the UK government did not follow the same pattern. Namely, the UK bailout policy to achieve the same goals, among other actions, was supplying (in

⁵ Northern Rock the one of UK largest mortgage lenders in the consequence of crisis experienced the severe liquidity problems. Bank of England avoiding the danger of bank run by its depositors in 2007 provided to the bank a financial support. However, as the financial condition of the bank did not improve in February 2008 bank has been formally nationalized. UK Government had become the main shareholder. The case of Northern Rock was not the only failure that UK banking system experienced. In 2008 Lloyds TSB has acquired another main player on mortgage segment Halifax Bank of Scotland being at the brink of bankruptcy.

⁶ Financial intervention by UK HM Treasury operated based on three main schemes: Government Recapitalization Scheme (GRS), Credit Guarantee Scheme (CGS), Asset Backed Securities Guarantee Scheme (ABSGS). Besides the aforementioned schemes, UK Treasury also has become involved directly as a bank's owner and an institutional investor with the controlling equity stake, purchasing the shares of two main players on UK banking market: Lloyds Banking Group (43%) and Royal Bank of Scotland (84%).

exchange for an agreed level of fees) Treasury insurance (guarantee) to encourage and support banks affected by illiquidity to lend on the interbank market. Bailout measures have engaged the UK government into spending at the huge scale. Only from the perspective of 2008 predicted amount of capital injections to the UK banking sector amounted to £850bn. However, the estimation has reached the new much higher level from the perspective of the 2008-2012 period. According to the UK National Audit Office the UK government financial help to the banking sector reached at its peak an amount of £1.162 trillion of which £1.029 trillion went into guarantee commitments and 0.133 trillion in cash.

The feature that distinctively characterized the balance sheet management strategy of the UK banking sector in the pre-crisis period was a heavy reliance on the wholesale short-term funding market. The motivation behind those actions was a necessity to cover a rising gap between volume of not sold loans and customer deposits (funding gap). The need to raise that the funding shortfall in case of UK commercial banks by 2007 was nearly twice as much as done over the same time by US commercial banks. ([Hardie, Maxfield, 2013](#)).

However, the low availability of wholesale funding in the aftermath of the crisis exposed banks to intense competition for alternative funding sources, mainly retail deposits. To attract potential depositors, banks faced the need to put up the deposits' price, but that decision also meant a rise of lending rates and a decline in lending growth (see Chart 4).

Records on profitability performance (Chart 3) confirm that UK commercial banks experienced over the crisis and post-crisis period a dramatic profits' deterioration. Between 2008 and 2013 (except 2010 and 2011 when the data shows the short-term recovery of profits however of the small magnitude) the analysed banks remained unprofitable, reaching the biggest losses in 2009 of nearly 2.5 % pre-tax profit on equity.

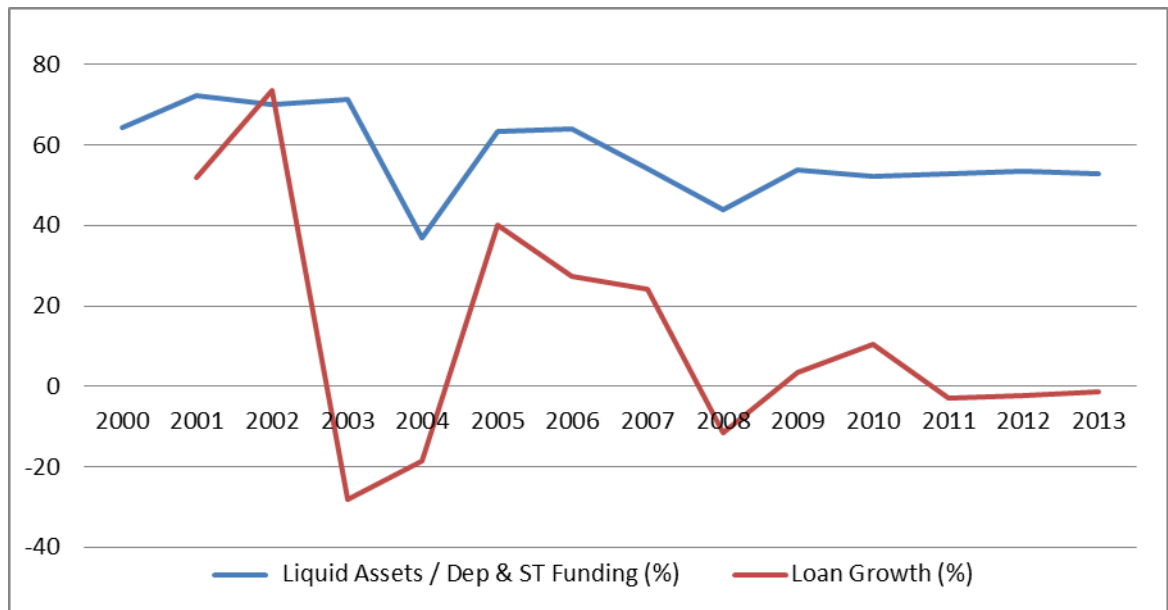
The ongoing low interest rate market environment additionally suppressed the long-term recovery of profit levels in the analysed banking sectors including UK.

Another vital factor that directly affected the profit performance level over the 2008-2013 periods were the problems with the quality of banks' assets. Massive downgrades of securitized investment positions held by banks in their balance sheets, create the huge costs. The assets-backed positions (including mortgage-backed ones) ceased to be an attractive form of collateral against liquidity provision on the wholesale funding market to the same extend, as mortgages on the base of which those positions were issued became the source of increasing default and borrowers' insolvency risk.

In those circumstances in search for profits' recovery, banks have faced the decision to restructure their balance sheet positions. The aforementioned took the form of liquidation of illiquid assets positions through their write-off and alternatively (in many cases also simultaneously) the recapitalization through issuing new equity or the government's recapitalization programs. The process of balance sheet restructuring over the analysed period put a pressure on banks' lending activity. As shown in Chart 4 the low loan growth level for the analysed UK commercial banking sector persisted over 2008-2013, taking the form of negative growth (contraction) of loans level to the UK economy between 2011-2013.

The increases in profitability over pre-crisis period (Chart 3) were supported by a sharp drop in loan loss provisions' level over 2004-2007 (Chart 5). The applied strategy has confirmed that banks facing the increasing profits on lending at the same time were underestimating the growing level of the non-performing loans. Banks extracting the profits from lending (loan growth was the highest over the 2004-2007 as per Chart 4) were taking a short-run approach in evaluation of potential losses on loans.

Chart 4. Indicators of liquidity and growth of lending in UK banking sector over 2000-2013



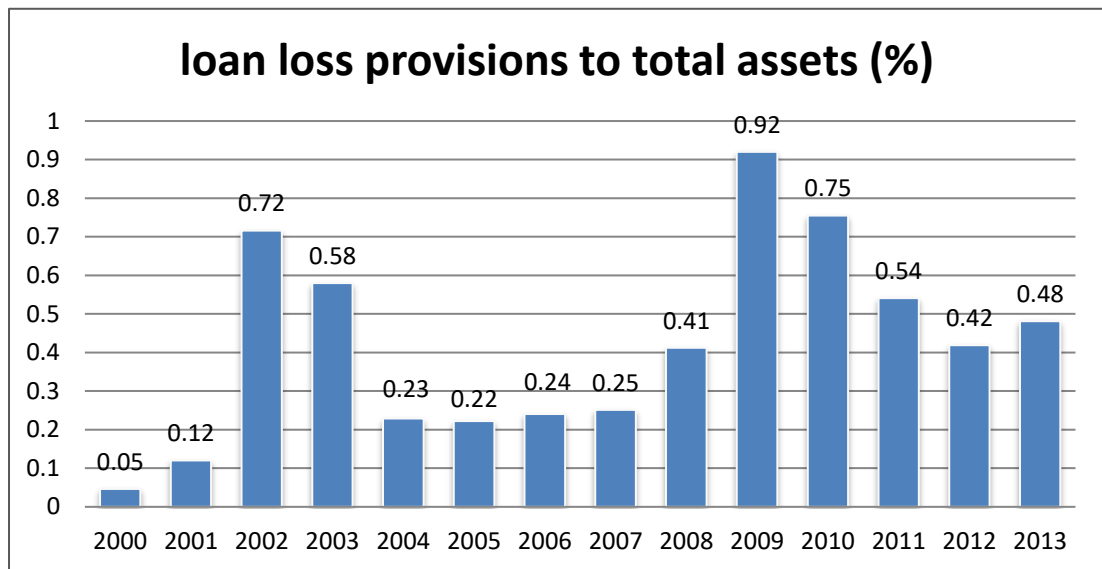
Source: Bankscope

In fact, banks in their provisioning policy complied with International Accounting Standards that over the pre-crisis period promoted the estimation of loan provisions based on a backward-looking model (known as a *'incurred loss model'*)⁷.

In consequence, the UK commercial banks not adjusting loan loss provisions to total assets to the level required relatively to the scale of lending expansion went into the crisis stranded by a not covered cost of write-downs and delinquencies. The above reasoning is also supported by the data on the ratio of impaired loans to total gross loans (see Chart 6). Among the all currently analysed commercial banking systems the UK one, experienced the highest growth of impairment charges since the crisis and that trend continued until 2013 - the last year covered by the analysis. Another factor that known for its also negative impact on profitability level in banking including UK banking were misconduct charges including costs related to mis-selling of payment

⁷ More on provisioning and new rules on future method of counting provisions in banking in section 3.3 of the thesis.

Chart 5. Loan loss provisions level to total assets over 2000-2013 in UK banking sector

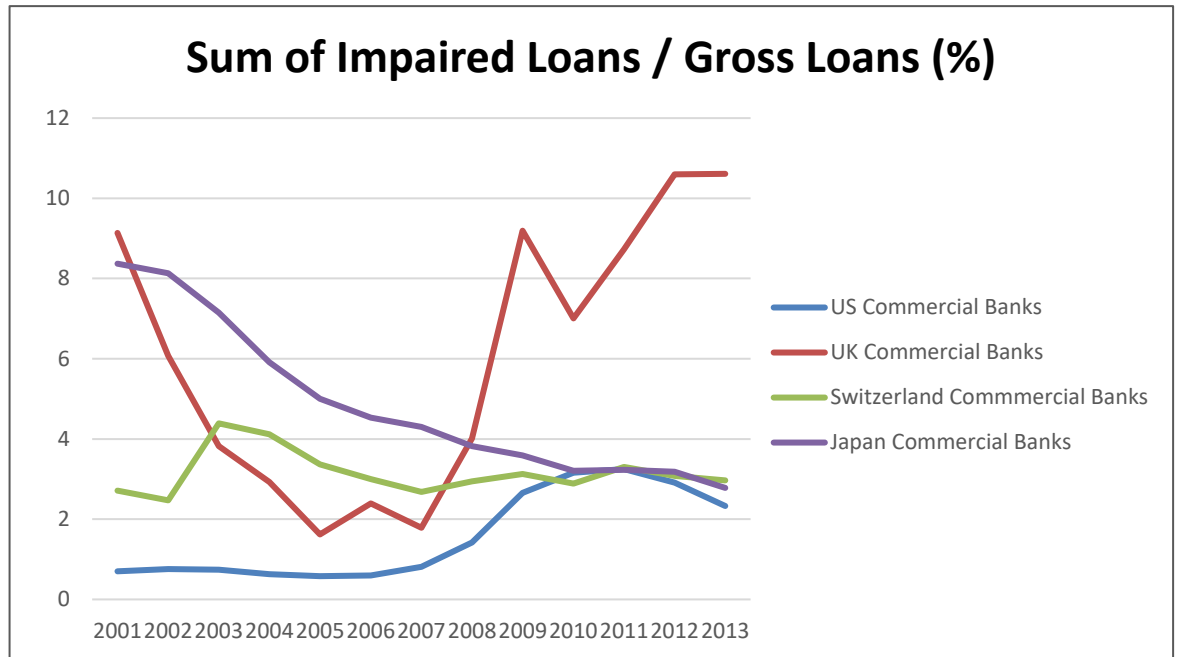


Source: Bankscope.

protection insurance, interest rate swaps, and regulatory fines related to the manipulation of Libor and lapses in anti-money laundering controls (Bank of England).

In summary, the UK banking sector over the pre-crisis period enjoyed high profitability growth. The expansion of banks' lending based on "originate and distribute model" conditioned the illusionary time of the stable and resilient banks' performance. Banks not only in the UK but also globally through the use of financial innovation become highly exposed to risk of adverse and unexpected changes in funding conditions on the market. The prices' boom solely was driving an idea of lending based on the risky strategy. However, when the market crashed, the consequences for banks' risk positions and bankruptcies among the indebted homeowners were catastrophic. Further, considering that the scale of involvement by UK banks in assets backed securities was far smaller than by U.S. banks, the use of securitization by analysed banks implemented over time the serious distortions to effective liquidity and credit risk management.

Chart 6. Sum of Impaired Loans to Gross Loans over 2000-2013 - Comparison across the UK, the US, Swiss and Japanese Commercial Banking Sectors



Source: Bankscope

To take the argument further, an insufficient recognition of losses by the UK commercial banks in line with increasing deterioration of credit quality over the pre-crisis period has led to a serious decline in analysed banks' ability to generate profits over 2008-2013. Consequently, due to necessity of funding loan losses from the retained earnings and capital UK banks entered the crisis, recording substantial performance losses. Moreover, the UK commercial banks over 2008-2013 in comparison to their counterparts from the U.S., Japan and Switzerland over the same period exhibited the lowest level of profitability level, in fact recording predominantly losses. Across all analysed countries, the commercial banking sector in the UK remained the one with the highest ratio of impaired loans to gross loans. Nevertheless, UK banks in their attempts for performance recovery responded by increasing their lending activity, confirmed by the increase of loan growth over 2009-2010. However, the aforementioned loan growth last briefly and was of lesser magnitude than similar growth recorded before

the crisis. An important role in the restoration of UK banks' capacity to lend again had the government financial intervention program. Funds, relocated by the UK Treasury, helped to regain confidence on the financial market and put banks back on the difficult path of post-crisis performance stabilization. The process of recovery is however gradual and to move forward banks need to apply solutions and standards that make them more risk-sensitive and open to changes.

2.2.2 The United States

Commercial banks in the U.S. belong to the largest group of financial service providers. As a part of the U.S. financial system along with thrifts and credit unions, they are labelled as depository institutions. In contrast to commercial banks, thrifts are organized as mutual associations. They specialize in longer-term lending to the real estate sector. On the other hand, credit unions are characterized by provision of short-term lending to customers who are members of the union, associated on the common grounds of the performed occupation or trade.

The current U.S. financial system is the result of an evolution that started during the 1930s. In 1933 the Congress fundamentally reformed banking with the Glass-Steagall Act (also known as the Banking Act of 1933). One of many provisions of the act, namely Regulation Q, placed limits on the interest rates banks could offer on deposits. As a result, any possibility of competitive rate wars was removed and The Glass-Steagall Act also established a system of deposit insurance for consumers with the creation of the Federal Deposit Insurance Corporation (FDIC). The FDIC guaranteed consumer deposits up to a certain level, quieting the widespread fears of bank failures.

In light of the above, and following the global trend, the banking sector in the US in the 80's and 90's experienced a number of regulatory changes taken to improve banking competition. Before deregulation, the state law governed banks in the U.S. limiting their operations to their home state. In addition, regulations on banks' deposits pricing policy created for banks a permanent constraint on free setting of funding and implicitly lending prices. With the aim of allowing banks and savings and loans to compete with money market mutual funds, President Carter signed into the law the Depository Institutions Deregulation and Monetary Control Act (DIDMCA) of 1980.

The legislation established a committee to oversee the complete phase-out of interest rate ceilings on all types of deposits within six years. Since then depository institutions were able to offer accounts with competitive rates of return in the market. However, the ban of interest rate payment on demand deposit stayed in power until 2010. It has finally been lifted by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (actively implemented from July 2011).

Further, the restriction on bank interstate acquisitions and set up of interstate banks' branches has been abolished with the introduction in 1994 of the Riegle-Neal Interstate Banking and Branching Efficiency Act (it gained legal power from 1997). Since then, commercial banks could expand their own presence simultaneously in different states. That deregulation step initialled the process of important changes that influence the structure of the commercial banking sector. Namely, banks responded by increasing their involvement in consolidations and mergers with other commercial banks. Consequently, a number of commercial banks in the U.S. started to decline (see Chart 8) however, the concentration of the sector intensified. Commercial banks in the U.S. become larger, multi-state financial institutions with a wide network of branching system.

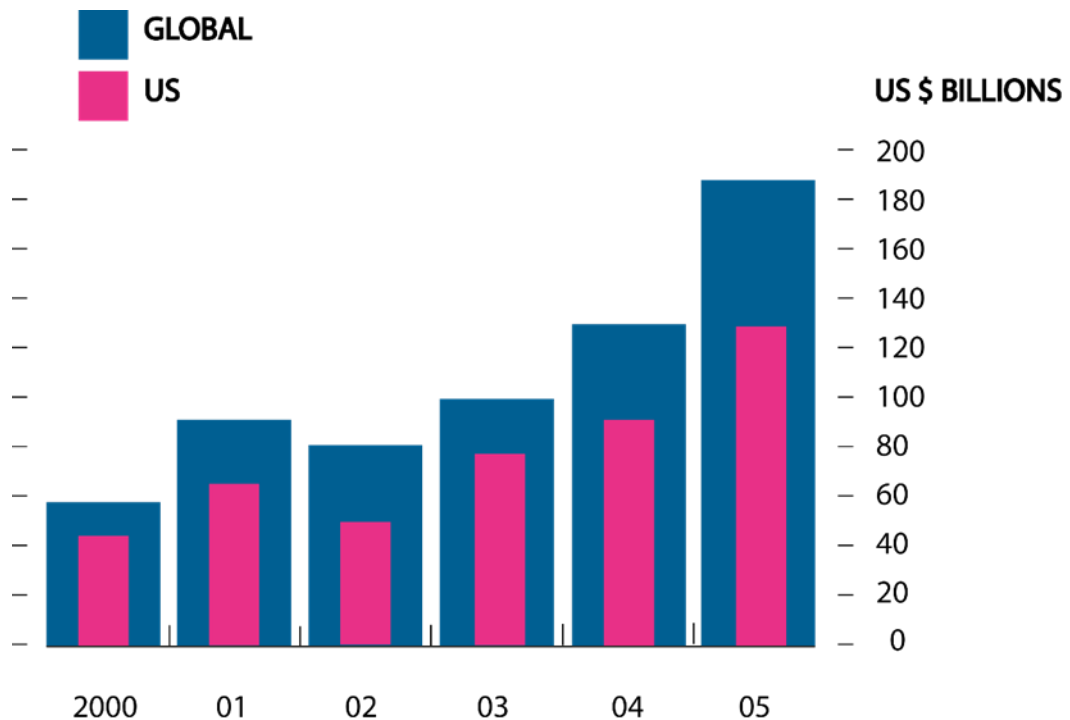
Next, a significant change within the process of the U.S. financial deregulation took place in 1999, when the Congress passed the Financial Services Modernization Act, also known for the names of its sponsors—the Gramm-Leach-Bliley Act. This legislation finally revoked the Glass-Steagall separation of commercial and investment banking. It also revoked the 1956 Bank Holding Company Act⁸. The new act permitted the

⁸ Gramm-Leach-Bliley Act amended the Bank Holding Company Act (BHC Act) to Bank Holding Companies that carried Financial Holding Company (FHC) status to conduct through their non-bank subsidiaries in fact any type of financial services; including unlimited securities dealing and underwriting as well as general insurance business. The modification of the BHC Act redefined the character of FHCs operation. They has become a financial entity providing “under one roof” financial products belonging not only to banking area but also to securities and insurance one.

The aforementioned reform contributed to the important structural changes in US financial market. It intensified wave of consolidations and development of diversified financial conglomerates such

creation of financial holding companies (FHCs) that may hold commercial banks, investment banks and insurance companies as affiliated subsidiaries. By the same token, commercial banks received the legal permission to re-enter the securities

Chart 7. Issuance of Commercial Mortgage-Backed Securities (CMBS) U.S. versus Global Share of Market over 2000-2005



Source: Financial Stability Review: December 2005, Bank of England.

market, a business after the Great Depression of the 30's reserved for investment banks. The US financial market since the 70's has been recognized as a pioneer and later the global player in the securitized lending business (Chart 7). Over the same period the issuance of the residential mortgage-backed securities (RMBS) on US market was even higher. The issuance of RMBS peaked in 2003 reaching a value of nearly \$3 trillion. The upward trend continued until the 2006 with the pace at the level not recorded on that market since the 90's.

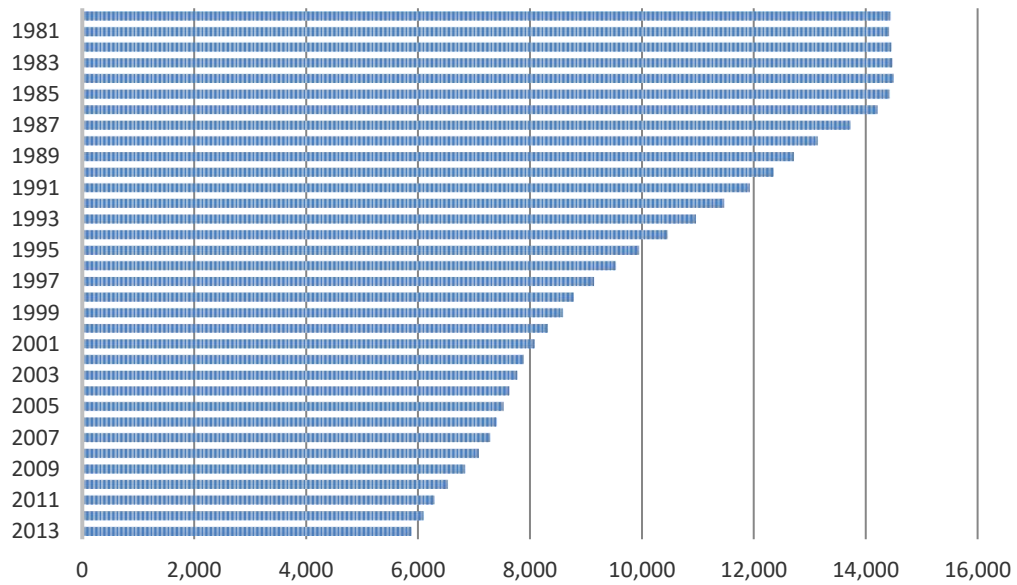
as Citigroup, JPMorgan Chase, and Bank of America. (Omarova, 2013)

Commercial banks through the development of the origination and distribution business model were able to transfer potential credit risk out of its balance sheet selling loan-backed securities to investors on the financial market. In that way, the securitization created a very lucrative source of fee-based income. Besides, what was even more important from medium and long-term performance outcomes, banks selling securitized assets were able to quicker retrieve capital invested into loans portfolio and reinvest it into new lending. Expansion of bank lending especially to housing had a significant impact on the appreciation of property market prices.

All of that contributed to the intensification of securitization, consequently improving loan supply with the availability to the customers of lower financial standing, better short-term bank liquidity management but also to underestimation of the speculative nature of that business. The U.S. financial system has a dual character of licence granting to depository financial institutions. In that light, commercial banks in the U.S. can apply for a state licence or national licence. Those ones that operate under national licensing level are required by law (Federal Reserve Act 1913) to be a member of the Fed. In contrast, the state licensed commercial banks have an option not the obligation to become Fed's member.

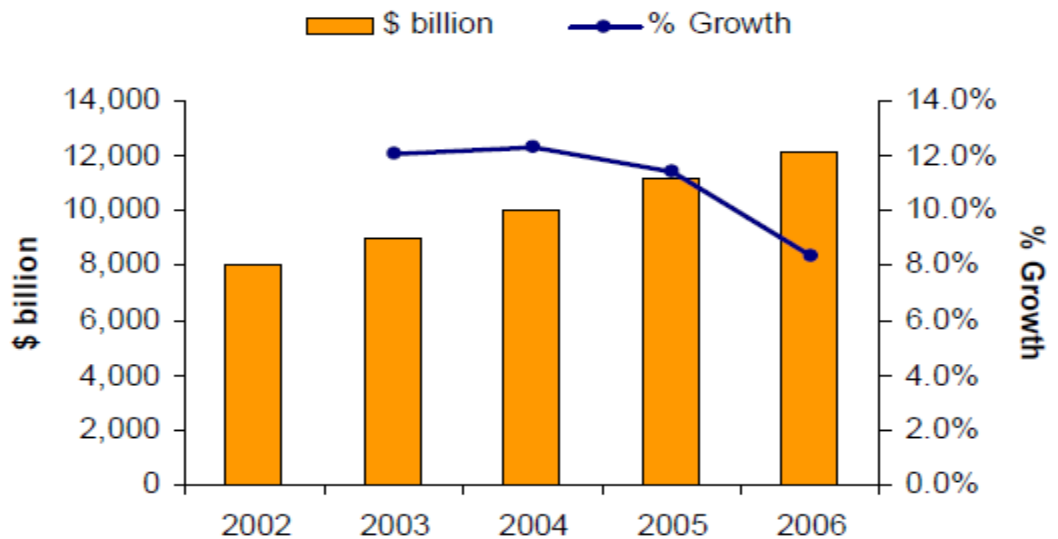
As we can see from the above Chart 8, since late 80's the number of commercial banks in the US started a decline. Particularly, strong reduction in number of analysed banks intensified over late 90's and 2000's. Over the aforementioned period, US commercial banks were experiencing growing changes in market structure dominated by wave of mergers and acquisitions. Further, due to the event of the recent financial crisis, the main earning positions of the US banks' balance sheets were severely affected. Consequently, banks entered the crisis period, losing the ability to generate a profit and accumulated the level of financial risk that put the sustainability of their market

Chart 8. Number of Commercial Banks in U.S. over 1980-2013



Source: Federal Deposit Insurance Corporation.

Chart 9. U.S. banking - revenue and its growth on the retail lending market over 2002-2006

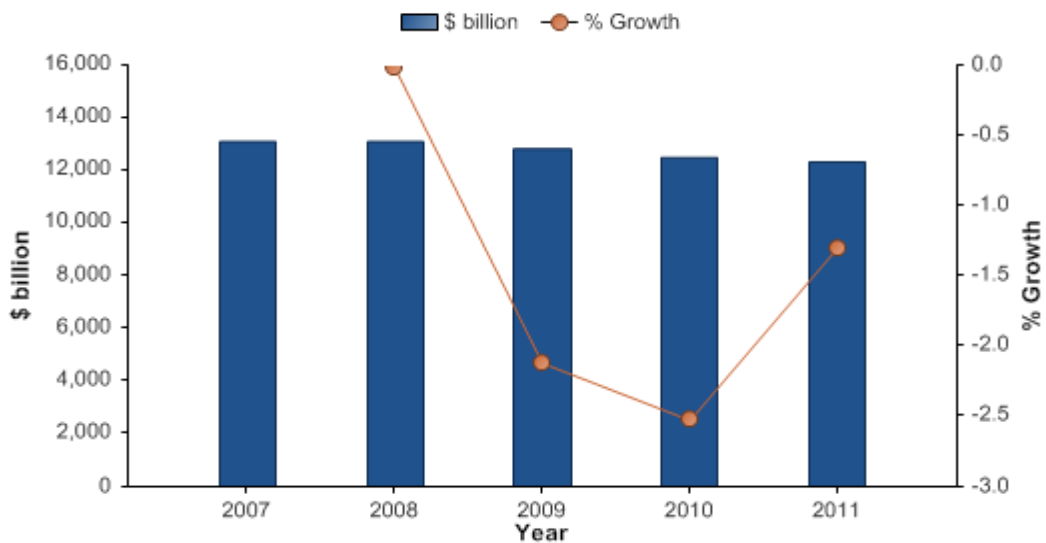


Source: Datamonitor.

presence under a serious strain.

In that regards, growing cases of US commercial banks' failures need to be seen as an important factor that contributed to a declining trend in a number of analysed banks.⁹ Another factor that drove the process of structural changes on the banking market near and over the crisis was a decrease in the number of licences for new banks. Moreover, banks, that were failing were often acquired by stronger, more financially sound competitors. All of the above shaped the new banking market landscape.

Chart 10. U.S. banking - revenue and its growth on the retail lending market over 2007-2011



Source: Datamonitor

Taking further the current analysis of commercial banking sector in the US, it is important to identify main trends in evolution of revenue on retail lending activity. The aforementioned metric constitute a main operating indicator of bank's performance,

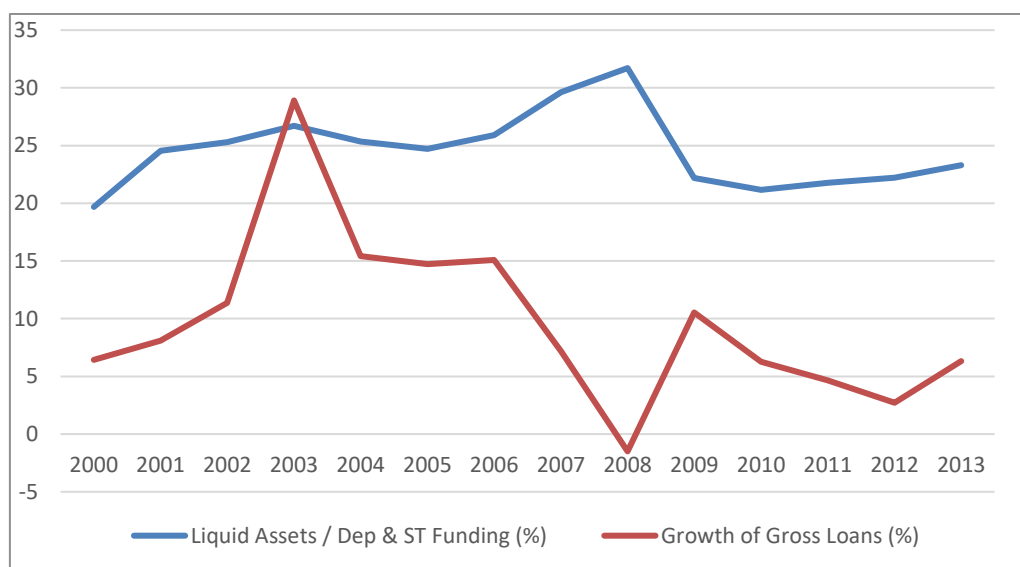
⁹ Only over 2009, the number of commercial banks' failures reached 120.

robustness and ability for market expansion. In the above light, the United States were recognised in 2006 as the largest retail lending market (mortgages and consumer credit) in the World, with a share of 48.3% in the global market value. In 2006, that market reached the value of \$12,135 billion (Chart 9). Over the period of 2002-2006 mortgages' sale had become the largest source of revenue, it generated the record level of \$9,704.7 billion in 2006. The consumer credit market value in 2006 accounted for 20% of the total market revenue, generating equivalent of \$2429.8 billion. In terms of annual growth rate, the revenue on the U.S. retail lending market over 2002-2006 grew by 11 %. Over the same period European and Asia - Pacific retail lending grew respectively by 8.6% and 5.9%.

After 2006, US commercial banks recorded in absolute terms a stable performance on retail lending of around \$13,000 billion for every year between 2007-2011. In relative terms the lending revenue growth recorded a drastic fall that started from 2008 reaching its bottom in 2010 of 2.5% (Chart 10). The mortgage-lending segment, in 2011, constituted the largest segment of the retail lending market in the United States, accounting for 79.7% of the market's total value, which in money terms reached the total amount of \$9818 billion.

The consumer credit segment contributed to 20.3% of the market revenue, generating a total of \$2508.2 billion in revenue. The residential mortgages and the commercial and industrial lending products constituted the most important source of loan growth. U.S. commercial banks expanded those lending activities the most over the period preceding the recent financial crisis. The mortgages relatively to GDP had the highest share of 25% over 2003-2006 (FED). The Growth of building constructions and land developments that intensified from 2002 contributed to the sharp increase in banking lending to that sector.

Chart 11. Indicators of liquidity and growth of lending in US banking sector over 2000- 2013



Source: Bankscope

In 2005, construction and land development loans amounted to around 35% in banking total lending portfolio¹⁰. The credit card products represented the lowest share among the lending business. During 2000 - 2008, they accounted for around 1 % of U.S. GDP. Moreover, U.S. commercial banks recorded the highest level of activity on the re-mortgaging market over 2002-2003.

By the end of 2006, the real estate and residential mortgage market started to slow down. Banks facing the lower rate of house prices' growth, the fall in sales of houses and increasing share of delinquencies especially on sub-prime mortgages started to experience a decline in the revenue level created by those business. The types of mortgage products sold to the market (for instance, interest only adjustable-rate mortgages)¹¹, generated delayed solvency problems among

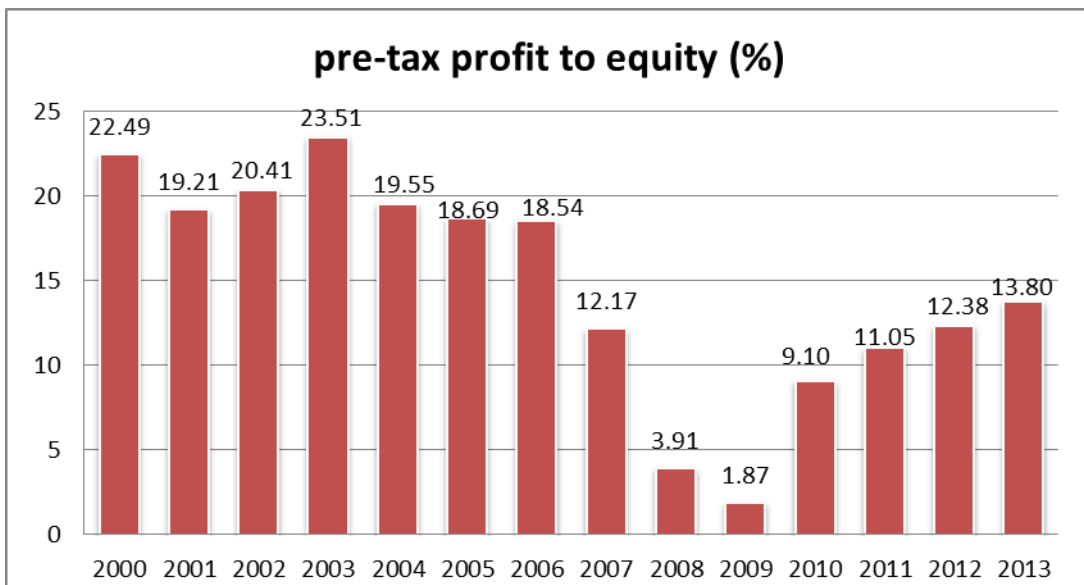
¹⁰ Over 2002-2006 construction and land development lending recorded the highest growth, while commercial real estate loans such as multifamily residential and nonfarm non-residential characterized the steady growth of around of 10% in total lending portfolio (FED).

¹¹ In 2005 the origination of interest only adjusted-rate mortgages in US increased to 23% from 17% at the end of 2004. However, the all types of adjusted-rate mortgages (including interest only mortgage) in 2004 constituted 63% of total mortgage originations (FED).

the borrowers. Those lending products were very risky, exposing borrowers to a steep rise in payments later over the duration of the lending contract. They were very attractive (in the banks' offer they were described as "affordable lending"), cheaper than the fixed rate counterparts and what was most appreciated by borrowers promoted the culture of easy spending and consumption at the cost of reduction in savings and liquidity.

The strongest performance on the pre-tax return on equity (Chart 12) was recorded by U.S. commercial banks in 2003 (23.5%). Nevertheless, the return stayed higher over the pre-crisis period (2000-2006) than over and post-crisis (2007-2013). In comparison to other advanced economies, U.S. commercial banks exhibited from year to year very stable results. The stability remained strong and sustainable even over 2000-2002, when analysed banks faced relative increase in provisioning expenses (Chart 13).

Chart 12. Pre-tax profit to equity over 2000-2013 for US commercial banking sector



Source: Bankscope

The U.S. commercial banking over 2000-2006 had continued to generate strong profitability outcomes, driven mainly by the growth of mortgage lending supported from a bank perspective by a securitization process and risk hedging using derivative contracts. The securitization, reaching the rocketing level from 2003/2004, had become for banks an attractive tool of liquidity and credit risk management. Moreover, it allowed generating the lucrative free-income from issuance and trading of assets-backed securities. However, it had also brought a great complexity of information to the market. It exposed ABS investors to risk of buying financial instruments in reality burdened by the mispriced, poor quality mortgages and other based assets. Underestimation and growing tolerance to risk among the parties involved in preparation of ABS onto the market contributed to the loss of investor confidence. Following the end of 2006 the investors gradually became more reluctant to invest in papers whose prices in fact did not reflect the level of risk involved. These market events while growing in strength dynamically have led to the worst financial crash since the Great Depression.

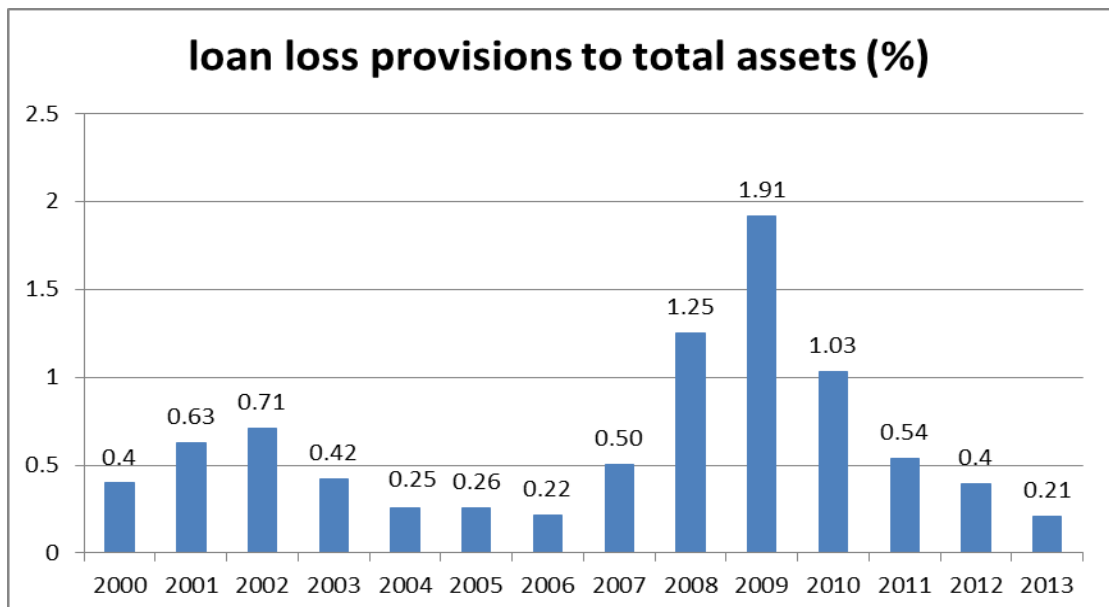
The first symptoms of the recent financial crisis at the national level were visible by the sudden growth in number of bankruptcies and insolvencies. The bankruptcy of Lehman Brothers in 2008 marked the momentum of the market problems and identified the source of the crisis in the U.S. financial sector that intensified spreading worldwide. Assets backed securities (ABS)¹² traded by the institutional investors, including hedge funds, industrial corporations also commercial banks become no longer a lucrative, low risk business. In response to a downturn in the US property market and the intensified growth of defaults especially on sub-prime mortgage lending, the confidence of ABS investors had immensely weakened increasing investors' risk

¹²For instance, MBS (Mortgage Based Security) gives the holder the right to participate in payment made by mortgage borrower. Specially, it gives a right to a percentage of the total payments on the pool of mortgages (less administrative fees for the trust).

aversion. The loss of confidence and trust in investments that exhibited a dubious quality, (hence an uncertain future of the yield) become a main driver of a decline in market demand for those financial instruments. As the values of securitized assets portfolios were declining, banks that already had them on their balance sheets have become exposed to increase in funding costs. Correspondingly, as the ratings for the ABS commercial papers used to finance the supply of the new ABS also were going down, the Special Purpose Vehicle (SPV)¹³ experienced the liquidity problems after not receiving the required funds from its sponsor (bank).

The mounting loan losses and stress related to US commercial banks exposures to illiquidity and credit risk increased to the scale not recorded over last two decades. In light to the above, banks experienced over 2008 and 2009 also the strongest deterioration of borrowers' creditworthiness.

Chart 13. Loan loss provisions level to total assets over 2000-2013 in the US banking sector



Source: Bankscope.

¹³SPV is the third party in the securitization process that was established to deal with funding of issuance and distribution of ABS from originators (banks).

Particularly, the delinquency rate on residential real estate loans in 2009 reached its highest level in more than 15 years (FED). Those facts have found their direct reflection in banks' strategy to maintain loan loss provisions to total assets between 2008-2010 at the highest level in the analysed 2010-2013 period (see Chart 13 as above). Facing the aforementioned problems' profitability performance of analysed banks over 2008-2009 recorded on average the highest decline measured by pre-tax profit to equity ratio (Chart 12).

The U.S. market for short-term refinancing based on asset backed commercial papers from July 2007 to March 2008 had contracted by nearly 30% and that decline continued till 2010 ([McKinsay Analysis](#)). To minimize their exposure to emerged problems with illiquidity risk banks stated to apply various strategies. For example, they go from liquidity hoarding to fire sales of illiquid assets. The use of the above strategies corresponded with the necessity of deleveraging that during the analysed period dominated the actions within the banking sectors of the most crisis-affected economies. The process of deleveraging was achievable through increase of bank's equity base relatively to assets level or alternatively had led to reductions of bank new lending. In 2009, the deleveraging of the U.S. commercial banking sector has intensified becoming a main driving force of government strategy towards recovery of sector's failing performance. In those circumstances, only immediate provision of emergency funding to undercapitalized, destabilized banking system seemed to prevent further increase of banks' losses and risk. The set of government funding initiatives known as Troubled Assets Relief Program (TARP) introduced the massive capital injections to the US banking system.¹⁴ Within those rescue programs, banks were selling to the

¹⁴TARP program has been set up under the Emergency Economic Stabilization Act (2008). Being launched in October 2008 and ended in December 2009 constituted the comprehensive emergency set of funding initiatives (altogether TARP was built of 12 rescue programs) established to help restoring US banking system at the onset of the recent financial crisis 2008 and 2008. The programs aimed to encourage banks to lend again in the effect reactivate the credit market and banks' liquidity creating in a long-run the

Treasury the shares of their preferred equity shares and toxic mortgage backed securities in exchange for the funds under the condition to repay them later.¹⁵ TARP initially was designed to provide around \$350 billion through its core Capital Purchase Program (CPP) and few months later in February 2009 around the same amount through Capital Assistance Program (CAP). However, CAP was closed in November 2009 without making any planned investments. Effectively the CPP program helped restoring the capital base of commercial banking system mainly through transferring capital to bank holding companies (BHC) and commercial banks not organized as a BHC.¹⁶ Overall the number of TARP's participants and effective recipients of its help belonging to aforementioned categories amounted to 659 of which 572 were BHC and 87 commercial banks not organized as a BHC (Berger, Roman 2015; US Department of Treasury). According to the Report published by US Government Accountability Office (GAC) the Treasury from the invested 204.9 billion under CPP recovered \$211.5 billion allocated in summary to 707 financial institutions in the form of repayments, dividends, and interest, fees, sold warrants. The government financial support to the banking sector has been completed though with the positive return to taxpayers. Nevertheless, TARP initiative and assessment of its effectiveness including the level of its cost for society attracts ongoing debates that include strongly polarized views.¹⁷ Funds redistributed under TARP helped participating banks to strengthen their

potential to restore country's economic growth.

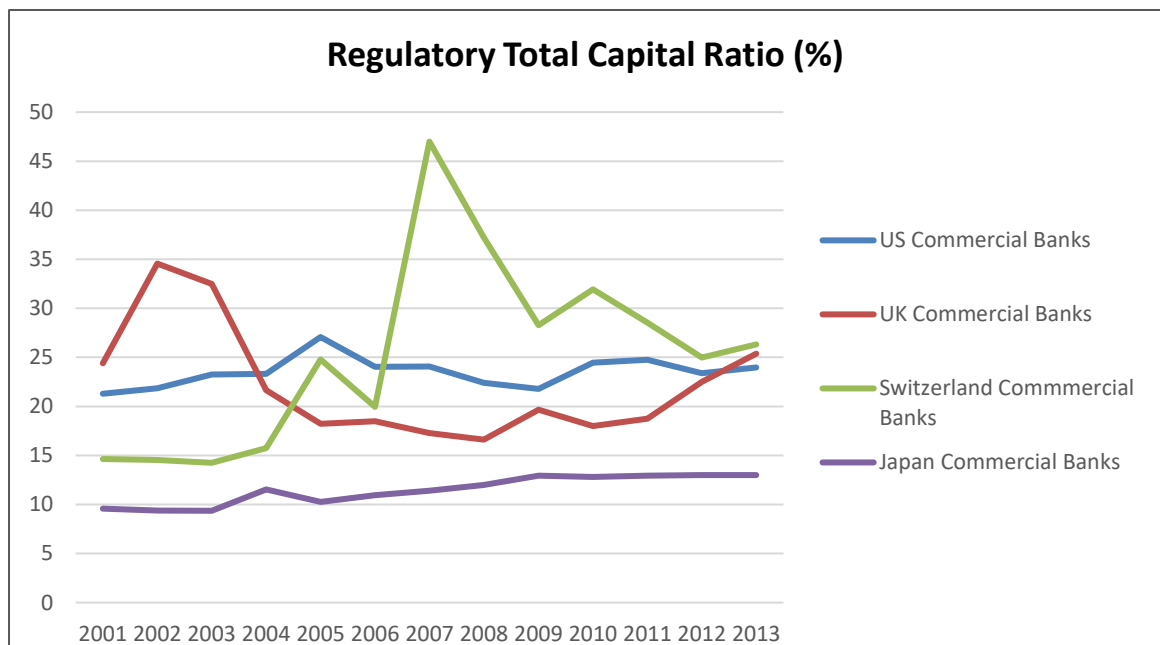
¹⁵Banks participating in the program could apply for a capital support in the amount of maximum 1-3% value of their risk-weighted assets, however no more than \$25 billion. US Treasury in return for its investments within TARP exercised the rights to dividend payments (5% for the first five years and 9% afterwards), interest payments and 10-year warrants. The latter were giving Treasury the option to buy common stock of banks participating in the program for the amount equal to 15 % of initial investment. (US Department of Treasury)

¹⁶Bank holding companies (BHC) are entities that own or are in control of one or more US commercial banks. As a parent organization (BHC) was a primary recipient of capital under TARP afterwards responsible for further transfer of that help to the commercial banks under its influence or ownership.

¹⁷ For example, following recapitalization under TARP banks especially big banks, increased their risk taking behaviour with no evidence for an increase of new credit origination (Black, Hazelwood, 2013; Duchin and Sosyura, 2012) Banks were more focused on using TARP funding to enhance their capital base then to boost their lending activity (Li, 2013; Taliaferro, 2009). Opposing evidence shows that banks that participated in TARP have increased the lending, improved their competitive advantage in terms

capital base, allowing them actively progressing with deleveraging process and also restructuring their assets compositions shifting to more liquid, higher quality positions. By conducting, the latter banks were able to improve their ability to meet required capital regulatory measures (Chart 14). In particular, following the recent financial crisis, U.S. commercial banks have recorded since 2009 the visible improvement in the level of regulatory capital ratio level.

Chart 14. Regulatory Capital Ratio over 2000-2013-Comparison across the U.K., the U.S., Swiss and Japanese Commercial Banking Sectors¹⁸



Source: Bankscope.

of both market share and market power (Liu et al, 2013; Berger and Roman, 2015).

¹⁸Regulatory total capital ratio consists of Tier 1 Capital plus Tier 2 Capital plus Tier 3Capital relatively to Risk Weighted Assets.

Tier 1 Capital is a common equity (excluding intangible assets such as good will, excluding net unrealized gains on investment account securities classified as available for sale) and certain perpetual preferred stock.

Tier 2 Capital is a subordinated debt, preferred stock not included in Tier 1 Capital and loan loss reserves up to a cap of 1.25% of risk-weighted assets.

Tier 3Capital is short-term subordinated debt with certain restrictions of repayment provisions and is limited to approximately 70% of bank's measure for market risk.

Risk-Weighted Assets, calculated multiplying the amount of assets and the credit equivalent amount of off-balance sheet items by the risk weights for each categories (risk weights increase from 0 to 1 the higher the risk the higher the weight associated with the asset category). (Federal Reserve Bulletin, May 2010)

In the same time, over 2009 U.S. commercial banks experienced the highest influx of capital facilitated by TARP via bank holdings companies that acted in the process of bailout as “a financial hub” providing funds for participating commercial banks they owned or controlled. However, in terms of regulatory capital ratio level U.S. commercial banks over 2004-2012 were able to outperform its UK, Japanese counterparts, while Swiss commercial banks over the same period showed the strongest capital resilience significantly outperforming particularly over the crisis period (2006-2009) competitors from U.K., U.S. and Japan.

To sum up, the performance of the U.S. commercial banking sector in the pre-crisis period followed buoyant profitability patterns. Growth in mortgage lending along with a reliance on securitization as a form of liquidity and credit risk management constituted for the analysed banks a lucrative source of revenue. Over the pre-crisis period, commercial banks in U.S. were able to develop a dominant position on the global lending market. The scale of their performance especially on the mortgage market’s segment has largely contributed to the fact that the U.S in 2006 was ranked as the largest retail lending market in the World, embracing 48% share of global value in that market. However, events of the recent financial crisis had adverse effects on further expansion of the lending market (the steep annual decline in lending that started from 2006 reached the lowest level in 2008, contracting nearly to -5%). U.S. commercial banks facing since late 2006 an accelerating decline in housing prices and a constant growth in the number of defaults on mortgage lending were further not able to expand mortgage lending applying the originate and distribution model. Uncertainly in sustaining, the future yield from trading with assets-backed securities (ABS) hit the banks’ strategy of balance sheet management. As a result, the analysed banks entered 2007 with significant depletion of revenue and profitability outcomes. The disruptions on the securitization market made banks unable to perform without mounting constraints on liquidity and credit risk

decisions. Losses and a growing number of banks' failures confirmed the seriousness of the emerged financial crisis. In that respect, the existing market pressure finds its reflection in a significant decline in analysed banks profitability performance. U.S. commercial banks, particularly over 2008 and 2009 experienced persistent slowdown of their profitability levels measured in terms of pre-tax profit to equity ratio. The pre-tax profit to equity ratio in 2008 in comparison to 2007 recorded an unprecedented decline of nearly 68%, deepening further to 84.6% in 2009. Nevertheless, the profitability rebounded on its recovery path again from 2010. However, its scale proved to be much lower than before the pre-crisis period.

In the above light, capital transferred to U.S. commercial banks via government financial interventions had an unquestionable, important impact on the restoration of banks' ability to generate profits again. The U.S. Government's actions on the financial market, designed to strengthen banks' capital base improved not only banks' ability to reduce level of leverage but also to support banks in meeting capital regulatory ratios at the new higher level. Especially, thanks to the latter, banks in their attempts to recover were prepared to face a future with greater capacity to withstand potential losses from risk on lending activity.

2.2.3 Japan

The Japanese financial sector was traditionally characterized by the rigid government regulations. Banking services were separated by an administrative guidance from securities services. The aforementioned separation also affected a deposit banking that has been isolated from the trust business and further a long-term finance isolated from the short-term finance (Hall 2003). The need to initiate a deregulation process became essential in the 70's, when the first oil-price shock resulted in structural changes in Japanese economy. However, even in the late 70's, when the Japanese companies turned to direct foreign investments, Japanese banks were allowed to open only one representative office abroad a year and a branch every 3 years.

The market events in Japan that took place over the 80's and the 90's had negative consequences for the performance outcomes of the Japanese banking sector. For example, the collapse of equity and property prices in the early 90's after the boom on these markets over the 80's, an increase of real estate lending by Japanese banks, delay of regulatory interventions design to deal especially with of the mounting level of non-performing loans, assets price deflation. All the aforementioned had led to the development of a systemic banking crisis in Japan in 1997 whose ripple effect was experienced not only for country's banking sector¹⁹ but also in the real economy until 2000's.

The above highlights provide an overall picture of the issues, the Japanese banking sector was exposed to in the period preceding the recent global financial crisis. The Japanese banking sector had been experiencing a recovery time till the early 2000's.

¹⁹Over 1994-2003 there were in total 171 banks failures. To deal with the risk of bankruptcies among banks between 1996-2002 Japanese government introduced the scheme of full guarantees in failed banking institutions on all types of deposits (including medium and long-term debt instruments) as well as interbank lending and derivatives trading (Nelson, Tanaka 2014).

No earlier than in 2004 the situation started to stabilize when problems of non-performing loans become a less dominating goal of regulatory policy.

However, looking back, the late 90's Japanese government trying to improve the market situation, decided to implement a number of significant regulatory changes known as a "Big Bang"²⁰. The reforms introduced by Prime Minister Hasimoto were designed to strengthen the international competitiveness of the Japanese banking sector traditionally organized on the bank-based model. Particularly, in comparison with the U.S. financial market organized on the market-based model, the Japanese market suffer from the high reliance on traditional banking services. That fact made the Japanese financial market not efficient enough also overly regulated with a low level of financial innovations including underdeveloped market for derivatives and securitization. In that respect, Japan's Big Bang was organized to:

- a) break down barriers between banks, insurance companies, and securities firms;
- b) liberalize brokerage commissions and foreign exchange laws;
- c) allow commercial banks and non-bank financial institutions to issue bonds reducing their reliance on deposit funding;
- d) remove restrictions on the portfolio holdings of Japanese households and firms;
- e) reform the corporate accounting system;
- f) liberalize restrictions on securities derivatives and asset-backed securities,;
- g) open the doors to foreign competitors and new financial products;

Actions implemented within the "Big Bang" reform developed a more liberal, less regulated banking sector in Japan. As a result, the reforms created prospects that applied in its pure form, a bank-based approach to banking operations will evolve offering more

²⁰ Japanese "Big Bang" reforms by its name aimed to create a synonym for UK "Big Bang" reforms introduced over the 80's that also aimed at actions to liberalize the UK financial market including the comprehensive set of reforms on the London Stock Exchange.

innovative, open and efficiency driven services. However, the process of adaptation of the Japanese financial market to new standards appeared to be long, impaired by persistent deflationary pressure, low economic growth, banking crisis of 1997-2001, mounting public debt.

The attempts to clear up the situation especially in order to support and promote a recovery of Japanese banking sector take a form of another set of reforms launched from 2003 by Prime Minister Takenaka. His Financial Revival Program (FRP) introduced tougher monitoring procedures on bank assets for all banks that have been experiencing performance problems. Moreover, the plan also pronounced the need for further recapitalization of banks' capital, a strengthening of bank governance. Low capital level in the Japanese banking sector constituted a serious problem since 90's and persisted into the 2000's. Between 1998-2009, there were five major capital injection programs (Hoshi, Keshyap, 2010). The strategy covered a tighter bank supervision design to reduce more effectively the amount of non-performing loans from banks' balance sheets. Moreover, to strengthen classification of loan loss provisions and reduce the value of equities held by banks to the level equal to 100% Tier 1 capital ratio. The plan was actively applied till 2007 and had led the Japanese banking sector to a slow but gradual path of recovery.

The cost of the banking crisis in Japan was huge. The overall non-performing loan level in existing in banks' books over 1992-2005 has been assessed to be equivalent of 25-20% of Japan's GDP. However, the actual value of write-offs performed by banks reached around ¥67 trillion, which constituted only about 19 % of Japans' GDP (BoJ). Considering that, the burden of bad loans affected not only banks directly but also contributed to the slowdown of the country's economy, the period of the banking crisis is known also as a "lost decade". Stagnation driven by deflationary pressure since the 90's affected the Japanese economy over long period of time. The crisis resulted also in a decline of consumer confidence in banks that over years stayed undercapitalized

despite the number of supported by government restructurization programs. There is still an uncertainty that this deflationary environment can return to the Japanese economy over the years to come.

Legislation of the banking sector in Japan is based on the Banking Law Act introduced in 1927, with the later changes made in 1981. The regulatory function over the banking sector in Japan until 1998 belonged to Ministry of Finance (MF). Nevertheless, due to the increasing support for creation a regulatory body, the new independent regulatory authority has been established, named The Financial Services Agency (FSA). It formally started active work from 2000 and continues to fulfil this function today. The Bank of Japan performs supplementary supervision over banks in Japan. It is responsible for monitoring the banks with the aim to preserve a sound and safe financial system ([Japanese Bankers Association](#)).

Financial institutions in Japan are classified into:

- a) private deposit taking institutions;
- b) private non-deposit taking institutions;
- c) public financial institutions;

Among them the first aforementioned group consists of commercially focused banks, the second refers to investment banking, while the third group is dominated by the financial institutions that support fulfilment of the government economic policy for instance by programmes of subsidies directed to particular industries or regions.

Considering the context of the current research further, we focus on characteristics of the first group alone, namely private deposit taking institutions. The breakdown of banks' number by subcategories within the aforementioned group is presented in table 1. Correspondingly, City Banks have traditionally the highest share in the domestic lending and deposit market; they provide a universal, traditional type

of banking. Regional Banks I and Regional Banks II are accordingly; medium and small size commercially focused regional banks that service mainly sector of Small and Medium-size Enterprises (SMEs). They constitute the most numerous type of private banks in Japan. Next, Trust Banks, besides provision of commercial banking services, they are also involved in “money trust” (kinsen shintaku) - of medium and long term deposits with a due date. Because of the character of their deposit services they specialize in long term commercial lending and also invest in bonds and equities. Long-Term Credit Banks were present on the market till 2006. Having their focus on long-term lending services, they supplied funds for the corporate sector. Facing the difficulties following the Japanese banking crisis they went through the consolidation process with city banks. As a result of restructuration they stopped to exist on the market in their initial form. (Uchida, et al., 2015).

Table 1. Number of Japanese Private Depository Institutions by Type over 2000-2009

TYPE OF BANK	2000	2002	2003	2004	2005	2006	2007	2008	2009
City Banks	9	7	7	7	7	6	6	6	6
Regional Banks I	64	64	64	64	64	64	64	64	64
Regional Banks II	60	56	53	50	48	47	46	45	44
Trust Banks	33	29	27	27	26	23	21	20	20
Long-term Credit Banks	3	3	2	2	1	1	0	0	0
Other Banks	-	5	5	6	9	9	10	13	14

Note: Number of Trust Banks includes also foreign owned entities. Other banks include the Second Bridge Bank of Japan and the Resolution and Collection Corporation. Source: Japanese Bankers Association.

In the period, preceding the recent financial crisis, Japanese banks were exposed to a hard time of recovery from the time of economic deflation and the Japanese crisis of the 90's. Growth of outstanding loans along with the decrease in banks' capital value had led to contraction of lending activity. The problem of non-performing loans that escalated in 1997 and has finally stabilized in the mid-2000's had a significant impact on the growth of banks' lending costs²¹. Over 1994 - 2004 the overall banking costs on lending activity reached around ¥96 trillions (Fujii & Kawai, 2010).

The aforementioned problems had their reflection in sluggish outcomes on growth in net interest income. The slight improvement of profits driven by banks' lending has become a fact from 2004, when banks managed for the first time since the 90's to reduce significantly the level of lending costs. The ratio of non-performing loans to total credit exposure of major private banks decreased from 8.7% in 2001 to 2.9 % in 2004 (Bank of Japan). The same ratio continued to decline further and at the end of the fiscal year 2005 reached 1.8% for major banks and 4.6% for regional banks. In response to the decline in the non-performing ratio to total credit, the banks also achieved a reduction of lending costs ratio defined as lending costs to total outstanding loans. The latter declined in 2005 to negative -0.18% in the case of major banks and 0.32% for regional banks.²² Similarly, from the analysis of Chart 15 we can see a declining trend in loan loss provisions to assets ratio. Following the end of Japanese banking crisis in 2004, that trend persisted from year to year until the last year of this analysis, in 2013. In that respect, the commercial banking sector in Japan was gradually developing resilience, improving the strategy to deal with loan losses. Nevertheless, the programs of reorganization and restructuring for corporate debt

²¹ Lending costs (credit costs) here understood as net losses from disposal of non-performing loans. (Bank of Japan)

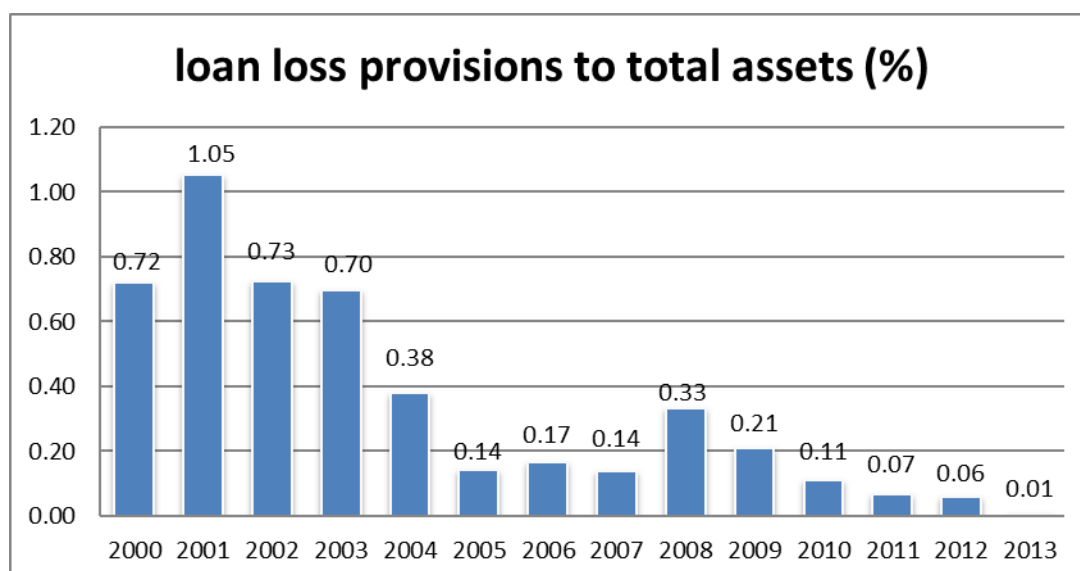
²² The Negative values of lending costs ratio was manly driven by reversals of allowances for loan losses due to improvements in borrowers' credit quality. (Bank of Japan)

continued in the Japanese financial market until 2013.

The factor that inevitably had affected Japanese commercial banks' net interest income was the steep, declining trend of interest margin. The source of that decline was identified in the low market demand, high competition in the banking market and decreased consumer trust in the banking sector, high level of cheap funding supplied to banks as customer deposits²³.

Overall, Japanese banks performed in difficult economic market conditions.

Chart 15. Loan loss provisions level to total assets over 2000-2013 in Japanese banking sector



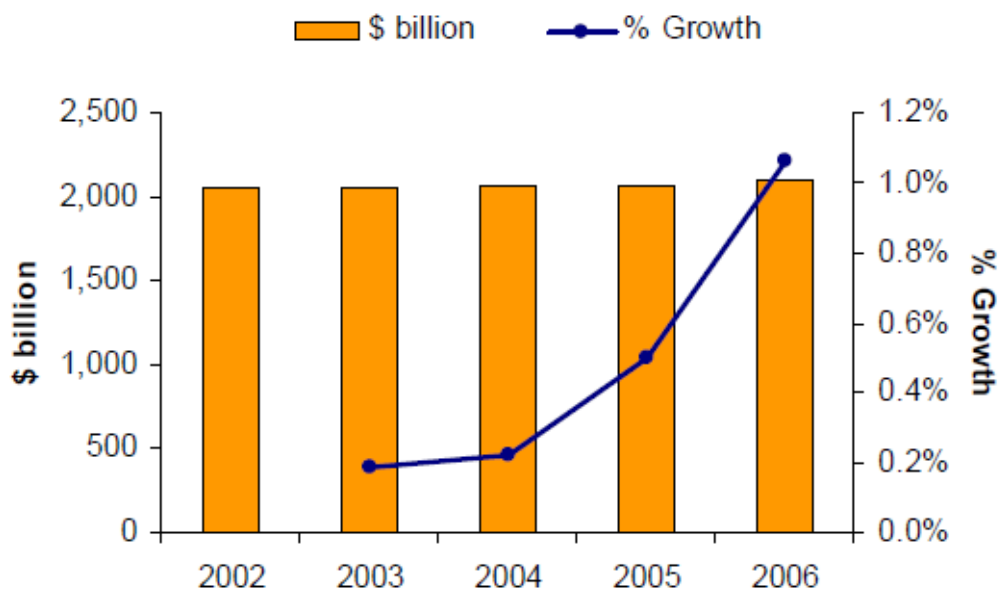
Source: Bankscope.

Over 2002-2006 the total revenue of Japanese banks on retail lending has recorded the annual average growth of only 0.5% (Chart 16). However, for the analysed period, the highest growth occurred in 2006, when the annual growth reached 1.1%. Excluding 2006 from the analysis; retail lending market experienced average decline

²³The Japanese banking sector among economically advanced countries traditionally is characterized by highest share of customer deposits in bank total liabilities. That feature reflects that in Japan still dominate the bank base model in organization of banking system.

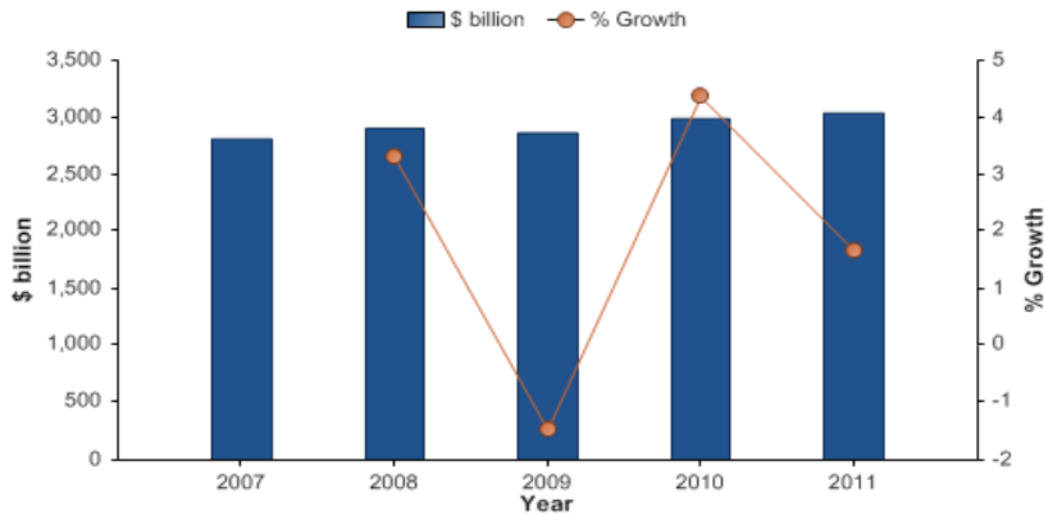
in revenue over 2001-2005 of 0.1 %. The most profitable segment of the market belonged to mortgages that in 2005 generated \$637 billion which accounted for 75.1% of the total of outstanding loan balances. In 2006 Japan became the largest lending market for the Asia-Pacific region achieving a share in that market of 53.2%. (Datamonitor). While over 2002-2006 revenue growth in the retail lending market in Japan indicated a very slow but consistent positive trend after 2006 the market performance became unstable, showing rapid negative changes. In particular, after a 3.3% increase on retail lending revenue in 2008, 2009 recorded sudden contraction of -1.5% , a recovery over 2010 to 4.4% and again a decline to 1.7 % in 2011 (Chart 17). The revenue performance on the analysed market entered the period of brief swings and instability, driven by uncertainty in the global financial market, and a decline of economic growth in Japan that has led to a deterioration of the internal market demand including the demand for lending.

Chart 16. Japanese banking - revenue and its growth on the retail lending market over 2002- 2006



Source: Datamonitor.

Chart 17. Japanese banking - revenue and its growth on the retail lending market over 2007- 2011



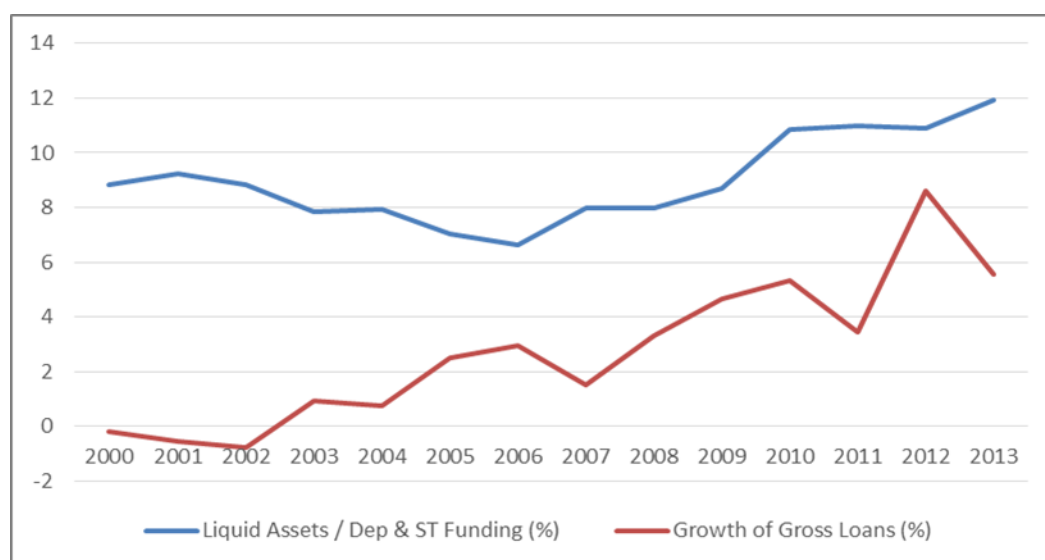
Source: Datamonitor.

Further, an important contribution to positive changes on profit performance in the Japanese banking sector was an expansion of fee-generated services (for instance: sale of investment trusts, private pension schemes, derivatives, securitization of loan assets) (BoJ). In 2005, fee income accounted for about 40% of profits among major Japanese banks. However, despite the fee income source started to play a more dominant role over analysed period, Japan in comparison to other advanced economies such as the U.S., the UK had a significantly lower share in that market segment.

Management of liquidity risk with the aim to boost bank lending at the presence of deflation remained the priority of the Japanese authorities. To tackle the problem Bank of Japan from 2001-2006 has introduced the policy of quantitative easing. However, the strategy did not bring expected outcomes. Deflationary pressure over the analysed 2000-2010 period persisted. The Bank of Japan reintroduced the program of Quantitative Easing in 2010. Further, over the analysed period 2000-2013 an average, ratio of liquid assets to deposits and short term finding (Chart 18) for the sector was relatively low,

but showed an increasing trend associated with a significant increase in banks' investment portfolios, outstanding amount of bond holdings. Lending growth also has been improving; however, the scale of this improvement was small.²⁴ In comparison over the same period the average ratio of liquid assets to deposits and short term funding for UK banking was at the around 70% and average growth of gross loans was around 25%.

Chart 18. Indicators of internal liquidity and lending growth in Japanese commercial banking sector over 2000-2013



Source: Bankscope

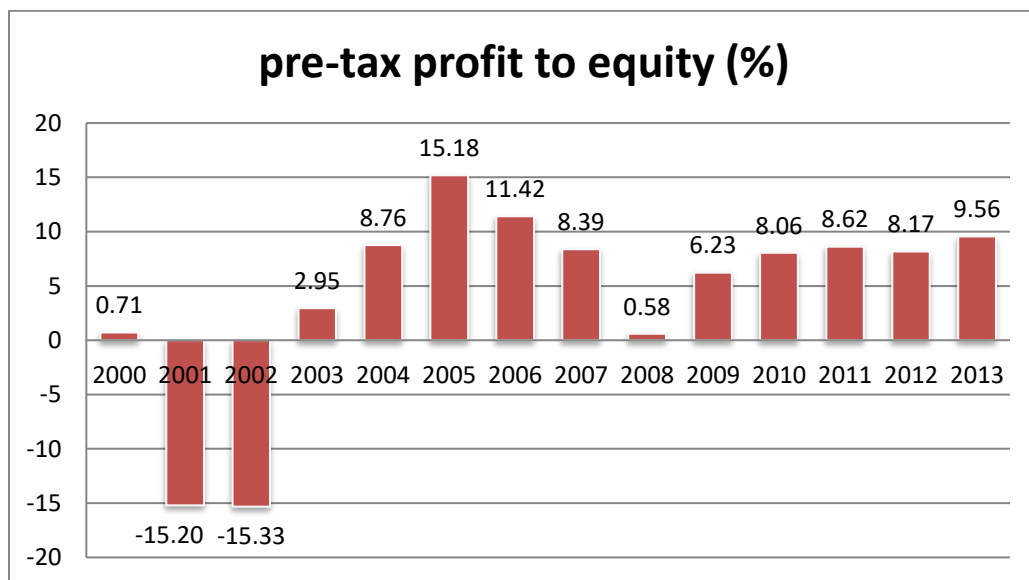
Reflecting on the factors underlying the performance outcomes of the Japanese commercial banking sector over 2000-2013, the outcomes in pre-tax return on equity (Chart 19) confirm that the performance recovery coincided with the time, when the level of total income generated by banks overcompensated declining from 2003 the level

²⁴ In Japan in contrast to other economically advanced countries, banking deposits constitute a stable, large pool of banks' short-term funding. For example, the aforementioned fact also has a positive impact on the management of government's debt in Japan (it reached in 2012 the level of 238% of GDP, in comparison the level for the UK in the same year amounted to 90% of GDP). For example, high supply of private deposits supports financing of the Japanese government debt. In a scenario that assumes that 40% of deposits would be withdrawn from Japanese banking system the yields on Japanese government securities would grow by about 10%. ([Japan Financial Report 1-2 FY2012](#))

of non-performing loans. Bad loans problem constituted an important factor of profitability performance for the analysed banks over 2000-2013.²⁵

Over 2009 the profitability performance of Japanese commercial banks have experienced a serious decline. That sudden swing in profitability needs to be seen as a result of external as much as internal factors. Among the external factors, break out of the recent financial crisis had a vital, however not directly transmitted influence on profit performance fluctuations of the analysed banks.

Chart 19. Pre-tax profit to total equity over 2000-2013 for Japanese banking sector



Source: Bankscope

In that respect, because Japanese commercial banks had a limited use of the “originate and distribute model” they were to the lesser extent (than the U.S. or the U.K.’s commercial banks) exposed to problems with “toxic” assets-based

²⁵ Over 2000-2008 the Japanese financial market went through numerous, bad debt restructuring programs. The problem of non-performing loans was solved via the reorganization of borrowers’ debt. In that respect, banks encouraged by the Japanese government funded a creation of assets management companies that assisted with buying from insolvent and also solvent banks outstanding bad loans. For example, between 2001-2008 the Resolution and Collection Corporation (RCC) restructured 127 borrowers’ debt, also it participated in the restructurization of 450 borrowers. In total from within aforementioned actions, RCC restructured 6.2 trillion of debt. (Hoshi, Keshyap, 2010)

positions, securitization losses or associated with all the aforementioned, the problems with a sustainability of funding liquidity and its management.²⁶

Further, funding liquidity of the Japanese commercial banks has not been seriously affected over the recent crisis and post-crisis period, despite of being at the lower level in comparison with banks from the U.S., the U.K and Switzerland. Correspondingly, yen-denominated liquidity needs that emerged on the interbank money market over 2007-2009 required only a temporary stabilization. The scale of stabilization involved far lower financial sources than in the case of the U.S. or the U.K. The limited exposure to funding liquidity needs stemmed from the fact that Japanese banks possessed a vast pool of deposits that as a stable and cheap source of short-term funding, constituted an effective alternative to the money market source's option.²⁷ Moreover, Japanese banks acting as a borrower on the interbank market had a sufficient collateral margin to borrow on the basis of the high share of Japanese government bonds in their investment's portfolio. In terms of non-yen denominated transactions, namely the ones denominated in US dollars, the interbank market is becoming more and more illiquid. The presence of a growing counterparty risk made participants of the money market more reluctant to meet growing demand for US dollar funding. The above situation also affected the funding requests of foreign financial institutions, including Japanese commercial banks. In those circumstances, at the end of 2008, the Bank of Japan, in cooperation with the central banks of United Kingdom and Canada entered into reciprocal currency agreement with the Federal Reserve (swap line).

²⁶ For example, the highest realized losses of Japanese banks (major, regional and cooperative) on sub-prime activities constituted only 2.2% Tier 1 Capital of those banks and were accumulated by autumn 2009. ([Financial Service Agency](#))

²⁷ High share of deposits in total liabilities constitutes a characteristic feature of the Japanese banking sector. Over the analysed period, deposits constituted on average 80% of the banks' liabilities. Correspondingly, banks' market funding on average accounted for between 10-15%. ([BoJ](#))

As a result, the Bank of Japan was able to provide US dollar interbank funding for Japanese banks easing up a further increase in short-term funding rates and stabilizing the movement of overnight rates on the money market in aforementioned currency.

The high volatility of the financial market over recent financial crisis made a heavy, negative impact on the Japanese banks' profitability outcomes. Shareholdings constituted over the crisis and also the post-crisis period a relatively high share in banks' total equity level. Therefore, the transmission of the recent financial crisis via a sudden decline in the prices of equity shares contributed to a significant decrease in banks' realized/unrealized gains on those shareholdings and correspondingly in banks' capital level.²⁸ Due to the above and also due to the decline in commission based transactions (especially in sales of investment trusts, foreign exchange and derivatives trading) over 2008 the level of non-interest income for Japanese commercial banks showed a large scale of deterioration (see Chart 20).

Nevertheless, the recovery of profits was achievable again between 2009-2013. As such, growth in retained earnings finds its reflection in positive developments in banks' capital base and the stabilization of capital adequacy ratio over the above mentioned period (see Chart 14). The positive trend of profit generation was also strengthened by a declining credit costs ratio. In that regard, the latter reflected also negative developments on analysed banks ratios of non-performing loans to total assets (Chart 15). During the analysed profits recovery Japanese commercial banks have been experiencing the continuous decline in interest rate margins. That fact made their domestic outcomes on lending not profitable enough to build market strength and profit

²⁸ For example, at the end of first half of 2008 more than 60% of all Major Banks a Regional Banks recorded a decline in Tier I Capital as a result of increase of unrealized losses on their stockholdings. To support banks during a turbulent time of high market volatility Bank of Japan especially over 2008-2010 has been reintroducing the program of stockholding's purchases from bank most affected by market risk. Moreover, to strengthen the capital position of analysed banks Bank of Japan in 2008 implemented changes to Special Measure for Strengthening Financial Institutions Act. On the above basis, in 2008 the capital's injections provided to Japanese banking sector were raised by 10 trillion yen to 12 trillion. (BoJ)

performance sustainability for the future. Besides, following the considerable drop in economic activity over 2009, driven by a slump of international demand for the Japanese export, banks have become exposed to the risk of defaults from the domestic business sector. The profit niche appeared to exist in overseas lending activities. In fact, Japanese banks (particularly Major Banks) were returning to the cross-border lending business. Before the onset of the Japanese banking crisis of 90's, Japanese banks had a considerable share in total cross-border claims. To gain a competitive advantage, they gradually increased their presence on the aforementioned market. However, the recent financial crisis put on hold again the attempt to grow as a leader in global lending. Following a recovery over the post crisis period, Japanese commercial banks were able to increase their profit performance on cross-border lending activities. In 2011, despite experiencing instability on the internal market due to the Tohoku Earthquake and tsunami, Japanese banks replaced German banks in their position as the World's largest international lender. At the end of 2013 they expanded their market share to 13%, while at the same time US banks' share accounted for 12% and German ones 11% ([van Rixter and Slee, 2013](#))

In conclusion, the Japanese banking sector also before the time of recent financial crisis has experienced serious distortions in the financial market and in the real economy. Banks' activity was weak due to deflation and high credit costs. However, the government capital injections and the loan restructurization process acted moderately to restore the general stability of the banking market. In comparison to other national banking markets analysed in this research, the positive but low profit performance in case of the Japanese commercial sector has become a fact since 2003. The efforts to bring effective recapitalization to the banking sector took a long time. The low capital base characterized the banking sector in Japan also over the 2000's. The conditions were fuelled by the low quality lending decisions (ever-greening), lack of transparency in bank

decisions on provisioning (in many cases banks had kept more loan losses on their books than had disclosed to the financial regulator).

The introduction of Financial Revitalization Program in 2002 helped to speed up a resolution of the aforementioned problems, drawing to the end the Japanese banking crisis of 1991-2004. The recovery of profits was gradual and consistent. Japanese commercial banks stayed robust recording between 2003-2005 general improvements of their performance. On-going restructuration of corporate debts, capital market interventions, increase of Japanese market openness for the international trade, created economic incentives to support market growth and correspondingly boost banks' profits. However, a sudden drop in economic activity along with growth of prices' volatility on the financial markets caused by recent financial crisis put again a downward pressure on profit performance of the analysed commercial banking sector. In 2008, Japanese banks' profitability declined. Nevertheless, the magnitude of that decline was much smaller than during 2001-2002, when banks performed below profitability level. Japanese banks were less severely affected by the events of the recent financial crisis. However, the Bank of Japan responded quickly among others providing active support in form liquidity injections to the money market, organizing the process of shareholdings write-offs to reduce the level of market risk from banks' balance sheets, opening subordinated lending facility. The actions allowed banks to rebound their profits again even at the presence of increasing business sector's bankruptcies, growth in mortgage defaults and an ongoing slowdown in Japanese economy. The source of new profits between 2010-2013 stemmed from an increase in non-interest income and overseas lending, a reduction of losses from banks' stockholdings and associated with the latter, improvements in banks' capital base. In comparison to the U.K, the U.S. and Switzerland, Japanese banks over the analysed 2000-2013 period were characterized by the lowest profitability level. In that regards, performance of Japanese commercial banks, over the

last decades, was subdued by a deflatory character of Japanese economy. Deflation in Japan persisted over the last decades, excluding 2008, when economy accelerated to the level that allowed obtaining short-run inflationary effects. Further to the above, experiences from banking crisis of 1991-2001 allowed the government over the recent financial crisis to take quicker and more effective actions to mitigate market risk limiting banks' performance losses. However, to facilitate a sustainable, less volatile performance of the economy and financial system there is a still a need for more actions. In that regards, economic program of "Abenomics"²⁹ is going to bring new prospects for a positive shift of the economy towards long awaited fiscal, monetary as much as structural changes in Japan. However, the country's adaptation to new policies is a complex process and the final outcomes remain to be seen over the years to come.

²⁹ In 2013, the Japanese government has introduced the package of reforms, named after Japan's Prime Minister Shinzo Abe "Abenomics". With the aim to reduce deflation, regain economic growth and sustainable fiscal and monetary policies, the reforms were designed on three pillars (arrows) approach. They consist of monetary, fiscal and structural economic reforms.

2.2.4 Switzerland

The Swiss banking sector is historically known for its exclusive, high quality financial services. Thanks to the importance of Switzerland as a one of major financial centre in the World, Swiss banks continue their influential position on the global financial markets. Financial services make up over 10 percent of the GDP, which according to the OECD constitutes more than twice the European Union average.

The total banking assets in Switzerland were estimated in 2012 at 460 percent of the country's GDP, one of the highest in the World. The Swiss tradition of banking secrecy and the importance of the Swiss franc as "a safe haven currency" plays an important role in attracting a huge volume of capital from the various international locations to that country. Besides, Switzerland, as a democratic, neutral federation was, and still is able to ensure a secure protection of the capital, deposited or invested within its borders. The trend of economic and financial globalization that intensified across the globe spread over the financial hubs such as London or Tokyo. The increase in the international mobility of capital attracted the entry of foreign banks to set up their business in Switzerland and correspondingly the Swiss banks become present in the financial markets outside Switzerland.

The commercial activities on the financial market have become more diversified carrying new opportunities for a business' international growth. Before the financial growth of the last few decades created the opportunities for investment in Switzerland, Switzerland was known for the promotion of cartelization across main regulated Swiss industries including the banking sector. The main recipients of that policy were the two Swiss biggest banks that through a participation in cartel-agreements had the very powerful, oligopolistic position in extracting profits from the market. For example, banks were the fixing on prices and costs related to trading of financial instruments,

but also related to deposits and lending products. The aforementioned, constituted a source of inefficiency and contributed to overcharging of bank's clients. The introduction of the reforms were motivated by market liberalization's goal for instance: the City of London "Big Bang" deregulation of 1986 or the EC reforms on free movement of capital ([capital liberalization directive](#) 1988) also influenced policy decisions in Switzerland. Namely, thanks to the involvement of the Swiss Cartel Commission (replaced later by Competition Commission of Switzerland³⁰) the government and the Swiss Banking Association have been introduced to a number of recommendations that effectively removed the majority of banking cartel agreements. The competition policy in Switzerland needed a reform that gradually has been implemented over years.

The Swiss banking sector has a universal character. The ability of Swiss banks to provide a wide range of financial services has led over the years to the development of the market structure of that sector that is not strictly based on the type of provided services but determined by the scale and geographical scope of the operation. The way to distinguish the commercial from any other type of banking activity is a classification used by the Swiss National Bank (SNB). Namely, the commercial bank in Switzerland is understood as the one whose share of domestic loans to total assets exceeds 50%. The overall structure and number of banks in Switzerland between 2000 and 2013 are presented in table 2 and 3. The legislative base of the Swiss banking sector constitutes the Federal Act on Banks and Savings Banks 1934, with the later amendments.

The Swiss Banking Law Act of 1934 contributed to the establishment of such important features of the Swiss financial market as the principle of Swiss bank privacy (enhanced by the introduction of numbered bank accounts) and put the regulative legal

³⁰ Competition Commission of Switzerland (Comco), located in Berne, set up to enforce the provisions of the Federal Act on Cartels and Other Restraints of Competition (Swiss Cartels Act), which focuses on agreements between actions affecting competition, abuses of dominant positions and merger control.

basis for development of Switzerland as an international financial centre and tax haven for offshore capital holders.

Table 2. Number of banks in Switzerland over 2001-2013

Type of Bank	2001	2005	2010	2011	2012	2013
Cantonal banks	24	24	24	24	24	24
Big Banks ³¹	3	2	2	2	2	2
Regional Banks and Saving Banks	94	79	69	66	66	64
Raiffeisen Banks	1	1	1	1	1	1
Stock Exchange Banks	61	56	47	46	47	47
Foreign-controlled Banks	125	122	122	116	103	93
Branches of foreign Banks	25	28	32	32	28	27
Private Banks	17	14	13	13	13	11
Other banking Institutions	19	11	10	12	13	14
Total	369	337	323	312	297	283

Source: Swiss National Bank, Banks in Switzerland.

The institution responsible for licensing and supervision of Swiss banking sector is Federal Banking Commission, and for private insurance market: The Federal Private Insurance Office and Anti-Money Laundering Control Authority. It has been working since 2009. Swiss National Bank (SNB) performs the supervisory duties over the Swiss

³¹ UBS-Union Bank of Switzerland and CSG-Credit Suisse Group

banking sector at the macro-prudential level (stability of financial sector and monetary policy strategy).

Table 3. Swiss banks by types, share in total balance sheet over 2001-2013

Type of Bank	2001	2005	2010	2011	2012	2013
Cantonal banks	13.7	11.5	15.5	16.5	17.5	17.5
Big Banks	63.6	67.1	54.6	52.5	49.1	46.4
Regional Banks and Saving Banks	3.5	2.9	3.5	3.6	3.8	3.7
Raiffeisen Banks	3.7	3.8	5.4	5.6	5.9	6.1
Stock Exchange Banks	3.1	3.7	4.5	4.9	4.5	4.9
Foreign-controlled Banks	8.4	8.0	11.5	10.9	11.2	9.8
Branches of foreign Banks	0.8	0.6	0.9	2.0	3.4	2.8
Private Banks	0.8	0.6	1.7	1.9	2.2	2.3
Other banking Institutions	2.4	1.7	2.4	2.1	2.4	6.5
Total	100	100	100	100	100	100

Source: Swiss National Bank, Banks in Switzerland.

Two main players dominate the banking market in Switzerland: UBS and Credit Suisse Bank, formally included into the Big Banks' category (see Tables 2). The size of their market share confirms that they are systematically important not only for a domestic Swiss financial sector, but also for the financial market at the global level. Relatively to the country economy, the aforementioned two banks are recognized as the biggest

on the financial market across the G-10 countries. In 2008 their total assets, combined together were 6.2 times greater than the Swiss annual GDP. One year later in 2009, facing the challenge of financial crisis the ratio recorded drop, but the banks were still the biggest across the G-10 countries achieving the ratio of their assets to Swiss GDP at the level of 4.4. The next position in terms of market share on the Swiss banking market belongs to Cantonal Banks (around 15%), foreign controlled banks (around 10%). The former, involved in offering the retail sector every day financial services, possess a considerable position on the Swiss domestic credit market. In 2006 its share on that market was represented by around 32%. That has placed Cantonal Banks as a second important after big banks (their share on the Swiss lending market in 2006 was around 36%) in provision a retail lending to the country's economy. ([Swiss National Bank](#))

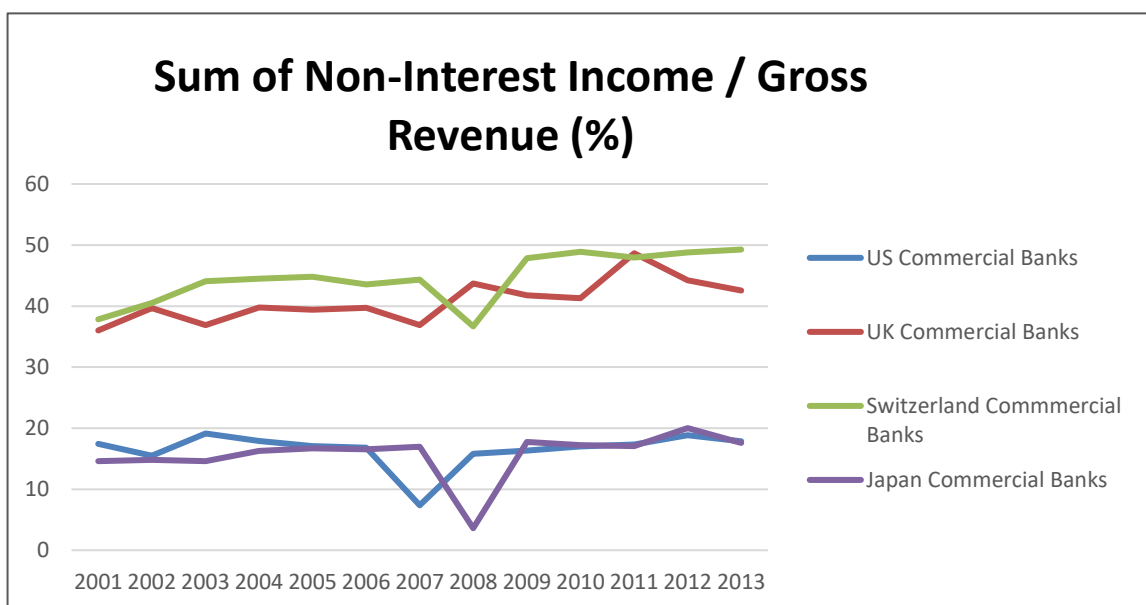
Overall, the performance of the Swiss banking sector over the pre-crisis period was characterized by the continuing growth of profitability across all sub-categories of banks³². A particular improvement of financial results in terms of return on equity was recorded between 2004 and 2007 (Chart 22).

Further, the banks more focused on the retail market such as the Cantonal ones achieved in 2005 in comparison with 2004 an increase in income by 27%, Raiffeisen by 20% and Regional banks by 13% ([Swiss National Bank](#)). In 2006, the sector including "Big Two" achieved a record high level of profits ending the time of very successful growth over the consecutive years before crisis. (see Chart 21) The biggest contributor to profitability reductions had been performance of the big banks that due to considerable involvement in financial positions on US sub-prime market, entering the crisis recorded the massive level of performance losses. UBS experienced the heaviest reduction in their assets. In 2009 the cumulative write-downs of assets reached in case of USB staggering

³² For instance, according to the Swiss Banking Association, over 1990-2011 the real value added by Swiss banking sector increased by 2,4 % per year, while for the same period the growth rate of the Swiss economy as a whole on average amounted to 1.6 % annually.

\$53 billion which constituted in that time around 12% of Swiss GDP. In the same year, CSG experienced lower losses of \$17.7 billion and also required the Swiss government's financial support. (OECD) The stabilization fund set up by SNB became a quick remedy to mitigate a systemic risk and prevent a further spread of the illiquidity risk onto the financial market. Amid the short-term approach to stabilize, the Swiss financial sector there was a need to decide about the future measures that would support stabilization targets in the longer horizon of time. In that light, FINMA launched the new capital requirements that exclusively will apply to "Big Banks". Among the changes that are due by 2013, the minimum leverage ratio, measured as Tier 1 capital to total assets is proposed to account for 3% and also a change will be implemented to the level of capital adequacy ratio.

Chart 20. Sum of Non-Interest Income to Gross Revenue across the UK, the US, Swiss and Japanese Commercial Banking Sectors



Source: Bankscope

Among the main sources of total income, the trading income (as a part of non-interest income) experienced over 2007-2008 the most significant deterioration.

The biggest contributors to the aforementioned losses on trading were “Big Banks” (Chart 20).

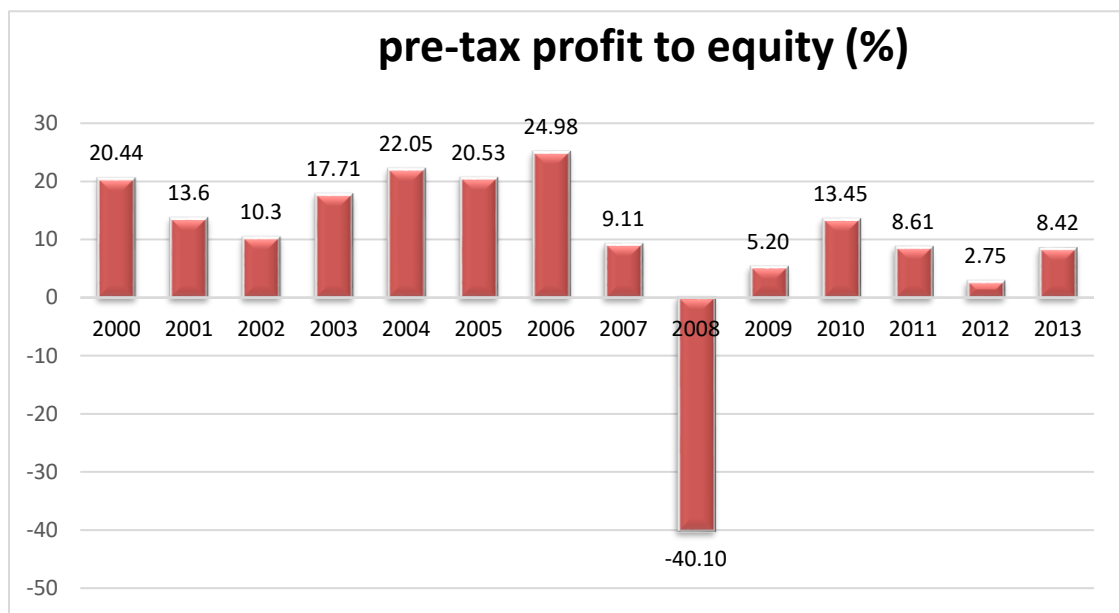
More commercially focused domestic Swiss banks in contrast to the global trends in the sector gained further improvements in profitability levels. Although they recorded over 2007-2009 a decline in profitability (as seen in Chart 22), from 2011 their ability to generate profits rebound again. However, the scale of profits improvement was slow. Over 2012-2013 profit returns stabilized, however remaining at the level lower than before the crisis.

The results on the Swiss banks’ quality of lending (Chart 23) show a stable decline in impaired loans. The aforementioned trend, may suggest that banks were characterized by the high standards of lending and exhibited due consideration to act against potential credit risk in the future. Across all categories of the banks Swiss banking sector the share of non-performing loans in total lending in 2006 was the lowest since 2000 and also was the lowest over the whole analysed period of 2000-2013. The highest level of loan loss provisions to total assets in the analysed period has been recorded by Swiss banks over 2008 and 2009. That rapid increase in the analysed metric is driven by the performance losses associated with high credit risk experienced by “Two Big Banks”.

Further, over 2004-2006 the total lending by Swiss commercial banks excluding “Two Big” on average recorder a rather modest growth. In contrast. ”Big Banks” achieved over 2005-2006 the high lending growth mainly through involvement on foreign markets. However, “Big Banks” experiencing high level of leverage were not able to expand their lending activity at the scale corresponding with the pre-crisis period (Chart 24). Over the same time commercially focused domestic Swiss banks characterized by gradual, positive lending expansion were able to increase their interest income remaining profitable over the whole period covered by the analysis

of 2000-2013. The growth of interest income in commercially focused Swiss Banks (Cantonal, Raiffeisen, Regional and Savings Banks) suggests that banks benefited their positions on domestic market by charging the higher margins. However, the net interest margin also can reflect the level of risk in lending decisions.

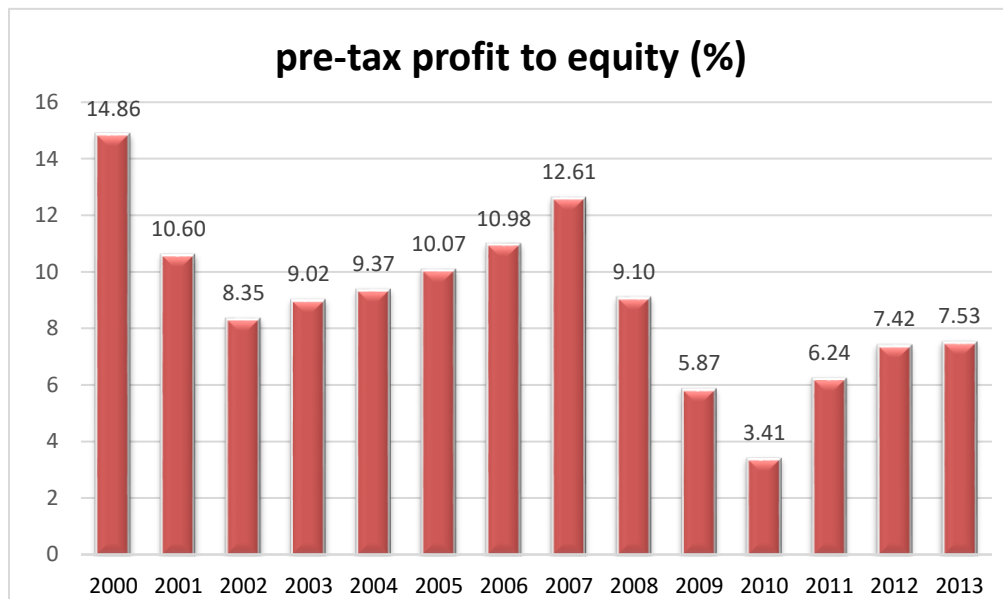
Chart 21. Pre-tax profit to equity generated by Swiss banking sector over 2000-2013 (including “Two Big Banks”)



Source: Bankscope

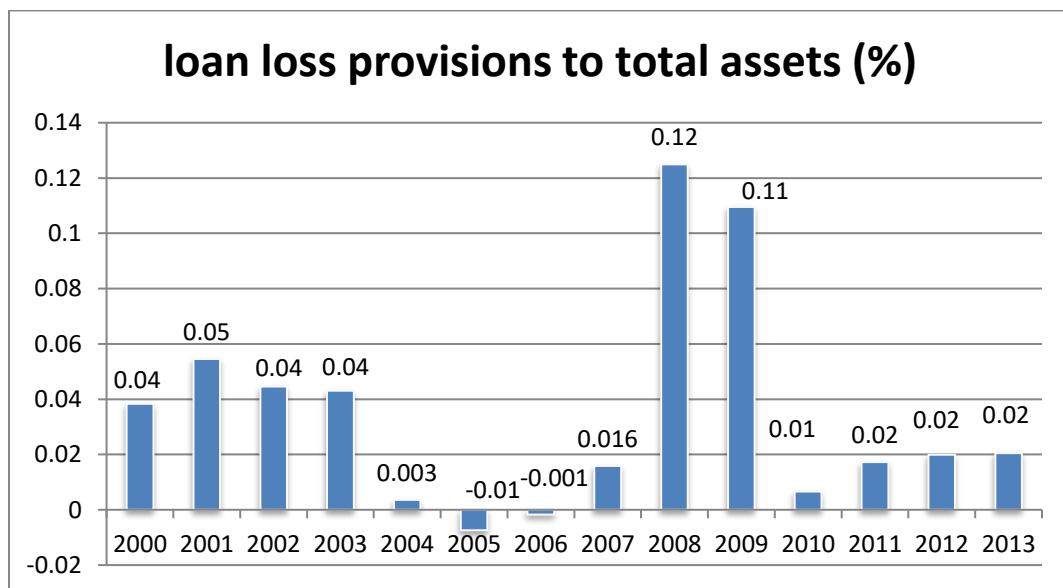
The higher its level there is a potentially higher risk involved in lending. Swiss banks over the decade before the break out of the recent financial crisis were characterized by a gradual improvement in capitalization level. The levels of capital ratios for the whole sector historically were considerably higher than Basel minimum standards. The upward trend of capitalization dominated across commercially focused Swiss banks. While the big banks at international level were leaders in capitalization in terms of weighted capital ratio, they lagged behind in terms of unweighted capital ratio. (see Chart 14).

Chart 22. Pre-tax profit to equity generated by Swiss banking sector over 2000-2013 (excluding “Two Big Banks”)



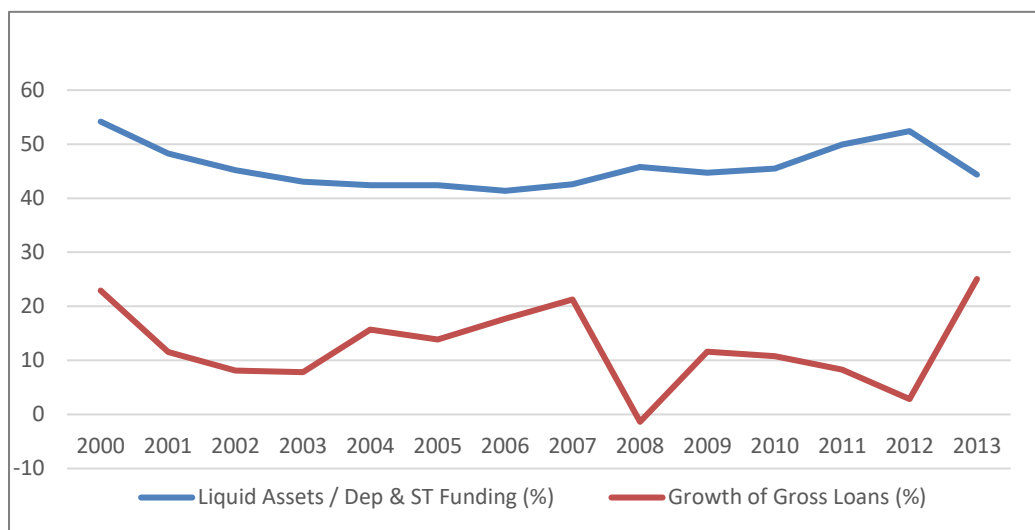
Source: Bankscope

Chart 23. Loan loss provisions level to total assets over 2000-2006 in Swiss banking sector. (including “Two Big Banks”)



Source: Bankscope

Chart 24. Indicators of internal liquidity and lending growth in Swiss commercial banking sector over 2000-2013 (including “Two Big Banks”)



Source: Bankscope

On balance, the Swiss banking sector before the recent financial crisis enjoyed stable market conditions and succeeded in extracting increasing rates of profits from year to year. The lowest since 90’s the level of credit risk measured by the level of loans write-offs and non-performing to total lending ratio levels, the sector recorded in 2006. Over the recent financial crisis domestically focused, commercial Swiss banks have not been negatively affected. Although, their profit performance slowed down over the crisis, in general they remained resilient, not recording negative performance outcomes. In contrast, the biggest contributors to the negative transmissions of the crisis to Swiss economy were losses, experienced by systematically important “Big Banks”. The recovery from the challenges of the recent financial crisis of the sector was quicker and more stable than in other advanced World economies. The importance of the country as an international centre inevitably contributed to positive performance trends. Strong capitalization and high liquidity of the Swiss banking sector are probably the most significant elements that underlay a stability of that banking sector, recognized over the decades as a leader and effective innovator of financial services globally.

CHAPTER 3. Non-constant Risk Preferences - Evidence from Pre-crisis, Crisis and Post-crisis Period for Commercial Banks Located in The United Kingdom, The United States, Japan & Switzerland

3.1. Introduction

The patterns of risk behaviour in the banking sector attract increasing attention of scholars particularly in the light of the recent financial crisis. Banks' profitability, as an outcome driven by managerial risk preferences typically tend to build and support sustained financial stability in a country's economy. However, especially over the last decade, a desire to achieve high performance has led to widespread appreciation of excessive risk taking (Haris & Raviv, 2014; Srivastav et al., 2014; Altunbas et al., 2011).

In effect, banks' financial decisions based on overconfidence (Ing-Haw et al., 2015; Niu, 2010) exposed the financial sector and the whole society to financial vulnerability, increasing the probability of default and bankruptcy. Reflecting on the above, banks proved that their choice between risk-return opportunities appeared to comply with neither the utility maximization concept in the sense of Expected Utility Theory - EUT (von Neumann & Morgenstern, 1944) nor a minimax solution (von Neumann, 1928) the two mainstream perspectives in Economics on the analysis of decision under risk and uncertainty founded on rationality condition.

In light of the above, the present chapter offers an alternative perspective on evaluation and identification of bank risk behaviour based on the condition of irrationality implying a presence of non-constant risk preferences. Namely, the main objective of the present chapter is to empirically evaluate risk decisions

involving risk drawing on the premises of Prospect Theory (PT) (Kahneman & Tversky, 1979).

The conceptual basis for the current research constitutes a condition that the bank's risk behaviour is reference dependant, meaning that decision maker (for instance commercial bank) compares the outcomes of his risky decisions to a reference target (status quo).

In this research, a reference target is defined as a sample-lagged median of Return on Equity (ROE). Hence, in this model, the identification of bank's risk behaviour is determined by its perception of the prospects relatively to the status quo. The value of the expected prospect is defined then as losses or gains; that is, negative or positive deviations from the status quo. The above element of PT constitutes its fundamental contrasting to EUT feature. Namely, the analysis of risk behaviour in PT context assumes that a bank compares prospects in terms of change of wealth relatively to status quo, rather than total wealth as in EUT. In the settings of PT we abstract from managerial discretion linked to the net wealth level, instead accept that bank risk decisions are based on marginal relative changes in prospects.

So far, explanation of bank's risk taking behaviour in the literature is dominated by the application of EUT. Among many, for example: analysis of risk-shifting and moral hazard problem in commercial banking (De Young et al., 2013; Levitt & Snyder, 1997), efficiency and risk in banking (Hughes, 1999; Mester, 1996), analysis of bank reputation risk (Acharya, & Naqvi, 2012; Corbett & Mitchell, 2000), or in theoretical perspective analysis of risk of bank's run (Ennis & Keister, 2009).

Nevertheless, there are a number of controversies in the literature that over the years, challenged a validity of EUT as a normative as well as descriptive phenomenon (Maurice Allais 1953, 1988, 1990; Markowitz, 1952; Simon, 1950; Tversky, 1975; Camerer, 2005). In that respect, it is important to turn research attention to competing

to EUT theories on decision-making and choice under risk and uncertainty looking for example at those ones that draw on the subjectivity premise.

From that perspective, PT offers interesting insight into a character of risk taking behaviour in the presence of non-constant risk preferences. Particularly, in light of the predictions of PT, risk behaviour of an economic agent is sensitive to the way the problem of choice is described, ("framing effect"). Agent's decisions between risky prospects emerge as result of biased judgement because "losses loom larger than gains", meaning that the prospect of reduction in wealth affects decisions of economic agents to a larger extent than the prospect of increase in wealth. This is the main idea that builds the current empirical analysis.

Despite the growing research interest in analysing risky decisions under the Prospect Theory framework, the focus of the previous studies has followed two different avenues: one experimental and another theoretical. For instance, the applications of PT is present for an analysis of assets' market ([Eraker et al., 2015](#); [Pasquariello, 2014](#); [Yan & Yang, 2013](#);), consumer choice ([Liu, Wuest et al., 2014](#); [Hui-Ping et al., 2015](#)), sport economics ([Eli, Lien, 2014](#); [Coates et al., 2014](#); [Nicolau, 2011](#)). Empirical studies that had incorporated the PT framework to the banking sector, empirical contributions are very scarce including: [Bornemann et al., 2012](#); [Shen, Chung-Hua, et al., 2005](#).

The main gap in the prior literature is the lack of evidence on application of PT to commercial banking within a cross-country perspective. Moreover, there is also a lack of knowledge about the crisis and post crisis period on commercial banks' risk behaviour in the discussed context. The present research aims to fill these gaps. It proposes a new perspective on examination of risk-taking behaviour in the banking sector. The analysis will focus on commercial banks in the UK, the US, Japan and Switzerland over the period between 2000-2013.

This research searching for patterns of commercial banks' risk behaviour via an application of PT, also contributes to the recently developing debate on descriptive theory and its attractiveness in fuller understanding of a suboptimal performance of economic agents. ([Weber, Siebenmorgen et al., 2005](#); [Andersson, et al. 2013](#)).

The problem of sub-optimality staying at the heart of the recent financial crisis has its roots, among others, in ignorance of rationality. In that line, as confirmed by recent studies, banks give out a rational behaviour and instead favour too optimistically on available financial opportunities. The above let them build a valuation of professional decisions on subjectivity. That is on the overconfidence and overestimation bias. In that respect, application of PT appears to be a very relevant context of risk and performance evaluation especially nowadays, for a banking sector. The perspective exclusively offered by PT does not tend to assume that market participants having an access to the information are characterized by constant risk preferences (averse towards risk in absolute terms) but instead favour a perception of risk depending on reference target, the evidence confirmed in number of economic experiments. Reflecting on the above, the present chapter constitutes a contribution to the analysis of commercial banks behaviour. It provides evidence on their risk perception outside an expected theory of utility; the aspect so far ignored in prior literature.

The present research also contributes to the existing literature by selecting the time frame of the 13 years between 2000-2013; that includes the last financial crisis. In particular, with the aim to provide comprehensive and updated evidence on the subject, the sample has been evaluated separately for three sub-periods, namely: the pre-crisis (2000-2006), the crisis (2007-2009), the post crisis (2010-2013).

A novel feature of this research consists of incorporation bank-specific variables that play an important complementary role in explaining what characteristics of banks are associated positively or negatively with a shortfall risk below/above status quo. By the same token, the introduction into the analysis of the aforementioned bank-specific factors allow extending the explanatory power of the present research contributing to better understanding of the commercial banks' risky choices.

Overall results of this research indicate that on average risk behaviour of commercial banks in the pre-crisis period is consistent with the predictions of PT. Correspondingly, on average managerial risk was sensitive to the framing effect implying that subjectivity bias had an important effect on risk choices in the commercial banking sectors of UK, US, Japan and Switzerland. However, in the crisis I obtained evidence that does not support predictions of PT. Over that time, banks facing losses as well as gains relatively to the performance target were characterized by risk aversion. The prospects of losses/gains changes relatively to target were assessed by those banks in an asymmetric way. They attached greater disutility to losses than to benefits of gains relatively to the performance target.

The structure of the chapter is organized as follows. Section 2 discusses the conceptual framework of prospect theory in the context of current research, formulates the main research hypothesis and introduces the potential expected effects of bank specific controls on bank risk behaviour. Section 3 characterizes the data sample selected to analysis, the applied specification of the research model. Section 4 reports empirical evidence and provides an interpretation and discussion of research results. Section 5 concludes the implications of research's outcomes for bank risk behaviour and its drivers.

3.2. Theory, the Main Research Hypothesis

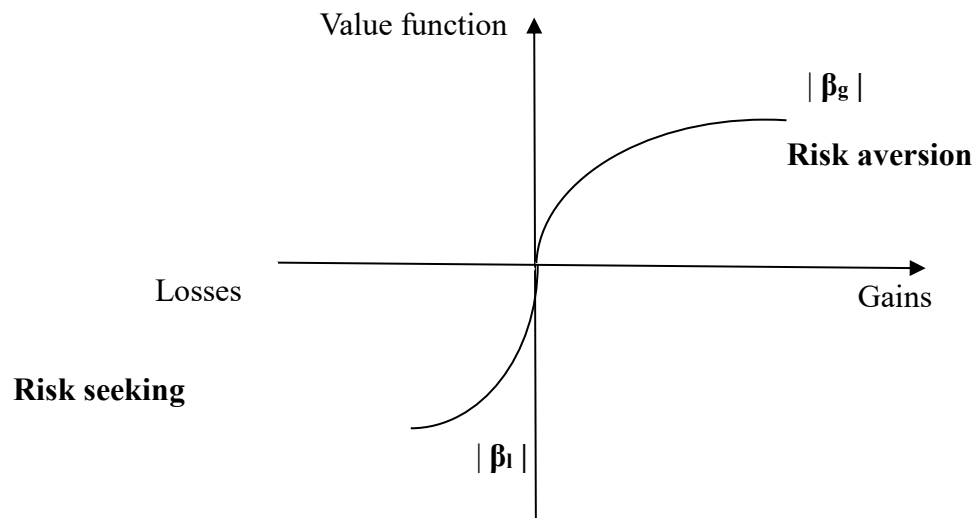
Since the publication by Kahneman and Tversky's on Prospect Theory in 1979, the economic modelling of decisions under risk acquired a new perspective that allows identifying patterns of risk behaviour, putting an emphasis on the role of a reference target in the process of decision making. Later on, the propositions of Prospect Theory confirmed by authors in number of experimental tests demonstrated that economic agents in the process of choice among risky and risk-less prospects, base their decisions on evaluating the selected alternatives as losses or gains relatively to status quo (current state of wealth).

In that respect the perceptions of risky choices as outcomes, located below or above a status quo, play a major role in shaping economic agents' attitude towards risk. Under PT, an economic agent deciding upon his choices acts to maximize a perceived value of the positive/negative deviations from status quo. The function that values those deviations is S-shaped (see Figure 1), convex for losses (implying risk-seeking) and concave for gains (implying risk aversion).³³In that respect, PT suggests that economic agents making choices below status quo are characterized by risk seeking behaviour while above status quo prefers/follows aversion towards risk. The above suggests that an economic agent facing losses relatively to status quo tends to select less probable loss over lower but certain loss, whereas experiencing gains relatively to status quo will choose certain gain over even higher but less probable gain.

Under PT, decision makers tend to overrate less probable negative prospects (losses) and underrate less probable but positive prospects (gains). In short,

³³ S-shaped value function shows that economic agent is characterized by a diminishing marginal sensitivity, facing an increase in gains and losses relatively to status quo.

Figure 1. The Prospect Theory - the hypothetical presentation of the concept



Risk seeking steeper in losses than in gains $|\beta_l| > |\beta_g|$ confirm, that losses looms larger than gains, which implies that banks are more sensitive, when experience losses than gains. They attach higher value to prospects of loss avoidance than to prospects of gains.

in the domain of losses relatively to status quo, decision makers avoid certain losses by taking a gamble of even higher but less probable loss, whereas in domain of gains relatively to status quo avoid gambling instead preferring lower but certain gain. Another integral part belonging to PT is a notion of loss aversion. In general, it defines a pattern of behaviour when probabilities of losses affect the economic agent stronger than the corresponding probability of gain. Specifically, loss aversion makes risky choices asymmetric, meaning that economic agent attaches a higher value to choices in the domain of losses than in the domain of gains. Hence, loss aversion implies that

agent's tend to be more sensitive to disadvantage of loss than to satisfaction of gain.³⁴

Overall, adopting the aforementioned propositions of PT, the current research applies a linear value function formulated in terms of shortfall risk that is defined over return on bank equity (ROE)³⁵ relatively to a status quo measured as a lagged median of ROE. The application of linear approximation for value function makes the measuring of concavity conditions not available. Therefore, instead, the risk attitude is going to be evaluated by assessing a direction of linear association between shortfall risk and return below and above status quo.

To evaluate if commercial bank's risk perception is consistent with predictions of Prospect Theory the present research formulates the hypothesis (1a):

(Hypothesis 1a): Commercial banks that experience losses in period t-1 relatively to performance target (ROE median in t-1) are characterized in a period t by risk seeking behaviour, given that, included into the analysis, variables of interest are at their mean value.

Accordingly, as banks dislike loosing, they tend to favour risk taking that potentially can expose them to larger but less probable losses, expecting to avoid certain losses.

The proposition 1 implies presence of a negative relationship between return (ROE_{t1}) and risk ($Shortfall\ Risk_t$); negative marginal effect on lag_roe_below ³⁶

³⁴ In a current framework the absolute value of β_l and β_g ($|\beta_l|$; $|\beta_g|$) coefficients (slopes) represents the level of loss aversion that economic agent attach to her/his risky choices below/above status quo (see Figure 1.)

³⁵ ROE (Return on Equity) popular accounting measure of performance. Reflecting bank's shareholder value is regarded as an important metric of peer performance analysis in intra-industry comparisons. ROE despite of being characterized by the number of imperfections (for example it is largely influenced by the bank capital structure) the level of reward to bank's shareholders play a major role in setting the risk-return relations. Therefore, by its application in the present context, ROE is considered as a base for setting the bank performance risk targets defined, depending on the level of bank's status quo- ROE median of banking industry.

³⁶ lag_roe_below defined as lagged bank Return on Equity (ROE) measured below the sample median of ROE lagged (status quo).

Correspondingly, the research is going to statistically test the validity of following hypotheses:

$$\mathbf{H_0: ME}(\text{return on equity}_{t-1}|\text{lag_roe}_{below}) = \frac{\partial \text{shortfall risk}}{\partial \text{return on equity } t-1} \geq 0$$

$$\mathbf{H_1: ME}(\text{return on equity}_{t-1}|\text{lag_roe}_{below}) = \frac{\partial \text{shortfall risk}}{\partial \text{return on equity } t-1} < 0$$

(Hypothesis 1b): Commercial banks that experience gains in period t-1 relatively to performance target (ROE median in t-1) are characterized in a period t by risk averse behaviour, given that, the included into the analysis variables of interest are at their mean values.

The hypothesis 1b implies a presence of a positive relationship between return (ROE in period t-1) and shortfall risk (Risk in period t), in the current context expressed by positive marginal effect on lag_roe_above³⁷. Bank avoiding gamble favours certain gains to ones higher in expected value but less probable, hence is characterized by risk aversion.

Correspondingly, the research is going to statistically test the following hypotheses:

$$\mathbf{H_0: ME}(\text{return on equity}_{t-1}|\text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{return on equity } t-1} \leq 0$$

$$\mathbf{H_1: ME}(\text{return on equity}_{t-1}|\text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{return on equity } t-1} > 0$$

³⁷ lag_roe_above defined as lagged bank Return on Equity (ROE) measured above the sample median of ROE lagged (status quo).

(Hypothesis 2): Banks are more sensitive to losses than to gains relatively to performance target, which implies that absolute value of coefficients:

$$\mathbf{H_0:} |ME(\text{return on equity}_{t-1} | \text{lag_roe}_{below})| = |ME(\text{return on equity}_{t-1} | \text{lag_roe}_{above})|$$

$$\mathbf{H_1:} |ME(\text{return on equity}_{t-1} | \text{lag_roe}_{below})| > |ME(\text{return on equity}_{t-1} | \text{lag_roe}_{above})|$$

Bank making decisions on risky prospects, put a greater value to the outcomes that generate losses than to the outcomes that allow her to achieve gains, relatively to status quo (evidence of loss aversion).

3.3. Data and Model

Data analysed in this research consist of the annual, financial information for commercial banks located in the UK, the U.S., Switzerland and Japan. The aforementioned data comes from the consolidated financial statements obtained from Bureau Van Dijk's Bankscope Database. The selected sample covers a time period over 2000-2013.

With the aim to get more consistent and transparent results, the whole sample had been divided into three sub-samples according to time period, namely; sub-sample for the pre-crisis: 2000-2006, the crisis: 2007-2009, the post-crisis: 2010-2013. Next, each sub-sample has been divided into two groups: one for banks performing below status quo (one period lagged median of ROE³⁸) and second for banks performing

³⁸ One period lagged median of ROE is value of the ROE median delayed by one year. The variable indicates (here from second year of the analysis) the value recorded in the previous year (t-1).

above aforementioned status quo. The value of prospects has been introduced to the model as a measure of shortfall risk (upper and lower first partial moment, [Fishburn, 1977](#)), expressed as an absolute difference (distance) between bank realized return prospects (ROE in period t) and reference target (median of ROE in period t) – shortfall of performance accordingly below and above target in period t. The proposed measure in PT context is expected to show that the higher the shortfall below the target in period t-1 the higher the level of risk perceived by bank in period t, while the higher the shortfall above the target in period t-1 the lower the bank's risk perception in period t. Consequently, banks making their performance decisions in period t that coincide also with the determination of their risk decisions, take as a point of reference a profit performance level from a previous period expressed by ROE median one period (here year) lagged . Descriptive statistics of variables used for every sub-sample below and above status quo are provided in Tables 4, 5 and 6.

All explanatory variables to reduce problem multicollinearity, in the presence of interaction terms, are centered by a grand mean³⁹. Moreover, as the analysis of relationship between bank risk and return are explained by one period lag variables⁴⁰ (t-1); such specification of the model helps also to mitigate a potential problem of endogeneity bias.

The model used in this research is based on the notion that a commercial bank as an economic decision maker derives the value from profit performance outcomes (prospects) expressed in terms of return on equity (ROE) changes. Following an existing approach in the literature ([Rosenblatt-Wisch, 2008](#); [Barberies, Huang, Santos,](#)

³⁹ When constant is subtracted from every value of variable the process is known as centering. in the current research, the constant has been defined as grand mean by country and (mean separately calculated across every country group) subtracted from the value of explanatory variables within the analysed groups (UK, US, Japan, Switzerland).

2001) bank's profit preferences are characterized by piecewise linear value function. Banks perceive choices between risky prospects as losses or accordingly as gains (changes) relatively to reference performance target (status quo), in present research formulated as a sample's lagged ROE median variable across time. By formulating the reference target as mentioned above, the present research in contrast to original proposition of PT (1979) identifies status quo as an effect generated endogenously. The model assumes that prospects (bank's performance in terms of ROE) at the level of reference target are consistent with condition of bank risk taking equilibrium.

The existing literature express criticism on the accuracy of a variance as a measure of risk (Markowitz, 1952, 1959). In situations, when return of distribution is skewed or value function (utility function) is linear, the application of a mean-variance model⁴¹ tends not to provide an optimal support for decisions (here economic agent) on choices under risk. Namely, at the presence of asymmetric distribution of return use of variance measures a risk applying the equal weight to the desirable upside (upper tail) distribution of return as to undesirable downside (lower tail) distribution of returns. In that way the risk analysis can easily reflect distorted, inaccurate results. For example, for negatively skewed distribution tends to undervalue the risk while for positively skewed distribution tends to undervalue a return potential and conversely.

Therefore, in response to limitations of the aforementioned mean variance approach current research introduces to the model a measure of shortfall risk. The applied in literature risk measure known as a lower/upper partial moment (Fishburn, 1977) allow identifying bank risk level below and above target including the case when

⁴¹ Developed by Markowitz (1952, 1959) offers a framework of investment portfolio optimization based on the risk-return trade-off decisions and application of return mean and variance assuming that returns are normally distributed or utility function is quadratic. It allows calculating portfolio decision that maximizes the expected return for a given variance or minimizes the variance for a given expected return.

decision maker is characterized, as in the current framework, by a linear type of risk preferences with returns non-normally distributed⁴² (Nawrocki, 1991). Lower/upper partial moment (LPM/UPM (return, target return) = | (return-target return) |ⁿ, where n is a weight investor put on risk/potential)⁴³, measuring a risk allow taking into consideration the degree of skewness for returns distribution. Namely, the higher the value of the lower/upper partial moment the greater the distribution asymmetry and higher the risk/potential of investment.

In the applied framework, the model is going to evaluate linear relationships between risks and returns controlling for bank specific determinants of performance in the losses and gain domain.

Empirical Model:

In domain of losses:

$$\begin{aligned}
 \text{Shortfall Risk}_{i,j,t} &= \alpha_0 + \beta_l \text{lag_roe_below}_{i,j,(t-1)} \\
 &+ \sum_{m=1}^7 \delta_m \text{lag}_{\text{roe_below}_{i,j,(t-1)}} * \text{Variables of interest}_{i,j,(t-1)} \\
 &+ \sum_{k=1}^7 \delta_k \text{Variables of interest}_{i,j,(t-1)} + e_{ij} \quad (1)
 \end{aligned}$$

⁴² Data that are not normally distributed do not fit the bell-shape curve. They are skewed meaning that the probability of distribution is asymmetric around the mean. The implication of the skewness is that the most probable outcomes exist to the left or to the right of distribution (left-tailed or right-tailed).

⁴³As n increases, the negative skewness remains the same but LPM/UPM implement higher weight to that skewness (in current research the aforementioned weights are proxied by coefficient on β_l and β_g).

In domain of gains:

$$\begin{aligned}
 \text{Shortfall Risk}_{i,j,t} &= \alpha_0 + \beta_g \text{lag}_{roe_above}_{i,j,(t-1)} \\
 &+ \sum_{m=1}^7 \delta_m \text{lag}_{roe_above}_{i,j,(t-1)} * \text{Variables of interest}_{i,j,(t-1)} \\
 &+ \sum_{k=1}^7 \delta_k \text{Variables of interest}_{i,j,(t-1)} + e_{i,j} \quad (2)
 \end{aligned}$$

where:

Shortfall Risk $_{i,j,t}$ – absolute difference between $ROE_{i,j,t}$ and median of $ROE_{i,j,t}$;

Median of ROE $_{i,j,t-1}$ –status quo target;

lag_roe_below/above $_{i,j,(t-1)}$ – bank return on equity in previous year;

In domain of losses:

$$\text{lag}_{roe_below}_{i,j,(t-1)} < \text{Median ROE}_{i,j,(t-1)}$$

In domain of gains:

$$\text{lag}_{roe_above}_{i,j,(t-1)} > \text{Median ROE}_{i,j,(t-1)}$$

Variables of interest:

eq ass $_{i,j,(t-1)}$ – equity to assets (in t-1);

assets gr $_{i,j,(t-1)}$ – bank’s assets growth (in t-1 period),;

loan loss $_{i,j,(t-1)}$ – loan loss reserves to total loans (in t-1);

fee income $_{i,j,(t-1)}$ – non-interest income to gross revenue in t-1;

D $_{country}$ – dummies for UK, US, JP and CH;

i- individual bank,

j- country,

t- time (in years),

And interactions of the control variable with ROE $i_{j,t-1}$ indicate how controls affect risk of shortfall in a domain of losses/gains.

While bank capital (at the given level of banks assets) constitutes an important guarantor of bank financial safety and stability, the theoretical as well as the empirical explanations on risk–capital trade-off provide indeterminate often contrasting perspectives. In that context, the capital effect on the bank risk taking behaviour remains a controversial, highly discussed issue. The post-crisis era and the need for a better insulation of the financial system from potential repeat of banks' reckless actions to use own capital as a gambling tool put to the fore the importance of capital relationships with bank risk. The ongoing debate on the subject has recently found its reflection in the noticeable number of research, among others for instance: [DeAngelo et. al., \(2015\)](#), [De Jonghe et. al., \(2015\)](#), [Duran et. al., \(2015\)](#), [Hogan \(2014\)](#), [Anginer et. al., \(2014\)](#).

Overall it is expected that banks which use leverage aggressively hold riskier assets portfolio. That confirms the potential presence of negative association between equity to assets ratio and shortfall risk above status quo and correspondingly positive association with shortfall risk below status quo. The evidence supports the *risk-shifting effect of leverage*.

On the other hand, well capitalized banks (assumed characterized by lower level of leverage) can afford to involve their assets portfolio in riskier investment. In that view we potentially expect that the lower leverage (higher equity to assets ratio) the higher the shortfall risk above status quo whereas below status quo the lower leverage the lower the shortfall risk. The latter line of argument is consistent with Berger et al., (1995) who suggested that through reduction of bankruptcy risk (decrease of the excessive use of leverage) banks are able to better control expenses such as cost of funds. Therefore, they can achieve higher return on equity along with higher

equity to assets ratio. The aforementioned reasoning supports *bankruptcy cost hypothesis*.

Accordingly, the research assumes validity of the following hypothesis:

(Hypothesis 3a): For commercial banks experiencing on average performance losses relatively to status quo, equity to assets ratio is negatively associated with shortfall risk, given that lag_roe_below is at its average value.

Correspondingly, the research is going to statistically test the validity of the following hypotheses:

$$H_0: ME(\text{equity assets}_{t-1} | \text{lag_roe_below}) = \frac{\partial \text{shortfall risk}}{\partial \text{equity assets}} = \pm \delta_2 \pm \delta_3 \text{lag_roe_below} \geq 0$$

$$H_1: ME(\text{equity assets}_{t-1} | \text{lag_roe_below}) = \frac{\partial \text{shortfall risk}}{\partial \text{equity assets}} = \pm \delta_2 \pm \delta_3 \text{lag_roe_below} < 0$$

(Hypothesis 3b): For commercial banks experiencing on average performance gains relatively to status quo, equity to assets ratio is positively associated with shortfall risk, given that lag_roe_above is at its average value.

$$H_0: ME(\text{equity assets}_{t-1} | \text{lag_roe_above}) = \frac{\partial \text{shortfall risk}}{\partial \text{equity assets}} = \pm \delta_2 \pm \delta_3 \text{lag_roe_above} \leq 0$$

$$H_1: ME(\text{equity assets}_{t-1} | \text{lag_roe_above}) = \frac{\partial \text{shortfall risk}}{\partial \text{equity assets}} = \pm \delta_2 \pm \delta_3 \text{lag_roe_above} > 0$$

As presented above selected control variables have been included as regressors. *The bank assets growth* in this research is selected to proxy

for commercial banks investment opportunities. In general, it is expected that growth of bank's assets reflecting bank investment expansion is negatively associated with shortfall risk for banks operating below status quo and positively associated with shortfall risk for those performing above status quo, expressed here in terms of bank return on equity. However, the above patterns tend to change for the banks analysed over the crisis period. For them the expansion of investment opportunities, for instance, in mortgage-backed securities are expected to increase downside risk contributing to the increase in shortfall risk relatively to status quo.

In light of recently obtained empirical evidence, bank's investment strategies reflected in the level of bank's core assets growth differs between bailout and non-bailout banks. Namely, banks that over the crisis period actively participated in a US government financial help programme tend to expand their assets portfolio investing in more risky securities than banks that stayed outside the financial help programme (Duchin & Sosyura, 2014). Correspondingly, banks, in response to received government financial assistance, were able to generate more additional investment in lending assets than the non-supported counterparts. The above claim has been confirmed in empirical work among US banks with capitalization ratio below median (Li, 2013) and among large international banks (including commercial ones from 14 major advanced economies) were as the study has found, the first to rebuilt their risk-weighted capital ratio (Breit et al., 2013).

All in all, an important indicator of bank's managerial investment decisions, such as level of bank's assets growth through its direct impact on bank market share and rate of bank profit performance adds to the current analysis. In the above light, the current research presents a perspective on how assets' portfolio changes are potentially associated with bank performance, shortfall risk.

Correspondingly, the research assumes the following hypothesis:

(Hypothesis 4a): For commercial banks experiencing on average performance losses relatively to status quo, bank assets growth is negatively associated with shortfall risk, given that lag_roe_below is at its average value.

$$H_0: ME(assets\ gr_{t-1} | lag_roe_{below}) = \frac{\partial\ shortfall\ risk}{\partial assets\ gr_{t-1}} = \pm\delta_2 \pm \delta_3 lag_roe_{below} \geq 0$$

$$H_1: ME(assets\ gr_{t-1} | lag_roe_{below}) = \frac{\partial\ shortfall\ risk}{\partial assets\ gr_{t-1}} = \pm\delta_2 \pm \delta_3 lag_roe_{below} < 0$$

(Hypothesis 4b): For commercial banks experiencing on average performance gains relatively to status quo bank assets growth is positively associated with shortfall risk, given that lag_roe_above is at its average value.

$$H_0: ME(assets\ gr_{t-1} | lag_roe_{above}) = \frac{\partial\ shortfall\ risk}{\partial assets\ gr_{t-1}} = \pm\delta_2 \pm \delta_3 lag_roe_{above} \leq 0$$

$$H_1: ME(assets\ gr_{t-1} | lag_roe_{above}) = \frac{\partial\ shortfall\ risk}{\partial assets\ gr_{t-1}} = \pm\delta_2 \pm \delta_3 lag_roe_{above} > 0$$

The effect of credit risk on banks' potential risk choices (the above and below a status quo) in this research will be proxied by *the ratio of loan loss reserves to gross loans*. The measure is used in banking practise as a basis to assess projections of future bank losses on loans. Namely, the higher its value, the greater is the bank's ability to absorb potential loans' losses. A bank increasing the value of that ratio expects the future growth in defaults on loans (credit risks). Bank's profitability and lending activity levels have been recognized for their procyclical character (Bolt et. al., 2012; Albertazzi et. al., 2009; Nijathawon, 2009). The empirical literature confirms a presence

of significant relationship between business and financial cycles and its role in emergence of upturns and downturns of the country economy (Claessenes et al., 2012, Caballero, 2010, Woodford, 2010). The research on bank lending behaviour (among others: Bikker & Metzmakers; 2005; Berger Udell, 2002; Borio, Furfine and Lowe, 2001) are known to support an argument stating that during the expansionary phase banks tend to underestimate credit risk exposure. Banks being driven by high profit's expectations (overconfidence) are more easily, than in any other phase of business cycle, able to relax existing credit standards and keep lower level of loan loss reserves. In contrast, building loan losses value on the forward-looking estimation creates for banks an opportunity to prudently insulate bank performance from increasing likelihood of loan default risk, when the economy faces a contraction phase⁴⁴. That strategy contributing to reduction of procyclicality in banks' lending can be also perceived by market participants and regulators as a sign of bank credibility and efficiency in dealing with credit risk in the long-run. Considering the above, the provisioning policy, hence also a level of bank loan loss reserves ⁴⁵ is subjected to constant fluctuations. Nevertheless, in practice the reduction of cyclicity and its impact on bank lending correspondingly profit behaviour is not possible or even not within an interest of banks

⁴⁴ The currently binding international accounting standards (established mainly by: FASB - Financial Accounting Standards Board; IASB - International Accounting Standards Board) that had introduced since 2005 method of evaluation of bank's loan loss provisions based on incurred loan loss model has been largely criticised for its pro-cyclicality magnifying effect on bank lending behaviour. The discussion on the subject presented among others by Dugan, 2009; Balla, Mckenna, 2009; Borio, Lowe, 2001 emphasised, that reliance on incurred loan loss model limits timely identification of loan losses. The model building on backward looking approach to provisioning policy assesses probability of loan impairment on the base of past events ignoring the consideration for assessment a future loan losses' expectations. Considering the importance of the above arguments especially in the light of recent financial crisis, Financial Stability Forum Report (2009) highlighted that bank using the incurred loss model were not always flexible to use managerial judgement in determining loan losses. In that light the Report recommended a review of regulatory practises to reduce identified opacity on provisioning standards. The regulatory approach to bank provisioning policy since the event of crisis is viewed as a long-lasting process design to mitigate a problem of procyclicality in financial sector around the World. Correspondingly, as an aftermath of ongoing regulatory changes the full implementation of expected loan loss model, recognised for its countercyclical features, will come into effect from January 2018.

⁴⁵ Since introduction BASEL II requirements in 2004 loan loss reserves has become part of supplementary banks capital base -Tier 2 capital. In response to that change the increase in loan loss provisions could increase loan loss reserves max to 1.25% of risk weighted assets.

and policy makers. The balance between bank security and profitability is a condition that should guide decisions on bank market performance over the changes in economic output in the short and the long run.

Alongside non-discretionary determinants of loan loss reserves (that for instance span from the level of economic aggregates such as country GDP growth to elements identified at the bank level such as value of bank loan's portfolio), bank discretion plays an equally important role as a driver of loan loss reserves. Namely, in the form of income smoothing⁴⁶ and/or signalling⁴⁷, bank uses her advantage over free access to bank's private information in deciding on the level of loan provisions (loan loss reserves). The results of discretionary actions not alone carry weight for the reported outcomes of bank's profit performance, but also influence perception of outside equity holders in terms of the exercised by bank risk attitude. In light of the aforementioned, the mechanism of the subjective decisions thorough provisioning policy will also find its place in a potential explanation of the empirical results on association between presented measure of credit risk and return on equity below and above status quo.

Therein, presenting a number of arguments based on theoretical as well as empirical identification the research assumes that the sign of the coefficient of marginal effect on credit risk is going to be positive or negative (ambiguous).

Thus, the research proposes the following hypothesis:

⁴⁶ By income smoothing banks take discretionary actions to set the level of provisions with the aim to lessen variability of bank's earnings over time. In general the mechanism consist on understating provisions in time of low bank's earnings and overstate them when bank's earnings' trend get picking up.(more on income smoothing for example in: Bouvatier, Lepetit, (2007).

⁴⁷ Bank manager by increasing loan loss provisions can convey to the market the info about bank's financial strength. That discretionary mechanism design to timely recognise loan losses aims to ensure market participants that bank possess an ability to absorb potential loan losses in the future.(more on signalling in banking for example in: Kanagaretnam et al., (2005).

(Hypothesis 5a): For commercial banks experiencing on average performance losses relatively to status quo, loan loss reserves to total loans ratio is negatively associated with shortfall risk, given that lag_roe_below is at its average value.

$$\mathbf{H_0:} ME(\text{loan loss}_{t-1} | \text{lag_roe}_{below}) = \frac{\partial \text{shortfall risk}}{\partial \text{loan loss}_{t-1}} = \pm \delta_6 \pm \delta_7 \text{lag_roe}_{below} \geq 0$$

$$\mathbf{H_1:} ME(\text{loan loss}_{t-1} | \text{lag_roe}_{below}) = \frac{\partial \text{shortfall risk}}{\partial \text{loan loss}_{t-1}} = \pm \delta_6 \pm \delta_7 \text{lag_roe}_{below} < 0$$

(Hypothesis 5b): For commercial banks experiencing performance gains relatively to status quo, on average, loan loss reserves to total loans ratio is positively associated with shortfall risk, given that lag_roe_above is at its average value.

$$\mathbf{H_0:} ME(\text{loan loss}_{t-1} | \text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{loan loss}_{t-1}} = \pm \delta_6 \pm \delta_7 \text{lag_roe}_{above} \leq 0$$

$$\mathbf{H_1:} ME(\text{loan loss}_{t-1} | \text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{loan loss}_{t-1}} = \pm \delta_6 \pm \delta_7 \text{lag_roe}_{above} > 0$$

Recognition for *non-interest based activities* as a lucrative source of bank income and insight into their potentially risk amplifying effect on bank performance has dominated a motivation of research of the last fifteen years. Banks' involvement in non-interest activities with the aim to build a new strategy for revenue diversification in fact accelerated in early 2000's, i.e. the time, when in a response to increasing competition, banks had to reinvent their own business attitude. The above view is shared among others in works by Lepetit *et al.*, (2008), Goddard, *et al.*, (2007), Valverde *et al.*, (2007). In that respect, banks developed a counter-strategy to maintain their financial stability at the presence of substantial market pressure on the reduction of margins from

interest rate based activities. For instance, when relying on data from a Report of Boston Consulting Group an average interest rate margin in retail banking between 2001 to 2006 declines about 21% (Leichtfuss *et. al.*, 2007). Further, the share of non-interest income in US banking sector in 2003 increased relatively to 1992 by 25.7% (De Young *et. al.*, 2013). Nevertheless, the high volatility of that line of business makes it also potentially counterproductive for bank profitability targets.

In that sense, bank involvement in non-interest based activities constitutes a function of its risk's acceptance. Prior evidence has shown, that increase of share in bank revenue activities, that generate non-interest income, make bank performance more risky (De Young & Roland, 2001; Stiroh, 2004; Demirgüç-Kunt *et al.*, 2010, DeJonge, 2010).

Building on the above the research assumes:

(Hypothesis 6a): For commercial banks experiencing performance losses relatively to status quo, on average, non-interest income in total revenue is positively associated with shortfall risk, given that lag_roe_below is at its average value.

$$H_0: ME(fee\ income_{t-1} | lag_roe_{below}) = \frac{\partial\ shortfall\ risk}{\partial\ fee\ income_{t-1}} = \pm\delta_8 \pm \delta_9 lag_roe_{below} \leq 0$$

$$H_1: ME(fee\ income_{t-1} | lag_roe_{below}) = \frac{\partial\ shortfall\ risk}{\partial\ fee\ income_{t-1}} = \pm\delta_8 \pm \delta_9 lag_roe_{below} > 0$$

(Hypothesis 6b): For commercial banks experiencing performance gains relatively to status quo, on average, non-interest income in total revenue is negatively associated with shortfall risk, given that lag_roe_above is at its average value.

$$H_0: ME(\text{fee income}_{t-1} | \text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{fee income}_{t-1}} = \pm \delta_8 \pm \delta_9 \text{lag_roe}_{above} \geq 0$$

$$H_1: ME(\text{fee income}_{t-1} | \text{lag_roe}_{above}) = \frac{\partial \text{shortfall risk}}{\partial \text{fee income}_{t-1}} = \pm \delta_8 \pm \delta_9 \text{lag_roe}_{above} < 0$$

3.4. Results and Discussion

Parameters of equation presented in the previous section are estimated using OLS regression method. The decision on selection OLS procedure from other potential alternatives (here random effect) is supported by the outcomes of diagnostic tests (a relevant statistics with interpretation reported in Appendix .)

The research hypothesis on marginal effect for lag_roe_below/above formulated in section 3.2 and hypothesis on marginal effect for variable of interest formulated in section 3.3 has been statistically verified using one-tail t-test procedure (the outcomes presented in Appendix 5 and 6). The results of estimation reported in tables 7 and 9, has been obtained over the pre-crisis (2000-2006), the crisis (2007-2009) and the post-crisis period (2010-2013) for commercial banks located in UK,US, Japan and Switzerland that performed below and above status quo (lagged median of ROE). Descriptive statistics for each time specific subsample are displayed in tables 4, 5 and 6.

All the estimated models are statistically significant (F-test) with p-value of the all models equal 0.000. The measure of estimation fit R^2 across all models is high on average 0.91 implying that selected independent variables explain a large share (91%) of variance of shortfall risk. The values in brackets in estimation tables display heteroscedasticity robust standard errors, using generalisation of White (1980) sandwich estimator. The results (based on the analysis of marginal effects presented in table 8 and 10), show that over the *pre-crisis* there was a significant negative

association between shortfall risk in period t and return on equity generated in the previous period for the analysed commercial banks operated below status quo. In contrast, for the same period the significant and positive association between shortfall risk and return on equity characterized banks performed above the status quo. The above findings reflect an empirical support for hypothesis 1a and 1b formulated in section 2 of this chapter and are reflected in the outcomes of statistical verification by Wald test (Appendix 4). In that light, we find that risk behaviour in the analysed commercial banking sectors over pre-crisis followed the patterns consistent with the propositions of Prospect Theory. Over 2000-2006 in the commercial banks that have operated in the domain of losses (below status quo), bank were characterized by the risk seeking behaviour. Whereas banks that operated above status quo were characterized by risk aversion. The aforementioned empirical evidence implies that bank's risk behaviour is driven by the way the risky situations (prospects) are framed, namely as losses or gains relatively to status quo. By the same token, confirming a departure from EUT framework the analysed evidence shows that the commercial banks' risk preferences are sensitive to the context in which the risky decision (prospect of negative or positive return on bank equity relatively to status quo) is presented.⁴⁸ Correspondingly, if risk behaviour is prone to subjective interpretation, the managerial choices tend to be biased. That creates a room for a presence of low quality, ambiguous and generally suboptimal outcomes of risky decisions. The errors in judgement constitute factors that intuitively have led and drive banking risk behaviour greatly contributing to a development of the recent financial crisis. For instance, as banks tend to overvalue the low probability of outcome's change when they recognise them as losses and undervalue the high probability of outcome's change that are seen as gains relatively to status quo, their risk assessment are guided by

⁴⁸ According to EUT preferences that meet rationality assumption are: consistent (transitive), stable (consistent with invariance dominance criterion, complete, and follows the independence axiom.

non-rational reason.

Besides the framing effect analysed in this research, recently the most discussed biases that are seen as a real triggers of the recent financial crises are the following: overconfidence bias, illusion of control, confirmation bias⁴⁹, extrapolation bias⁵⁰. All of them have common characteristics. Therefore, it is not only difficult to measure their impact one by one on managerial risk behaviour but that also confirms, how powerful impact they can have on patterns of managerial risk behaviour.

Next, a prediction of hypothesis 1a did not find the empirical confirmation for banks analysed over *crisis period*. Specifically, the findings for those banks show the positive, significant association between shortfall risk and return on equity above status quo (as consistent with hypothesis 1b), but also below status quo.

The effect of bank's decision on *lag_roe_below* and *lag_roe_above* indicates that in the crisis period the overall risk behaviour of commercial banks contradict the predictions of Prospect Theory. The analysed banks were risk averse having an opportunity of potential gain and also facing losses. The risk seeking started to be perceived too big a gamble, that implies the potential occurrence of much higher costs than before, for example the instability of the country financial system.

Further, the risk behaviour in *the post-crisis* opposes the predictions of Prospect Theory. Banks that face losses relatively to status quo are characterized by risk aversion, confirmed by the positive statistically significant marginal effect on *lag_roe_below*. (table 8) While, banks that managed in that period to earn above the status quo appeared to be described by risk seeking behaviour, the marginal effect for that result shows

⁴⁹ *Confirmation bias* tendency to overweight importance of the information that supports your view while underweighting the importance of the information that stay in opposition to your view.

⁵⁰ *Extrapolation bias* is a tendency to extrapolate recent events (past trends) while forming a forecasts or expectations about the future. For example, decisions of investors are characterized by an extrapolation bias when facing the period of market upturn they make unwarranted extrapolation that the same trend will dominate in the future.

negative, however not statistically significant coefficient. (table 10). The framing effect appeared to influence banks' decisions under risk, but that effect appeared to work in the patterns that are reverse to assumption of Prospect Theory. The obtained empirical evidence shows that commercial banks on average in comparison to crisis period stayed prudent in their monetary choices when facing losses while in contrast they became risk-seeking benefiting from gains in performance relatively to the status quo. Reported evidence can be explained by the view that in attempt to recover from suboptimal performance outcomes banks do not gamble.

They are being afraid that too aggressive investment decisions, especially in crisis affected market environment, can hinder future improvement of bank profit performance and deepen or slow down the prospects of operating closer to status quo level. However, commercial banks that were able to outperform status quo feel much confident about the future. Their risk seeking behaviour can be also supported by the potential as well as already obtained bail-out financial support.

Correspondingly, their risk seeking behaviour may be encouraged as a result of their protection from downside risk, that tends to create incentives to increase moral hazard problems. Moving the empirical investigation towards the analysis of loss aversion, the results differ across all estimated models. The statistical verification of the potential presence of loss aversion is based on the statistical testing of hypothesis 2 (outcomes of Wald test are reported in Appendix 4).

What deserves a special attention is that over the pre-crisis period the analysed banks in their risk perception were more sensitive to (sure) gains than to (sure) losses.

Table 4. Descriptive statistics for the subsample over pre-crisis period 2000-2006.

Variables	BELOW STATUS QUO				ABOVE STATUS QUO			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
<i>risk_roe</i>	.1321206	.6267643	.00007	10.2004	.8458082	5.907092	0	108.277
<i>lag_roe_be~w/above</i>	-.8910265	33.0347	-550.395	1.93386	-1.267596	7.004794	-2.85926	83.3338
<i>equity_assets</i>	-.8703631	5.517773	-7.85526	40.7677	-1.544544	4.902527	-24.8973	34.2457
<i>equity_ass*lag roe below/above</i>	7.315177	112.7687	-13.519	1935.33	7.113351	64.98274	-274.856	1145.39
<i>assets_gr</i>	-2.043721	14.10017	-40.0239	103.866	.3600608	37.56485	-31.1439	470.346
<i>assets_gr*lag roe below/above</i>	16.7168	251.5486	-74.8694	4135.6	7.770825	243.3158	-1304.62	3904.11
<i>loan_loss</i>	.1714414	1.677665	-2.55539	17.8856	.2300515	1.456439	-2.45339	12.9536
<i>loan_loss*lag roe below/above</i>	-2.288617	40.60143	-732.363	33.4097	-.7901247	6.85001	-82.2828	52.0978
<i>fee_income</i>	-5.233622	20.67188	-31.3486	74.8514	-2.212155	18.97894	-28.1186	73.9714
<i>fee_income*lag roe below/above</i>	-43.46484	517.235	-8884.16	497.144	26.57249	128.7534	-227.046	1390.96
<i>dummy_CH</i>	.0530973	.2245591	0	1	.0379404	.1913115	0	1
<i>dummy_GB</i>	.0176991	.1320503	0	1	.0216802	.1458349	0	1
<i>dumm_JP</i>	.7109145	.4540078	0	1	.7642276	.4250569	0	1
<i>dummy_CH*lag roe below/above</i>	.0997935	.4220706	0	1.93386	-.0176398	.9669942	-2.85132	14.7069
<i>dummy_GB*lag roe below/above</i>	.0332076	.2477657	0	1.90568	.0427585	1.487754	-2.62701	27.7347
<i>dummy_JP *lag roe below/above</i>	-1.422296	33.00074	-550.395	1.93204	-1.150199	6.078795	-2.85926	83.3338

Table 5. Descriptive statistics for the subsample over crisis period 2007-2009.

Variables	BELOW STATUS QUO					ABOVE STATUS QUO				
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max		
<i>risk_roe</i>	.071722	.1732371	0	1.52739	.3589101	.998116	.000036	8.18592		
<i>lag_roe_be~w/above</i>	1.122611	4.052132	-38.6696	1.92815	.2636923	14.37277	-2.86307	127.181		
<i>equity_assets</i>	-1.242176	4.49111	-6.40626	28.0617	-1.181016	5.076138	-15.0393	32.0127		
<i>equity_ass*lag roe below/above</i>	-1.554281	13.3981	-107.429	55.4518	-1.302413	20.88945	-144.695	23.2593		
<i>assets_gr</i>	1.826706	50.56716	-87.2339	646.196	-.6282665	18.43443	-32.5139	177.586		
<i>assets_gr*lag roe below/above</i>	4.168134	98.0348	-160.609	1240.11	-.8946464	266.9294	-3118.97	958.282		
<i>loan_loss</i>	-.3858013	1.258453	-2.02039	7.65261	-.3378514	1.378834	-2.06339	10.0496		
<i>loan_loss*lag roe below/above</i>	-.4577307	3.672345	-20.41	23.5551	.9874411	28.17264	-161.878	315.105		
<i>fee_income</i>	-6.195705	52.04154	-241.399	420.671	-.1448432	22.48294	-83.5286	77.7714		
<i>fee_income*lag roe below/above</i>	-7.201783	140.6736	-717.665	1144.36	17.27634	111.6799	-432.234	848.304		
<i>dummy_CH</i>	.0172414	.1305452	0	1	.0542169	.2271303	0	1		
<i>dummy_GB</i>	.0632184	.2440577	0	1	.1325301	.3400921	0	1		
<i>dummy_JP</i>	.7183908	.4510819	0	1	.6204819	.4867353	0	1		
<i>dummy_CH*lag roe below/above</i>	.0324274	.2455406	0	1.90744	-.084861	.6170309	-2.85137	4.16264		
<i>dummy_GB*lag roe below/above</i>	.1002688	.4175136	-.034033	1.90121	1.855078	13.90669	-2.86307	127.181		
<i>dummy_JP*lag roe below/above</i>	.7597687	3.68648	-38.6696	1.92815	-1.00622	2.651932	-2.86291	23.8062		

Table 6. Descriptive statistics for the subsample post crisis period 2010-2013.

Variables	BELOW STATUS QUO					ABOVE STATUS QUO				
	Mean	Std. Dev.	Min	Max		Mean	Std. Dev.	Min	Max	
<i>risk_roe</i>	.5504608	5.301676	0	84.8822		3.006751	27.36185	0	338.551	
<i>lag_roe_below/above</i>	.1843233	13.83085	-199.683	1.90599		-.573601	8.309332	-2.84126	69.1551	
<i>equity_assets</i>	1.117553	8.557815	-6.64826	56.7747		-1.457885	3.892758	-6.51126	24.9877	
<i>equity_ass*lag roe below/above</i>	4.436429	36.39556	-51.6718	525.816		2.781264	23.14599	-135.26	251.487	
<i>assets_gr</i>	-2.684819	13.67309	-87.1639	64.4861		-1.035216	27.2065	-35.9539	379.746	
<i>assets_gr*lag roe below/above</i>	-4.489545	88.34336	-928.754	967.236		-7.498515	113.1679	-1071.47	572.654	
<i>loan_loss</i>	.0652285	2.666392	-2.10939	21.7326		-.3236818	1.224098	-2.08239	6.83561	
<i>loan_loss*lag roe below/above</i>	-3.326097	54.26625	-871.936	53.4932		1.163947	14.65627	-80.8045	217.395	
<i>fee_income</i>	3.10511	23.7363	-32.9786	95.8014		2.184365	19.64061	-36.5686	74.5414	
<i>fee_income*lag roe below/above</i>	-16.78728	249.7492	-3103	558.827		32.92327	230.5328	-198.246	2446.06	
<i>dummy_CH</i>	.0597602	.324419	0	1.8984		.0177305	.1322048	0	1	
<i>dummy_GB</i>	-1.237781	13.64416	-199.683	1.89072		.0851064	.279536	0	1	
<i>dumm JP</i>	.7575236	1.344588	-14.3764	1.90599		.7553191	.4306621	0	1	
<i>dummy_CH*lag roe below/above</i>	.0342205	.1821418	0	1		-.0436916	.3351173	-2.82166	0	
<i>dummy_GB*lag roe below/above</i>	.1711027	.3773167	0	1		.235432	4.015635	-2.82155	53.758	
<i>dummy JP*lag roe below/above</i>	.4676806	.4999057	0	1		-1.002508	4.608273	-2.84126	60.9208	

Table 7. Estimation Results, Regression Models across Pre-crisis (2000-2006), Crisis (2007-2009) and Post-Crisis Period (2010-2013) – Performance of Banks Below Reference Target.

Variables	Parameters	BELOW STATUS QUO		
		2000-2006	2007-2009	2010-2013
		(y) shortfall risk _t	shortfall risk _t	shortfall risk _t
lag_roe_below ⁵¹	β_1	-1.420*** (0.227)	-0.0219* (0.009)	3.599*** (1.005)
equity_assets _(t-1)	δ_2	-0.0220 (0.021)	-0.0123* (0.004)	0.368** (0.112)
equity_assets_x_roe_below _(t-1)	δ_3	0.0108 (0.011)	0.00633** (2.63)	-0.196** (0.060)
assets_gr _(t-1)	δ_4	-0.00744* (0.003)	0.00871*** (0.002)	-0.18191*** (0.010)
assets_gr_x_roe_below _(t-1)	δ_5	0.00428* (0.002)	-0.00458*** (0.001)	0.0995*** (0.005)
loan_loss _(t-1)	δ_6	-0.116*** (0.19)	-0.0232 (0.013)	-0.351*** (0.062)
loan_loss_x_roe_below _(t-1)	δ_7	0.0633*** (0.01)	0.0163* (0.006)	0.218*** (0.026)
fee_income _(t-1)	δ_8	0.00532*** (0.001)	-0.000247 (0.000)	0.00509 (0.005)
fee_income_x_roe_below _(t-1)	δ_9	-0.00209*** (0.0004)	0.000337** (0.000)	-0.00592*** (0.002)

⁵¹ lag_roe_below – lagged bank Return on Equity (ROE) measured below the sample median of ROE lagged (status quo).

below_dummy_ CH	δ_{10}	0.659 (1.23)	35.39*** (0.54)	-9.691*** (1.33)
below_dummy_ GB	δ_{11}	2.743*** (0.807)	0.0792** (0.028)	-4.623*** (1.075)
below_dummy_ JP	δ_{12}	1.438*** (0.032)	0.0173 (0.019)	-3.506** (1.07)
dummy_CH	δ_{13}	-1.238 (2.35)	-66.10*** (1.028)	17.88*** (2.48)
dummy_GB	δ_{14}	-5.211*** (1.52)	-0.212*** (0.054)	7.703*** (2.00)
dummy_JP	δ_{15}	-2.676*** (0.67)	-0.0410 (0.045)	6.285** (2.00)
_cons	α_0	2.734*** (0.43)	0.107*** (0.026)	-6.417*** (1.878)
<hr/>				
N		339	174	263
R²		0.95	0.83	0.96

parenthesis robust standard errors adjusted for clusters in bank_id;
*, **, ***; regression's coefficient significance accordingly at 5%, 1%, 0.1%

That evidence stays in opposition to predictions of PT, implying that satisfaction of gains motivated their risky decision more than the disadvantage of losses. In contrast, the loss aversion consistent with PT characterized the commercial banks in the crisis and post-crisis period. In that light over the crisis and post-crisis the propensity of shortfall risk for commercial banks, performing below status quo, was higher than for commercial banks, operating above status quo (in line with hypothesis 2). Shifting current perspective to the analysis of bank-specific potential determinants of shortfall risk below and above status quo, the outcomes are diversified.

Bank shortfall risk is positively as well as negatively associated with incorporated into the analysis variables of interest across the time specific models: pre-crisis, crisis and post-crisis.

Table 8. Average Marginal Effects across Models for Pre-crisis, Crisis and Post-Crisis Period – Performance of Banks Below Status Quo.

Marginal Effects (Below Status Quo)			
Variables	2000-2006	2007-2009	2010-2013
lag_roe_below	-0.310*** (0.0745)	0.581*** (0.00942)	0.346* (0.206)
equity_assets _(t-1)	-0.0316 (0.0317)	-0.00515** (0.00236)	0.332*** (0.101)
assets_gr _(t-1)	-0.0112** (0.00547)	0.00357*** (0.00102)	-0.164*** (0.00991)
loan_loss _(t-1)	-0.172*** (0.0281)	-0.00487 (0.00723)	-0.311*** (0.0580)
fee_income _(t-1)	0.00718*** (0.00150)	0.000131 (0.000180)	0.00400 (0.00496)
1.dummy_CH	-1.826 (3.455)	-26.37*** (0.421)	16.10*** (2.244)
1.dummy_GB	-7.655*** (2.242)	-0.123*** (0.0289)	6.851*** (1.813)
1.dummy_JP	-3.958*** (0.0944)	-0.0215 (0.0272)	5.639*** (1.810)

The following subsections identify the results estimated accordingly from equation 1 and 2 formulated in section 3 of the research. The average, conditional (given other variables at that average level) marginal effects on selected variables are reported in tables 8 and 10.

3.4.1 Results for Variables of Interest - Below Status Quo

In general, over all analysed sub-periods for commercial banks operated below status quo (table. 8) in major cases, a negative, statistically significant association with shortfall risk characterizes the coefficients on marginal effects for the variables of interest.

The exception is recorded for *fee income effect*, for which marginal effect over all time specific models stays positive and economically significant⁵², whereas for pre-crisis period statistically significant. The latter finding goes in line with predictions of hypothesis 6a) that had been presented in section 3 of this paper. Accordingly, the results suggest as expected that for banks that experience losses relatively to status quo increase of fee income share in the bank's total revenue through its risky character contribute to the higher volatility of profit performance exposing banks to increase in shortfall risk in the next period.

The average marginal effect *on equity to assets ratio* below status quo, shows statistically significant negative association with shortfall risk over crisis period and statistically positive association over the post-crisis period (see Appendix 6). Over the crisis solvency and liquidity problems ultimately have led to increasing costs of leverage. Correspondingly, as in line with bankruptcy cost hypothesis, the findings can suggest that the cost of leverage was greater than the potential return on equity from leverage application. That implies the increase in distance in bank performance, relatively to status quo (increase in shortfall risk). In contrast, over the post crisis period

⁵² *Economic significance* - the importance of the estimated coefficient based not on the statistical probability but on the economic theory. (also labelled as the scientific importance of the coefficient)

the higher the equity to assets ratio (lower leverage) the greater the shortfall risk, so the losses relatively to status quo. Those findings can actually reflect change increase in bank risk aversion and problems on the financial market in a form, for instance contraction in lending and decrease in assets prices.

Consistent with the sign of the pre-defined hypothesis 4 a), the estimate of average marginal effect for *bank's assets growth* is negative, statistically significant in the pre and post-crisis period. In contrast to expectations, average marginal effect for the assets growth over crisis, shows positive statistically significant association with shortfall risk. The negative association of assets growth (in current research proxy for bank's investment opportunities) with shortfall risk, may suggest that over the pre-crisis and post-crisis examined commercial banks increasing their assets growth (for instance by making investment decisions which involved securities, loans and other core asset investments) on average reduced the level of their losses in performance relatively to status quo level. Bank's investment decisions appeared to be adequate to recover from the potential increase in shortfall risk. However we can consider, positive statistically significant coefficient of average marginal effect on assets' growth over crisis as an indicator of profit performance difficulties. Namely, that evidence may suggest misjudged bank's investment decision for example in the mortgage-backed securities.

Those financial instruments initially over the pre-crisis period inflated bank asset's positions but market overvaluation and presence of asymmetry in their risk assessment on average later resulted that profit performance of the exposed banks actually diverge further from status quo level. Hence, the financial market downturn, that follows increase in premium risk and plunge in assets prices, can be the most likely factors behind these results.

Table 9. Estimation Results, Regression Models across Pre-crisis (2000-2006), Crisis (2007-2009) and Post-Crisis Period (2010-2013) – Performance of Banks Above Reference Target.

Variables	ABOVE STATUS QUO			
	parameters	2000-2006	2007-2009	2010-2013
		(y) shortfall risk _t	shortfall risk _t	shortfall risk _t
lag_roe_above ⁵³	β_1	1.118*** (0.187)	0.436** (0.145)	3.436*** (0.392)
equity_assets _(t-1)	δ_2	0.0216 (0.0346)	0.0114 (0.018)	-0.318 (-0.332)
equity_assets_x_roe_above _(t-1)	δ_3	-0.00461 (0.004)	0.00424 (0.007)	-0.112 (0.131)
assets_gr _(t-1)	δ_4	0.10148*** (0.030)	0.01717*** (0.003)	0.03754 (0.030)
assets_gr_x_roe_above _(t-1)	δ_5	0.0400*** (0.012)	0.00461*** (0.001)	0.0127 (0.011)
loan_loss _(t-1)	δ_6	-0.110 (-0.217)	0.0698* (0.0318)	1.665** (0.563)
loan_loss_x_roe_above _(t-1)	δ_7	-0.0403 (-0.49)	0.0192*** (0.0037)	0.693** (0.21)
fee_income _(t-1)	δ_8	-0.0262 (0.018)	-0.00821 (0.005)	0.0896* (0.037)
fee_income_x_roe_above _(t-1)	δ_9	-0.00905 (-1.23)	-0.00540** (0.002)	0.0320* (0.014)
above_dummy_CH	δ_{10}	1.059 (1.28)	-0.172 (0.145)	-4.603*** (0.69)
above_dummy_GB	δ_{11}	-6.162** (1.97)	-0.346* (0.146)	-4.227*** (0.283)

⁵³ lag_roe_above – lagged bank Return on Equity (ROE) measured above the sample median of ROE lagged (status quo).

above_dummy_JP	δ_{12}	-0.809*** (0.141)	-0.366* (0.159)	-3.968*** (0.221)
dummy_CH	δ_{13}	0.867 (3.06)	-0.543 (0.356)	-11.53*** (2.35)
dummy_GB	δ_{14}	-13.88* (6.12)	-1.023* (0.408)	-11.56*** (1.44)
dummy_JP	δ_{15}	-3.110*** (0.482)	-0.826* (0.410)	-9.710*** (1.5)
_cons	α_0	4.154*** (7.65)	1.310*** (3.71)	8.779*** (1.86)
<i>N</i>		369	166	282
<i>R</i>²		0.91	0.80	0.98

In parenthesis robust standard errors adjusted for clusters in bank_id;
 *, **, ***; regression's coefficient significance accordingly at 5%, 1%, 0.1%

To take the argument further, the enhancing effect of bank assets growth on shortfall risk may also suggest that possibility of government bailout is likely to encourage those banks to gamble playing for resurrection through making investments in riskier assets.

Further, the estimated average marginal effects for *loan loss reserves to total loans ratio* are negative over all analysed periods and statistically significant over pre-crisis and post crisis period. In particular, the negative association of aforementioned ratio (understood in this research as a proxy for bank's credit risk) with bank's shortfall risk may provide an evidence that the level of loan loss reserves relatively to bank lending portfolio over pre-crisis, crisis and post crisis on average acts as a buffer absorbing losses. For instance, the losses from selling to poor quality borrowers or from banks' miss-selling the insurance products. The implications of that finding also show that especially over the upturn of pre-crisis and post-crisis time the analysed commercial banks, despite facing losses relatively to status quo, stay consistent in identifying their loan loss

and are able to improve their performance by the same token aiming to reduce a performance distance relatively to status quo level.

Auxiliary perspective on the commercial bank's performance and its drivers relatively to status quo presents an analysis of the selected to the sample countries, represented by *dummy variables* *UK*, *US*, *JP*, *CH*. In current research, (for bank performing below as well as above status quo) the average marginal coefficient reflected association with shortfall risk. In particular, this implies that, on average increase in shortfall risk for analysed commercial banks, located in the US, by 1 percentage point, was associated with decrease in shortfall risk for commercial banks located in the UK, JP and CH.

The strongest decrease over the pre-crisis period characterized commercial banks in the UK (7.5 percentage point) whereas in Switzerland was over the crisis period (26.37 percentage point). In contrast, the marginal country effects over the post-crisis period show positive and statistically significant association with shortfall performance risk.

The latter evidence confirms that in the post-crisis period the increase in shortfall risk in the commercial banking sector located in the US is synchronized with the increase in shortfall risk among banks located in the UK, JP and CH. However, the magnitude of that increase differs. Namely, the highest increase in shortfall risk relatively to the U.S. has been recorded for CH (16.1 percentage point).

3.4.2 Results for Variables of Interest – Above Status Quo

The interest in examining a potential association between shortfall risk and bank level variables of interest for commercial banks operated above status quo lead us to analysis of average marginal effects calculated as displayed in table 10.

Table 10. Average Marginal Effects across Models for Pre-crisis, Crisis and Post Crisis Period – Performance of Banks Above Status Quo.

Variables	Marginal Effect (Above Status Quo)		
	2000-2006	2007-2009	2010-2013
lag_roe_above	0.438*** (0.102)	0.140*** (0.0284)	-0.00666 (0.367)
equity_assets _(t-1)	0.0275 (0.0364)	0.0126 (0.0202)	-0.254 (0.260)
assets_gr _(t-1)	0.0508*** (0.0168)	0.0184*** (0.00316)	0.0303 (0.0225)
loan_loss _(t-1)	-0.0588 (0.126)	0.0749** (0.0321)	1.267*** (0.448)
fee_income _(t-1)	-0.0147 (0.00982)	-0.00964* (0.00525)	0.0712** (0.0298)
1.dummy_CH	-0.475 (1.502)	-0.588 (0.393)	-8.891*** (2.013)
1.dummy_GB	-6.068 (3.854)	-1.114** (0.443)	-9.132*** (1.407)
1.dummy_JP	-2.084*** (0.373)	-0.922** (0.451)	-7.434*** (1.465)

Confirming that the *fee income effect* is consistent with predictions of hypothesis 6b) the corresponding, average marginal effect shows negative statistically significant value

of over the crisis period, whereas negative economically significant over the pre-crisis period. The contrasting, non-expected findings were reported for the post-crisis period. Over that period, on average, positive association between fee income to total revenue ratio and shortfall risk characterized analysed commercial banks. The former findings suggest that banks performing above status quo especially over the crisis period, through increasing the share of fee income in their total revenue experienced on average a negative change in shortfall risk, relatively to status quo. Hence, the greater bank's involvement in fee income generated products was the closer to status quo they operated. Surprisingly, over the post-crisis period bank revenue's share based on fee income generated products indicate the positive association with shortfall risk that can suggest a more prudent bank approach, dealing with that source of banks' profit performance.

For banks that outperform the performance target the reverse *leverage ratio* does not have a statistical significance in explanation of shortfall risk across all estimated time-specific regression models.

For commercial bank's investment opportunities expressed by assets' growth and its association with shortfall risk above status quo, results show positive average marginal effects across all three formulated models. These are statistically significant for pre-crisis and crisis period, which stays in line with prediction of hypothesis 4b). In that light, for banks analysed over pre-crisis period the increase in assets' growth, which implies growth in assets' based investments, enhanced their return on equity. In that way banks' investment performance on average was associated with increasing divergence from status quo level, hence increase of shortfall risk. However, the time of crisis and post crisis potentially display a different perspective on banks investment choices and their association with shortfall risk. Namely, the market downturn impaired banks investment opportunities. Facing among others, the problems with financial market liquidity, devaluation of assets, solvency problems banks face problems

attempting further increasing their assets' growth. That carried the weight for their future profit performance outcomes, which display a tendency to lessen. Hence, the above reasoning supports the obtained findings, that a decrease of assets' growth is associated with decrease in bank profit performance distance from status quo (decrease in shortfall risk).

Loan loss reserve to total loans ratio shows for the pre-crisis period a negative, economically significant association with shortfall risk. The pre-crisis period encouraged banks to undervalue potential loan loss risk and instead make the best commercial use from market lending boom. In consequence, banks could extract the abnormal profit rent from the market, in correspondence achieving return on equity further from status quo. These findings provide the support for pro-cyclicality evidence. In contrast to the pre-crisis period, results for the crisis and the post crisis period show on the aforementioned variables positive statistically significant estimates. Consistently with argument of importance of the timely recognition of loan losses, over the crisis and carried through the post crisis period, the delay in adequate identification of cost of loans' default was associated with the lack of required adjustments of provisioning policy. The latter exposed analysed commercial banks to erosion of profits.

The magnitude of the negative association of credit risk with shortfall risk was even greater in the period directly following the time of recent financial crisis (2007-2009), namely the interval between 2010-2013 (post-crisis model). This implies that the actual economic effect of mounting problems with deterioration in loan's portfolio quality, with their potential effects on reduction in bank's profit's return, were likely amplified by the spreading impact of the post-crisis recession. On the other hand, the evidence of unidirectional association between loan losses reserve to total loans ratio and shortfall risk may suggest a tendency of bank managers to follow actions, motivated

by income-smoothing incentives. In that respect, through the discretionary adjustments within provisioning policy banks tend to decrease level of recognised loan losses over the downturn when profits go down. In that way, adding to bank's opacity risk, banks create impression of less volatile performance outcomes.

Negative, statistically significant coefficients on country effects for commercial banks located in the UK, Japan and Switzerland held over the post crisis period. Over the crisis, negative statistically significant association for banks operated above status quo characterized banks located in the UK and Japan, while over the pre-crisis on average only commercial banks located in Japan in comparison to the US displayed a negative statistically significant association with shortfall risk.

3.5. Conclusion

The key purpose of this research was to empirically evaluate patterns of risk behaviour in commercial banking sector utilizing Prospect Theory. Accordingly, the interest of the current research was to identify and better understand what types of risk behaviour describe managerial actions from a behavioural perspective on the analysis of choice and decision under risk and uncertainty. Risk taking is recognised as a complex, intuitive process dominated by subjective perception of risky prospects that stems from emotional as well as cognitive errors in judgement such as confirmation bias, loss aversion bias⁵⁴, extrapolation bias. The leading hypothesis was that attempts of a bank manager to maintain subjective value of the risky prospect is exposed to influence asymmetry in risk perception between losses and gains of equal

⁵⁴*Loss aversion bias* is a tendency of experiencing a loss more severely than a gain of the same magnitude.

amount relatively to the status quo.

The findings reflect that non-constant risk preferences characterized managerial risk behaviour over the pre-crisis period. PT described risk behaviour for that period. Namely, banks that underperform the status quo behaved as risk seekers while those that overperform the status quo were characterized with the averse approach to the risk. Further, the obtained evidence on loss aversion suggests that banks that operated below status quo especially during the crisis period were motivated towards risk seeking behaviour by the reverse sunk-cost fallacy. The latter represents a powerful occurrence that in the presence of framing effect tends to encourage decision makers to take further gambling, ignoring the prior losses in a hope to recover or at least break even from the past-misjudged evaluation of risky situations. That problem, known in literature as a tendency to “throw good money after bad money” identified the common actions of banks in the pre-crisis and crisis period. The aforementioned decision makers, speculating on the financial markets, when the indexes started to crash, played for resurrection expecting the market recovery soon, along with a decrease in downside risk of their investments and return to status quo level.

On the other hand, the reverse loss aversion present in findings for the pre-crisis period implies that the certainty effect addressed by PT framework did work in the opposite direction. Namely, the commercial banks were giving over that period less weight to (sure) losses however the greater appreciation to the (sure) equivalent gains. The above confirms that the deteriorating financial situation of commercial banking sector changed the subjective tolerance (subjective value), assigned to potential outcomes of risky choices relatively to the status quo. It suggests that commercial banks over the pre-crisis period become a more tolerant to losses and to a larger extent encouraged by prospects of the same level of gain relatively to status quo.

An evaluation of bank level variables incorporated to the analysis demonstrates complementary to PT perspective on bank risk behaviour. In that context, over the pre-crisis period bank assets' growth, loan loss reserves to total loan and fee income share in bank total revenue significantly explain changes of bank performance below status quo. In contrast, among commercial banks operated above status quo over the same period only assets' growth has a significant effect. Over crisis equity to assets ratio for banks below and the loan loss reserves to total loan for banks above status quo, displayed the greatest association with shortfall risk. Whereas over the post-crisis period for bank operated below status quo equity to assets and effects work in opposite direction, but nearly with the same significant scale on shortfall risk. The strongest significant association in the post-crisis period for banks above status quo characterized loan loss reserves to total loan ratio.

To sum up, the analysis of choices under risk at the presence of positive as well as negative prospects defined by the return on bank equity relatively to the status quo level provides a valuable insight into economic but also psychological aspect of risk taking process. In particular, it sheds a new light on sources of risk behaviour that are present when we accept the assumption that market is not always efficient and decisions of economic agent in real economic circumstances tend to deviate from equilibrium level. In that respect, this research contributes to the explanation of risk taking in commercial banking arguing that problems in risk control existing over the pre-crisis and also the crisis period could stem from the ignorance of discrepancies between subjective perception and objectivity in risk decisions.

Further research within the already introduced area may focus on the analysis of risk behaviour incorporating to the risk analysis the empirical examination of money house effect for a sample of commercial banks that cover data for all available countries.

CHAPTER 4. Examination of Profit Efficiency in Commercial Banking Sectors in the United Kingdom, the United States and Japan over 2000-2012

4.1. Introduction

Efficiency measurement, used as a tool in bank performance evaluation as enjoyed a predominant position in the banking literature over the last 30 years.⁵⁵ The majority of prior studies have tried to achieve this goal employing frontier analysis, based on a cost minimization perspective. Among those studies, the most recognized works include: Galligan, Smirlock (1984), Berger et al., (1987), Ferrier, Lovell (1990), Berger (1991), Allen, Rai (1996), Berger et al., (1998), Altunbas, Liu, et al. (2000), Weill (2004), Khumbakar, Tsionas, (2005a) & (2005b), Brissimis, Delis, Tsionas, (2010).

However, the cost perspective delivers an incomplete view of a bank's market behaviour. A bank's performance depends on costs, but also on revenues. Because of this obvious fact, profit efficiency perspective provides an alternative and, probably, more accurate approach to efficiency assessment. The profit efficiency perspective enables the identification of potential gains and losses associated with supply as well as demand driven factors of the bank production process (Maudos et al., 2002; Rogeres, 1998; De Young, Hasan, 1997). A bank that experiences profit performance efficiency gains over time is regarded as more efficient in utilization its resources to generate own profits, relatively to the best practice profit efficient benchmark. Accordingly, an efficiency analysis in profit context in compared to the aforementioned cost

Farrel (1957) for example, defines efficiency as the firm's ability to obtain maximum output employing given amount of input.

perspective, provides greater potential, a more informative and compact approach to bank performance evaluation.

Building on the contributions of the aforementioned research, the key objectives of this paper are to provide and analyse empirical evidence on profit efficiency performance along with identification of the drivers affecting that performance in the commercial banking sector of the UK, Japan and the U.S. over the period 2000-2012. In doing so, the research puts a special emphasis on the impact of the recent financial crisis 2007-2009 on bank ability to perform efficiently- the aspect completely overlooked by the prior contributions within the analysed research area.

The introduction to the analysis of market specific, bank and country specific efficiency drivers enables us to extend the scope of the present research. In that respect, the selected efficiency drivers assist in explaining, not only how banks can potentially improve their ability, to generate profit more efficiently, but also what potentially impairs that ability.

The issue of commercial banks' profit efficiency measurement and the interest in potential drivers behind its intensification becomes especially relevant in the light of the global markets' distress and economic uncertainty, produced by the 2007-2009 crisis. Banks, especially in high-income countries, through an active participation in the process of capital and investment accumulation, are seen as important market agents, responsible for a country's economic growth and prosperity (the view shared and empirically confirmed among others by: Levine and Zervos, 1998; Arestis, Demetriade and Luintel, 2001; Deidda and Fattouh 2002; Herwartz and Walle, 2014. By the same token, the banking sector facilitates the flow of important market signals between financial sector and real economy. In doing so, one amplifies a transmission of positive as well as negative shocks to the country's and further to the global economy.⁵⁶

⁵⁶For the recent empirical analysis on interactions between business and financial cycles that takes

Accordingly, the mechanisms through which banks conduct their economic functions have a largely pro-cyclical character (Borio, Furfine, et al., 2001).

From the microeconomic perspective, the procyclicality of bank market performance finds its reflection in the structure of bank assets and liabilities. Banks' balance sheet and off balance sheet positions play here a key role in transmitting the economic signals from the financial market to the real economy. By means of financial market regulations and bank decisions, the structural adjustments of those financial positions create a direct basis for bank actions. Amid those actions, the significant role plays a level of profit efficiency and attempts for its improvements at the different stages of the business cycle.

The above is especially important in the light of the recent financial crisis. Bank profit efficiency in that context can become a reliable means of bank financial recovery and a source of learning, on how to correct its future performance goal, in order to avoid potential risks of financial distress or even failure. A bank, that at the presence of a given supervisory and technology constraint, builds its commercial on the profit efficiency maximization goal is also more effective in minimizing negatives effects of market imperfections (market inefficiency) in the form of information asymmetry. Therefore, efficient bank performance also implies the performance that corresponds with the lower risk of moral hazard and adverse selection problems (Stigler, 1961).

In the context of the recent crisis, the bank's efforts toward efficiency improvement have the potential in speeding up the process of a country's economic recovery and in the long-run financial stability.⁵⁷ Reflecting on the above, an efficient

in an international perspective applying comprehensive data sample over 1960-2010,(see Claessens, Kose, Terrones, 2012).

⁵⁷The more efficient so quality driven financial intermediation there is a greater probability that country savings will fund the best investment projects. By the same token the macroeconomic stability condition

banking sector, that built its market performance on sustainable and solid foundation, guarantees a country development long-term, while over the time of market downturn corrects negative effects of market imperfections.

However, it is commonly known, that a bank's performance is associated with certain level of inefficiencies. The economic implications of the recent events of the crisis and the post-crisis periods provide us with relevant example. Looking from the perspective of developed countries, banks located there were potentially able to improve efficiency, fulfilling their economic and commercial functions. In doing so, they take advantage of the business prospects offered by a global market upturn that started in late 90's. The access to diversified sources of funding and investment opportunities available on the global financial market contributed to an increase in bank profitability (Tragenna, 2009). However, on the other hand, business opportunities offered by market upturn also encourage banks to an imprudent type of investment behaviours often at the risk of debt-holders and other bank creditors. That moral hazard type of problem known in literature as a risk shifting (Jensen and Meckling, 1976) has been recently confirmed in an empirical study to play a major role in triggering off the 2007-2009 financial crisis in the U.S. (Duran and Lozano-Vivas, 2014).

The risk-shifting constitutes a very serious problem in contemporary financial intermediary practice. As bank's depositors do not have perfect information about the volatility of a bank loan portfolio over time, the bank owners take a risk whose scale exceeds the insurance premium already available to debt holders. In that context, the bank shareholders decisions about the bank exposure are not based on the ground of the fair insurance premium (Merton, 1977, 1978). Reflecting on the above, it might be misleading to account an improvement in bank profit performance over the pre-crisis

Savings =Investments can be built on continuous and enduring basis.

period broadly to the banks' decisions, based on efficiency improvement premise. It is equally important also to consider bank's risk taking preferences. Therefore, by including into the current analysis the aspect of capital, credit and liquidity risk, the research offers multidimensional insight into the inefficiency analysis in commercial banking.

Drawing on the above, is the commercial banking sector capable to generate profits, also so efficiently facing the hardship of the new economic reality, developed by the global financial crisis? If this is the case, how can banks achieve that goal, but at the same time avoid excessive risk taking? Correspondingly, how do banks profit efficiency results look like in comparison, evaluated for pre-crisis and recovery time? What elements of its operating market behaviour does a bank need to reconsider to overcome efficiency problems? These are the questions that the current research seeks to answer.

To emphasise that the problems in financial markets over 2007-2009 were concentrated within the banking sector, let us look at the number of failures in the U.S in the aftermath of a global financial crisis. The reported number reached 417 cases (Lu et al., 2013). In a broader view, according to Federal Reserve sources, the decline in a number of commercial banks due to bankruptcy and lack of new commercial banks' entries onto the financial market in the U.S. between 2007-2013 has fallen down by 14%, which in absolute terms accounted for 800 cases.

Surprisingly, the scale of that dramatic decrease was not mainly driven by the fall in number of existing small commercial banks (less than \$50 million in assets), but by the fall in a number of new small commercial banks' entries onto the market. Moreover, the structural changes on the financial market in form of consolidations and acquisitions to a lesser extent than commercial banks' failures had an impact on the overall decline of the aforementioned banks in the U.S. (McCord et al 2015).

In that respect, can efficiency analysis help us as an early warning predictor of the probability of a bank's failure? The available literature provides conclusive evidence. For instance, work by Wheelock et al., (2000) empirically proved that bank efficiency among other factors such as capitalization, loan quality, liquidity influences a risk level of bank failure. In the earlier studies, performed also for the U.S. commercial banking sector (Barr et al., 1994; Hermalin et al. 1994), bank managerial inefficiency was empirically recognized as an important determinant of the risk of bank failure. Reflecting on the above, the result of market failure on such a big scale creates a need for better understanding of the factors that potentially can explain why banks' performance deteriorated so severely.

The interest to examine profit efficiency performance for commercial banks that are located in the most economically developed countries in the World, the UK, Japan, the U.S. has important implications in the context of the objectives of the current research. Firstly, by looking at the US, where the global financial crisis had originated, the analysis within the current research allows direct evaluation of the effects of that crisis on the estimated scale of banks' profit inefficiencies. Further, the UK, Japan, the U.S. as a country group of long-lasting, tight economic connections are recognized by its strong bilateral partnerships in trading, close integration of the financial systems via the financial markets (cross-country capital holdings). The countries, in this research, are selected to represent the largest providers of financial services in the main regions of the World: for Europe – the UK, for Americas-The U.S. and for Asia-Japan.

All of the above confirms the importance of the analysed countries in the international, global economy. Moreover, it is worth pointing out other major factors that amplify the global position of the UK, Japan and the U.S. as stable and mature economies. First, it is their active participation in global wealth management through the fact that London, New York and Tokyo are the important global financial centres.

They play a vital market role as financial and informational hubs. Secondly, the fact the currencies of the analysed countries are held as main international reserves. The role of the latter can be well illustrated by looking at the organization of the Eurobond markets where the debt issuances are denominated in Pound Sterling, US Dollar, Yen and Euro.⁵⁸

Following the above and in the context of the recent financial crisis the presence of an economic interconnectedness accelerates a spread of negative economic signals, that we witnessed, looking at the example of the U.S. financial crisis and a quick recreation of its negative effects in the UK and Japan. The above implies that the performance of the real economy in the closely interconnected countries by the same token the performance of their banking sectors is especially exposed to high level of systemic risk.⁵⁹ The already identified economic linkages constitute the important financial crisis transmission channels (see for example [Asgharian and Nossmann 2011](#)).

To sum up, the analysis of banking performance in efficiency context across the countries that almost at the same time have experienced through the *spill-over effect* illiquidity shocks, creates a common ground for better understanding of the economic conditions that affected the process of bank profit efficiency creation.⁶⁰

The main findings provide evidence showing that on average profit efficiency in commercial banking of the UK, the U.S. and Japan increases along with the bank liquidity improvement in all analysed sub periods (pre-crisis, crisis, recession). Next, the consumer confidence index over pre-crisis, when channelling positive consumer's expectations about the country's future economic prospects to financial market

⁵⁸ *Eurobonds* are issued either in a currency other than that of the country in which they are issued or by an issuer that doesn't reside in the country in which they are issued. The borrowers on that market are not only banks but sovereigns, municipalities or private corporates.

⁵⁹ International Monetary Fund Spillover Reports set an economic policy recommendations for the economies identified as a systemic, on the basis of concerns raised by their external partners. Following the above the main systemic economies are: China, Euro Area, US, Japan, UK (known as Systemic-5).

⁶⁰ *Spillover* understood as an increased correlation in financial assets performance after the shock to individual country or group of countries ([Dornibush, Park, Claessens, 2000](#)).

encouraged profit efficiency increase among analysed banks. The effect of banking market concentration is found to support a presence of managerial discretion in profit efficiency maximization for the pre-crisis period. In the light of the above, the evidence shows a negative association between banking market concentration and profit efficiency.

The remainder of this paper proceeds as follows. The next section presents the most relevant literature on efficiency analysis in banking. Section 3 provides the formulation and development of the main research hypothesis. Section 4 explains the research methodology, informs on selected data samples, and identifies the variables used. Section 5 reports estimation results and analyses them in the light of earlier formulated research hypothesis. Section 6 presents a research summary, implications of the main findings, and suggestions for further research.

4.2. Related Literature

Numerous studies in the recent years frequently concentrated on the analysis of banking efficiency performance. However, none of them attempts to explore the subject simultaneously, considering the impact of the global financial crisis (2007-2009), the pre-crisis and the post crisis period of time. Moreover, none of those studies focuses on the commercial banking sectors located exclusively in the UK, Japan and the U.S. For example, prior studies predominantly offer empirical evidence focusing on commercial banking sector in countries that belong to the European Union (EU), the U.S. or take aggregated international perspective on bank efficiency by pooling the country's data by geographic regions. Accordingly, while the latter allows assessing efficiency outcomes, in the context of main world geographic regions the average outcomes for the selected countries still remained unknown. The research interest

of recent works on bank's profit efficiency is quite wide and leads in a number of different directions. In that context, the related research developed an empirical insight into the following aspects of a bank's efficiency performance. The impact of risk and capital level on commercial banks' efficiency performance in the EU over the period 1999-2007 has been analysed by [Fiordelisi, Marques-Ibanez et al., \(2011\)](#). Research on the importance of off-balance sheet transactions in analysis of commercial bank efficiency conducted for 87 countries over 1999-2006 in a work by [Lozano-Vivas and Pasiouras \(2010\)](#). Further, the impact of effective tax rate on the efficiency in commercial banking sectors located in 46 countries based on data over period 2001-2009 has been introduced by [Gaganis, Pasiouras et al., \(2013\)](#).

Next, the examination of banks' stock returns on their performance efficiency in 15-EU countries over 2002-2006 belong to [Liadaki and Gaganis \(2013\)](#). The effect of Schumpeterian type of competition proxied by trademark intensity variable, however employing the data sample of only 20 UK commercial banks over 2001-2012 highlighted in a work by [Duygun, Sena et al., \(2013\)](#). The influence of regulations within Basel II supervisory requirements, such as capital adequacy, official supervisory power and market discipline on commercial bank efficiency in 74 countries over 2000-2004, has been investigated by [Pasiouras, Tanna et al., \(2009\)](#).

An impact of the three main existing patterns of financial supervision such as central bank involvement, its independence and unification of supervisory authority on bank efficiency performance located in 78 countries over 2000-2006 in the study by [Gaganis, Pasiouras, \(2013\)](#). Nevertheless, despite the main thesis of the aforementioned studies confirm the high potential of bank efficiency as an area of academic research, they are lacking the consideration for last events on financial markets - namely, the financial distress and recession of global financial crisis 2007-2009.

Another important issue to be addressed, reflecting on the review of recent

contributions on profit efficiency in commercial banking there is surprising scarce empirical evidence for the Japanese environment. Despite the fact that Japan, besides the U.S. and the UK is recognized as a one of the biggest economy in the World (according to ranking by the International Monetary Fund) the research interest in better understanding of the bank efficiency drivers in that country is very limited.

The above argument is also partially valid, taking into consideration the research of the U.S. banking environment. While the earlier studies on profit efficiency in banking were predominantly focused on analysis for the US banking sector, they provided the empirical evidence on efficiency and its determinants over the 80's, the 90's and beginning of 2000's (De Young, Hasan, 1997; Berger, Mester, 1997; Rogeres, 1998; Maudos et al., 2002; Akhibe, McNulty, 2003; Akhibe, McNulty, 2005; Bos, Kolari 2005). So far, no research in the context of the U.S. banking environment, has dealt with the analysis of profit inefficiency and its determinants, considering the impact of the global financial crisis. The above is more than surprising bringing to the fore the fact that the financial crisis originated in that country.

Reflecting on the above, this research is going to fill the identified gap, making a contribution to the existing literature on commercial banking efficiency in a number of ways. First and foremost, the research provides new evidence on profit efficiency performance level and its evolution over a relatively long period of time, 13 years paying special attention to the impact of the recent global financial crisis. Next, rather than exclusively relying on the efficiency drivers employed by the prior studies, the current research adds also to the analysis two new drivers not applied before in the literature on the subject. Namely, the research will empirically test the significance of a liquidity and consumer confidence index as a factors behind profit (in)efficiency performance and consumer short-run spending behaviour, proxied by consumer confidence index. Next, the analysis relies on the banking data from three of the most economically

developed countries in the World, the UK, Japan and the U.S. The economies of strong mutual financial and trading ties such as the aforementioned are especially exposed to the risk of the crisis spill-over effect. Further, it uses the one-stage profit stochastic frontier method following the approach introduced by Battese and Coelli (1995), the method not applied before to the recent, so long period of time exclusively for the UK, Japan and the US within one study.

In summary, facing the lack of the prior studies that contribute in the same way to the investigated research area, the present research can be considered as an important extension and advancement to the knowledge on banking efficiency.

4.3. Selected Determinants of Profit Efficiency and Development of Research Hypothesis

In this section, the research drawing on the implications of existing theories within bank performance analysis aims to determine an interpretation and significance of the obtained empirical results. In fulfilling that aim the author formulates a number of research hypotheses. Their role, from building a conceptual framework to shaping directions of the author's reasoning, assists in potential explanation why profit efficiency outcomes differ across banks and/or time. Against that background, the hypotheses identified below one by one constitute important building blocks of further empirical analysis.

With the theoretical insight into potential determinants of bank profit efficiency, the author starts from discussion about the importance of an application of macroeconomic conditions (environmental factors) to efficiency analysis. Their inclusion to the inefficiency models as a part of a stochastic frontier framework constitutes a widely accepted aspect of the research related to the current subject

(for example [Maudos, et al., 2002](#)).⁶¹ To be more specific, as they affect a bank efficiency performance exogenously (bank management does not have a direct control over them) measuring a country's economic activity over time, their introduction to the bank efficiency models helps assessing an impact of economic fluctuations and cyclicity. Macroeconomic factors for example, the ones that explain a demand side of the country's economic activity have a potential impact on bank profit efficiency outcomes through affecting bank lending. In that respect, the latter known for its pro-cyclical character, expands in tandem with the acceleration of country's economic activity measured typically by country real GDP growth and contracts when country economic performance is characterized by a downturn trend (for example as a result of recession following the recent global financial crisis). In a similar manner, increase in aggregated market demand is expected to enhance bank's profit efficiency outcomes. While the opposite relationship between demand and bank profit efficiency should occur in the time of market downturn, when demand is weakening. Consequently, looking at the profit efficiency phenomena through the long run perspective, it is assumed that its level moves in the same direction as the country's economic activity.

Reflecting on the above, the author implements as a potential driver of bank profit efficiency a new, not applied before macroeconomic factor, namely the *Consumer Confidence Index*. The one is assumed to play an important role in explaining differences in bank efficiency phenomenon. In that context, unlike previous efficiency research to control for a market aggregated demand effects, the conventionally use of the GDP growth, the current work examines the effects of aggregated demand through customers' perspective and their spending behaviour.

⁶¹ Among those studies the most popularly applied macroeconomic factors are the real GDP growth and inflation.

Table 11. Determinants of Profit Efficiency in Commercial Banking of the UK,
the U.S. and Japan.

Determinants of Profit Efficiency	
Variable Name	
HHI	Concentration Index of Bank Industry
CCIND	Consumer Confidence Index
liqass	Ratio of bank liquid assets to total assets
Equity to assets	Ratio of bank equity to total assets

In that respect the choice of the consumers' confidence index (CCIND) is supported by the fact that consumption constitutes a dominant component of a country's GDP (accordingly consumption as a share of GDP average between 2000-2011 on average amounts to for the U.S. 70.3%, the UK 63.7 % and Japan 58.1%, source: OECD). In that context, the index is recognized as a leading indicator of country economic performance, expected to proxy the impact of fluctuations on the market, driven by an aggregated consumer demand analysed in context of its impact on bank profit efficiency performance. In the related discussion, employing the aggregated data over 1980Q1-2009Q3 for G7 [De Nicolo, Lucchetta \(2010\)](#) identified that demand as opposed to bank loan supply aggregated shocks stays behind the cyclical fluctuations in bank loan growth. The above underlies and can support reasoning that changes in lending, hence, also implicitly changes in bank profit efficiency performance constitute the increasing function of aggregate demand for bank lending products. Referring to the above, it is assumed, that increase in the aggregate consumer demand for bank lending occurs when consumers are more confident about the country's

economic conditions, (the latter captured by CCIND). Further to the above, the index assesses the extent to which consumers modify their willingness to purchase, shaped on their expectations towards the main economic factors, such as inflation level, employment, future amount of discretionary income.

In that perspective, the interplay between market macroeconomic aggregates influences decisions of consumers as market agents, which has further implications for the banking sector performance as a whole and especially bank profit efficiency driven commercial choices. For example, consumer uncertainty about the future country's economic climate expressed by the decrease of Consumer Confidence Index, will bring change in the structure of consumer expenditures, for instance decrease in spending on long-term durable goods (houses, cars etc.), luxury goods.

A downward trend in consumer confidence will consequently also negatively affect market demand for bank financial products. People will be more careful about their debt decisions as they will not feel secure about their capability to meet the loan payments in the future. Accordingly, the lesser consumption optimism creates negative economic signals, transmitted into the economy over the medium and long-term can contribute to the downward shift in an overall consumer demand curve, implying also the downward shift in a demand for bank's financial products.

Reflecting on the above, by inclusion of *Consumer Confidence Index (CCIND)* to the profit efficiency model the research proposes the following hypothesis.

H_0 : On average, the consumer confidence index has no effect on the commercial bank profit efficiency in the UK, the U.S., Japan in the period between 2000 - 2012, ceteris paribus.

$H1a$: On average, the consumer confidence index has an effect

on commercial bank profit efficiency in the UK, the U.S., Japan in the period between 2000 - 2012, ceteris paribus.

***H₀*: On average, the consumer confidence index has no effect on commercial bank profit efficiency in the UK, the U.S., Japan in the period in the period of financial crisis 2007-2009, ceteris paribus.**

***H_{1b}*: On average, the consumer confidence index has an effect on commercial bank profit efficiency in the UK, the U.S., Japan in the period of financial crisis 2007-2009, ceteris paribus.**

Shifting the author's interest on potential determinants of bank profit efficiency from country specific to market specific ones, the research offers a rationale behind the role of market concentration in the model.

The market concentration proxied in the efficiency model as *Herfindahl-Hirschman Index (HHI)* is defined as the sum of the market shares squared over all banks in the market. Market share is approximated by the share in the total value of the market expressed in terms of assets, a measure widely applied in empirical studies as an indicator of market structure.

The HHI index considering the number of banks and their market shares measure an inequality in the size distribution of firms in the market. Hence, the application of HHI index has a potential to reflect bank firm dominance in the analysed market structure (from the bank firm perspective of oligopoly character). However, the important precondition to obtain a meaningful HHI index lies in an accurate definition of the market. Accordingly, in the context of the considered measure of concentration,

the market is expected to be defined as a total value of assets across banking sectors, accordingly in the UK, Japan and the U.S..

A number of theoretical perspectives frames the role of market structure in explaining differences in banks' profit efficiency level. In that respect, it is possible to distinguish the two main directions in which the scholars' reasoning developed, bringing the formation of well-recognized hypothesis on the subject. In that context, there is a line of reasoning that places an emphasis on a managerial utility and a role of managerial motivation on the quality of bank performance outcomes. It was presented by Quiet Life Theory by Hicks (1935) Scitovsky (1943); Expense Preference Theory Williamson (1964); Agency Cost Theory, Jensen and Meckling (1976); X-Inefficiency Theory Leibenstain, (1966)⁶². The above has been employed to the research on banking performance among others by Berger and Hannan, (1998), Weill, (2004), Delis and Tsionas, (2009). Next, there is a theoretical approach that attempts to infer the observed variability of performance, by investigating the relationship between profitability and market concentration, treating the latter as an exogenous characteristic of the market. The aforementioned known as a collusion hypothesis, originates from the Structure-Conduct-Performance framework (Bain, 1956) to banking context has been implemented among others by: Evanoff and Fortier (1988), Berger, (1995). The collusion hypothesis assumes that small numbers of firms operate in the market, which is characterized by high barriers to entry, and can so achieve above normal profits by applying collusive behavior and arbitrage pricing strategies.⁶³

Following the above line of thinking, the presence of the positive relation

⁶²The QL theory recognizes the explicit role of market power in encouraging firm's non-profit maximizing behaviour by suggesting a claim that "the best of all monopoly profits is a quiet life". The aforementioned reasoning due its simplicity can be inevitably classified as a consistent with the Occam's razor principle.

⁶³ *Arbitrage pricing strategies*- refer to actions aimed to increase investor profits by taking advantage from differences in assets prices across markets. For example, by buying on one market and simultaneously selling with profit on the other market.

between HHI index and the level of bank profit efficiency is assumed to indicate dominance on the market cooperative forms of oligopoly strategic interactions. In the current research, the above amount to the presence of bank profit efficiency outcomes is relatively closer to the bank profit efficient frontier. The higher the positive relationship between the bank ability to extract market profit at the level located relatively closer to bank industry frontier and market concentration index, the greater probability of bank involvement in cooperative type of profit conduct, for example in the form of tacit collusion or price signalling.

Further, reflecting on the context of the current research, bank's underperformance in extraction of oligopoly profits relatively to the profit efficient frontier it assumed to be consistent with the Quiet Life (QL) and related theories, mentioned within the former part of the above discussion. Under that perspective, managerial actions driven by the uncertainty avoidance attitude affect negatively firm's revenue maximization as well as cost minimization objectives. Ultimately, through a reliance on bank strong market position (market power degree), relatively to rivals operating on the less concentrated markets, they are able to enjoy oligopoly rents in the form discretionary expenses and other suboptimal efforts to maximize profits, for example expenses to strengthen bank market power or shirking managerial behaviour. The above constitutes in the light of the presented approach a main source of profit inefficiency. [Berger \(1998\)](#) found that quiet life effects (inefficiency) in banking appeared to be several times larger than social losses associated with the mispricing of products from market power (welfare triangle's area). Moreover, these authors postulate that the lack of market discipline created by market concentration can worsen an agency problem between owner and managers, because managers who exercise market power in pricing can allow costs to rise somewhat and still earn economic rents for the owners ([Jensen and Meckling, 1976](#); [Leibenstein, 1966](#)).

Reflecting on the above arguments, the research proposes that the differences in banks' profit efficiency will be explained through the application of the set of theories that are built on the importance of managerial discretion at the presence of market power. Hence, in order to verify empirically a validity of the above argument, the research formulates the following hypothesis.

H₀: On average, market concentration has no effect on profit efficiency over 2000-2012, ceteris paribus.

H_{2a}: On average, market concentration has an effect on profit efficiency over 2000-2012, ceteris paribus.

The number of theories provides potential explanations on the presence of a trade-off between capital risk and bank profit efficiency. In that context, we can distinguish the arguments that on the one hand favour the presence of a positive and on the other hand a negative trade-off between aforementioned indicators of bank performance.

Broadly speaking, the level of bank capitalization should reflect and correspond with the quality of the bank's, earning assets' portfolio. Namely, the lower the quality of the portfolio, the financial performance is more exposed to the risk of potential insolvency and/or default. Holding higher levels of equity in proportion to bank total assets, allow withstanding and absorbing the potential losses of a bank's misjudged own investment decisions. The aforementioned approach, because of its mitigating effect on bank risk behaviour, finds its supporters on the side of financial supervisory authorities. However, is the same approach in the interest of bank shareholders and bank managers? The answer to this question seems to be obvious. There is a fundamental

polarity between motivations of those economic agents. While regulators, as already mentioned, prefer banks that run safe socially secure financial intermediation, bank shareholders are economically driven by the goal of bank value maximization at the given level of risk (here expressed through the profit efficiency channel), that can be in principle achieved by increasing the level of bank leverage. In contrast to the above, the motivation of bank managers, as theory and practise suggests, is conditioned on preference for a discretionary type of behaviour. The one that finds its reflection in the personal utility maximization and agency cost problem (Jensen & Meckling, 1976; Williamson, 1964). In that regards, even profitable banks can be run inefficiently if their equity-leverage decision tends to expose bank depositors (taxpayers) to the excessive risk of financial loss. The implications of the presented arguments find their theoretical rational to support as much as reject the negative trade-off between bank capitalization risk and profit efficiency outcomes.

Accordingly, following the first view, known as efficiency-risk hypothesis (Berger & Bonaccorsi di Patti, 2006), banks that earn higher profits thanks to more efficient utilization of their resources do not need to hold high *equity to assets ratio* to protect themselves against potential risks of financial default or insolvency. They can instead for the same purpose use profits obtained from efficiency improvement. In line with the above reasoning banks that are more profit efficient can control potential cost of their financial distress effectively at the level of equity lower than the one held by their less profit efficient market counterparts.

Correspondingly, the author proposes a following research hypothesis:

H₀: On average, bank capital to assets ratio has no effect on profit efficiency outcomes for commercial banks located in the UK, Japan and the U.S. over 2000-2012, ceteris paribus.

H_{3a}: On average, bank capital to assets ratio has an effect on profit efficiency outcomes for commercial banks located in the UK, Japan and the U.S. over 2000-2012, ceteris paribus.

The alternative reasoning provides an opposite perspective on interplay between bank equity ratio and profit efficiency performance. In that context, a bank concerned in protection of its franchise value (Keeley, 1990) (that can be improved through profit efficiency gains) tends to hold higher equity ratio than other less profit efficient banks on the market. Correspondingly, improvement of bank profit efficiency is perceived as a source of economic rents (franchise value) that is lost in case of bank liquidation. Therefore, in order to keep economic rents bank owners will be focused on running banking operations, considering the higher level of risk aversion.

The control of the bank illiquidity risk is understood as a process of monitoring and reduction of the potential mismatch in maturities between banks assets and liabilities, with the aim to avoid financial losses (while in the extreme scenario in the short term to prevent the possibility of a bank run). The financial liquidity management has an important implication for an effective fulfilment by bank its main economic functions, namely the function of maturity transformation. In that context, a bank facing the liquidity problems will be unable at the short notice to convert its assets holdings into cash in order to meet withdrawals of funds by its depositors. Bank's assets are illiquid or simply the level of their liquidity is not sufficient to cover emerged needs

for short-term liabilities (funding liquidity risk)⁶⁴.

Taking the above into consideration, (all else equal) a bank that aims to obtain or to maintain its potential to extract profits from the market, (reduce profit inefficiency) is expected to rise the volume of liquid assets to total assets (improve liquidity ratio) or alternatively hold their volume in the direct proportion to the scale of bank involvement in short term leveraging. Correspondingly, if marginal increase in bank liquidity, all else equal, constitutes the major factor, underlying a change in a structure of bank total assets, a bank in times of intensified debt funds' outflow (for instance due to economic downturn) is able to meet its clients expectations, keeping the high profile of its activity by ensuring safe and stable financial intermediation. Simultaneously, the more liquid assets a bank holds in the structure of its balance sheet, the lower financial cost related to their conversion to cash comparing with balance sheet structure of a bank, that to the greater extent relies on less liquid assets' positions. Consequently, the higher share of liquid assets in total bank assets portfolio, the higher bank's potential to generate profits more efficiently.

However, there is a point to which further increase in liquid assets to total one is becoming efficiency reducing. Every economic decision, here for example the potential decrease in financial costs from relatively cheaper conversion of liquid assets into cash, has its opportunity cost. Following the above, the positive relation between the marginal level of liquid assets to total assets and marginal cost of illiquidity holds until the opportunity cost of keeping higher volume of liquid assets equalize with obtained advantages from the reduction of illiquidity risk. Correspondingly, the further increase of a liquid assets share will effect in the quicker increase of their opportunity cost than the increase of cost reductions (profit efficiency gains) from effective

⁶⁴ Liquidation of asset positions attached to bank investment contract is due on the later date or else selling that asset by its maturity date will lose an expected profit from that investment evaluated on the basis of the discounted value of its future cash flows.

controlling and management of illiquidity risk.

Empirical validity of illiquidity risk effect on profit efficiency performance is going to be tested through the following hypothesis:

H₀: On average, liquidity risk has no effect on profit efficiency outcomes for commercial banks located in the UK, Japan and the U.S. over 2000-2012, ceteris paribus.

H₄: On average, liquidity risk has an effect on profit efficiency outcomes for commercial banks located in the UK, Japan and the U.S. over 2000-2012, ceteris paribus.

4.4. Choice of Methodology

In the process of research design and methodology selection, the author was considering the number of available techniques applied within the economic efficiency framework and based on the benchmark performance concept: such as Thick Efficiency Frontier (Berger, Humphrey, 1991) Distribution Free Efficiency Frontier (Schmidt, Sickles, 1984) and Stochastic Efficiency Frontier (Aigner, Lovell & Schmidt, 1977; Meeusen, van den Broeck, 1977, Battese, Corra, 1977).

Correspondingly, the search for the most adequate method in light of the current research was based on the following premises:

- a) Applicability of the method within profit approach in the presence of imperfect competitive market conditions.

- b) Flexibility of the method in terms of its use for panel as well as for cross-sectional organization of the data.
- c) Possibility of estimation (in)efficiency residuals as a variable component of frontier error (point (in)efficiency estimation).

Maximization of profit objective, in the presence of imperfect competition present in the banking sector requires modification of the Standard Profit Efficiency Function consistent with the theoretical contribution of [Gorman \(1968\)](#) [McFadden \(1978\)](#) into Alternative Profit Efficiency Function. The former specification of the frontier introduces an assumption of bank, as an output price maker (presence of output price endogeneity). Accordingly to the above, a bank generates the optimal level of profit (frontier efficient level), setting the level of its output prices and input quantities while taking the output quantity and input prices as given. Thus, the recognized performance inefficiencies are considered as a lack of adjustment in output prices and input quantities relatively to the best-practise, efficiency frontier achievable at the given level of output quantity and input prices.

Concluding on the above arguments, the current research will favour an alternative approach to profit frontier specification seeing one as the most adequate and consistent with the character of competition in the commercial banking sector. Further, choice of Stochastic Frontier Analysis (SFA) deserves a relatively highest degree of attention as it enables the researcher to work with cross-sections as well as with a panel data based sample. Moreover, it allows for point estimation of (in)efficiency scores, utilizing the statistical procedure of error's decomposition. In general, the SFA is based on the estimation of the conditional mean or mode that holds when the inefficiency component of error has for example a truncated or half-normal distribution probability, while the random component of error follows standard normal distribution ([Jondrow, Lovell, Materov et al., 1982](#)). Pointing to the limitations

of previously mentioned techniques of efficiency measurement, Distribution Free Approach can only be utilized for a panel data framework, assuming the invariability of (in)efficiency scores over time. There is a core (in)efficiency for each firm, which is constant over time, while random error tends to average out over time. Ultimately, another distribution the Free Thick Frontier Approach in comparison to the former one constitutes the most simplified model of efficiency analysis. The method offers only general assessment of performance efficiency, relying on the theoretical mean of sample quartile. Following that line, the inefficiency level is derived from Ordinarily Least Square residuals of quartiles, by calculating its deviations within the highest and the lowest sample subgroup.

Reflecting on limitations and potentials existing within the examined methods of efficiency analysis the current research employs Battese, Coelli, 1995 conditional mean approach.

The model not only meets the methodology selection criteria specified earlier, but also in contrary to the available alternatives, is based on the one-step estimation procedure that allows for estimation of (in)efficiency outcomes along with potential impacts of their determinants at the same time. In that light, the chosen methodology offers the comprehensive and convenient way of efficiency analysis. The proposed one-stage model, introducing the inefficiency as a component distributed independently but not identically,⁶⁵ corrects the existing in two-stage models inconsistency that, in contrast, is based on the assumption of independently and identically distributed (in)efficiency component (Coelli, Rao et al., 2005).

⁶⁵ u component of error term in BC model distribution varies with the values of selected determinants of (in)efficiency results ($E(z_{it} \delta | v-u)$). Ignorance of that issue leads to bias estimation present in two-step models.

In general BC model is defined as follows:

The stochastic profit frontier with multiplicative form of error term:

$$\boldsymbol{\pi}_{it} = \mathbf{f}(\mathbf{Y}_{it}; \mathbf{W}_{it}; \boldsymbol{\alpha}) \mathbf{e}^{\mathbf{v}_{it} - \mathbf{u}_{it}} \quad (1)$$

where u and v have distributions:

$$\mathbf{u}_{it} \sim \mathbf{N}^+(\mathbf{z}_{it}\boldsymbol{\delta}; \sigma_u^2) \quad (2)$$

$$\mathbf{v}_{it} \sim \mathbf{i. i. d.}(\mathbf{0}; \sigma_v^2) \quad (3)$$

and

conditional mean model:

$$\mathbf{u}_{it} = \mathbf{z}_{it}\boldsymbol{\delta} + \mathbf{R}_{it} \quad (4)$$

where:

\mathbf{Y}_{it} – vector of bank output quantities;

\mathbf{W}_{it} – vector of bank i input prices;

$\boldsymbol{\alpha}, \boldsymbol{\delta}$ – vector of unknown scalar parameters;

\mathbf{v}_{it} – random error;

\mathbf{u}_{it} – non-negative inefficiency component obtained by truncation at zero of $\mathbf{N}(\mathbf{z}_{it}\boldsymbol{\delta}; \sigma_u^2)$ distribution;

\mathbf{z}_{it} – vector of observable variables, bank specific determinants of profit (in)efficiency;

\mathbf{R}_{it} – random variable, truncation of normal distribution at point $(-\mathbf{z}_{it}\boldsymbol{\delta})$,

4.5. Data and Model Specification

The research sample is based on the annual data, available in consolidated financial statements extracted from Bankscope Database for commercial banks located in the UK, the U.S. and Japan. The selected to the analysis country-specific Consumer Confidence Index was sourced from DataStream. The full sample (2000-2012) consists of 326 banks, which yields to the empirical analysis altogether 2454 observations. Table 12 presents descriptive statistics of variables used in the study to construct profit frontier and efficiency regression over 2000-2012.

Reflecting on the identification of accurate measurement of bank output, the common practise was a consideration for the different perspective in approach to bank output measure, for example (Benston, Berger, Hanweck, & Humphrey, 1983). The earliest studies (Alhedeff, *op. cit.*) measured bank output as the dollar amount of loans and interest made. Benston, (1965) applied for the same purpose a number of bank's clients' accounts (production approach). However, the technique was based on too unrealistic assumption of equal costs across different types of accounts. In that respect, it did not provide the reliable proxy for bank output.

The problems with an accurate distinction between input and output still has been the source of controversy.

The introduction of alternative definition of bank output measurement, known as intermediation approach (Sealey, Lindley, 1977) opened the way to reduce existing conceptual discrepancies. As per the approach, the bank has been defined as a financial intermediary, where clients' liabilities are transformed into the earning assets. From that point of view, deposits and other liabilities have been classified as inputs, whereas loans and other earning assets as outputs. Moreover, within that strand, interest expenses and other operating costs are together included into the empirical analysis.

The empirical bank efficiency studies, conducted up to the present time, indicate the major support for the intermediation approach (Gargaris, Pasiouras, 2013, Maudos et al., 2002, Berger et al., 1997).

Accordingly, to construct profit frontier, we assume that the bank intermediation process is based on the four outputs and two inputs. In particular, bank outputs are defined as: loans to non-bank borrowers (Y_1), inter-bank loans (Y_2), investment in trading securities (Y_3), and off-balance assets expressed by non-interest income (Y_4). The bank inputs used to produce bank outputs are bank funding (deposits) and fixed assets. The prices of those inputs are accordingly: price of bank funding, the ratio of operating expenses to fixed total assets (W_1) and price of bank fixed assets, the ratio of total interest expenses to total funding (W_2).

Next, to consider existing differences in bank risk preferences, the formulation of profit frontier besides input prices and outputs, includes also the bank equity (Mester, 1996) as a frontier netput (input or output)⁶⁶. Further, all specified bank outputs and regressand of efficiency frontier are scaled by value of bank equity. The normalization by bank equity allows controlling the model for differences in bank size which, by the same token brings correction to a magnitude of model residuals (including the variance of efficiency term).

Profit frontier expressed by means of Cobb-Douglas functional form, such as:

$$\ln(\text{PBT}_{it}) = \alpha_0 + \sum_{n=1}^4 \alpha_n \ln(Y_{nit}) + \sum_{m=1}^3 \alpha_m \ln(W_{mit}) + \ln(E_{it}) + \sum_{l=1}^2 D_{countries} + \sum_{k=1}^{12} D_{years} + v_{it} - u_{it} \quad (5)$$

and

⁶⁶ Bank equity has been included to profit frontier as a fixed input. That approach is supported by the fact that due to presence of financial regulations (minimum equity requirements) banks can't set the equity at the individually, optimal level. In that view, equity is treated as a fixed (short-run perspective).

(in)efficiency regression model:

$$u_{it} = \varphi_0 + \varphi_1 E_{it} + \varphi_2 HHI_{it} + \varphi_7 CCIND_{it} + \varphi_5 LIQ_{it} + \varphi_6 D_{countries} + \varphi_7 D_{years} + R_{it}$$

(6)

where:

Ln(PBT_{i,j,t}) – natural logarithm of bank profit before tax;

HHI_{i,j,t} – bank industry concentration; (definition, please see section 4.3)

E_{i,j,t} – bank equity to assets ratio; (definition, please see section 4.3)

LIQ_{i,j,t} – liquidity risk ratio; (definition, please see section 4.3)

CCIND_{i,j,t} - Consumer Confidence Index; (definition, please see section 4.3)

D_{countries}- vector of dummy countries variables: UK, US, JAP,

D_{years} - vector of dummy t= 2000,...,2012;

i- individual bank,

j- country,

t-tme,

Considering the fact, that in the analysed samples presence of banks that performance are characterized by the negative profits to equity outcomes, limit the application of Cobb-Douglas frontier specification (domain of logarithm is defined on non-negative numbers), we use the solution presented by Bos et al., (2009) known as a negative indicator approach. Namely, the regressand Profit before Tax to Equity (PBT/EQ) is transformed into indicator, variable whose value is defined separately for the left and right side of the frontier's equation. For the left hand side the transformed variable takes a value 1 when data on PTB/EQ are non-positive, but when PTE/EQ is non-negative, the transformed variable is equal to the value of collected data. For the right hand side,

the transformed variable takes an absolute value on the non-positive data and value 1 when data are non-negative. Transformation of the regressand as above explained, allows applying natural logarithm without the loss of non-positive data points.

Table 12. Descriptive statistics of full sample (2000-2012).

Variable	Mean	Std. Dev.
Profit Frontier Level		
ln(Y ₁)	1.794515	1.048941
ln(Y ₂)	-0.5647248	1.896113
ln(Y ₃)	0.6922501	1.494927
ln(Y ₄)	-0.6058304	1.625129
ln(W ₁)	0.2529804	1.452669
ln(W ₂)	-4.886696	1.306014
(In)efficiency Model Level		
equ_ass	0.1056795	0.1085901
hhi_	1442.214	1300.805
ccind_	70.91404	27.36693
liqass_	0.1740645	0.2084616

The method implements adjustments on the left side and the right side of frontier's equation. For the illustration of the explained method, please see below the table 13 with the practical example. In columns 3 and 4 we took a natural logarithm from the value of transformed regressand.

Table 13. Example of data transformation for dependent variable of profit frontier, defined on banks' profit before tax to equity (PBT/EQ) using indicator method.

PBT/EQ	(PBT/EQ) for Left Hand Side (1)	(PBT/EQ) for Right Hand Side (2)		Ln(PBT/EQ) for Left Hand Side (3)	Ln(PBT/EQ) for Right Hand Side (4)
0.023013	0.023013	1		-3.77172	0
-0.266412	1	0.266412		0	-1.3222711

4.6. Results

The stochastic profit frontier has been estimated under the assumption that all analysed commercial banks share the same, common technology and potential determinants of profit (in)efficiency are defined on selected bank-specific and market specific variables. Parameters of applied BC frontier model, using Maximum Likelihood estimator performed for pre-crisis, crisis, post-crisis period and full sample are reported in table 14.

Considering the context of the current research, the role of gamma parameter (γ), reported in table 3 deserves a special attention. Namely, its value that lies in between 0

and one, indicates the share of inefficiency component variance in total error variance. The value of gamma closer to one informs that the deviation from the frontier is to a larger extent due to inefficiency than to random error.

4.6.1. Evolution of Profit Efficiency over Time

In general, the evolution of commercial bank average profit efficiency over time appeared to be in line with expectations. Graphic illustrations of profit efficiency outcomes over time separately for commercial banks in the UK, the U.S. and Japan are presented in Appendix 10.

Table 14. ML Estimation of Profit Frontier and drivers of profit in (efficiency) across all formulated models.

Variables	Parameters	Pre-crisis	Crisis	Post-crisis	Full Sample
		2000-2006	2007-2009	2008-2012	2000-2012
Ln(PBT)- lhs					
Ln(PBT)- rhs		-0.959*** (-27.80)	-0.833*** (-20.42)	-0.910*** (-25.80)	-0.918*** (-38.83)
Ln(Y ₁)	β ₂	0.365*** (9.00)	0.680*** (6.84)	0.464*** (5.60)	0.372*** (11.40)
Ln(Y ₂)	β ₃	0.0141 (1.19)	-0.00232 (-0.09)	-0.00173 (-0.11)	0.00954 (1.00)
Ln(Y ₃)	β ₄	0.0480* (2.29)	0.103* (2.23)	0.0729* (2.30)	0.0441** (2.69)
Ln(Y ₄)	β ₅	0.0786*** (3.60)	0.0472 (1.03)	0.0270 (0.85)	0.0694*** (4.19)
Ln(W ₁)	β ₆	0.108*** (5.31)	0.170*** (4.38)	0.0924** (3.08)	0.0937*** (6.05)

Ln(W ₂)	β_7	-0.0277 (-0.76)	-0.0495 (-0.55)	-0.0352 (-0.74)	-0.0257 (-0.95)
lnequity	β_8	0.0439** (2.96)	0.0203 (0.66)	0.0350 (1.49)	0.0349** (2.96)
_cons	β_9	-3.097*** (-7.78)	-4.560*** (-4.67)	-3.479*** (-5.29)	-3.299*** (-10.92)
mu					
equ_ass	δ_1	-1.426 (1.31)	3.634 (-1.90)	-0.101 (0.04)	-1.608 (0.86)
hhi_	δ_2	-0.000779*** (3.80)	-0.000661 (-1.10)	0.000854 (-1.34)	-0.000304 (1.49)
ccind_	δ_3	0.0210* (-2.23)	-0.00560 (0.46)	0.0415 (-1.47)	0.0614** (-3.20)
liqass_	δ_4	1.703* (-2.52)	2.482*** (-3.44)	3.548** (-2.71)	4.040** (-3.25)
_cons	δ_0	-1.836*** (4.19)	1.325 (-1.54)	-1.028 (0.75)	-1.958** (2.72)
ilgtgamma					
_cons		1.783*** (8.80)	1.924*** (7.23)	2.320*** (8.29)	2.364*** (9.17)
lnsigma2					
_cons		0.347* (2.06)	0.709*** (4.14)	0.986** (3.22)	1.098*** (4.24)
Sigma²		1.414	2.031	2.681	2.998
Gamma		0.856	0.873	0.910	0.914
N		1369	595	870	2454

in parenthesis t-statistics: *,**,***; regression's coefficient significance accordingly at 5%, 1% and 0.1%,

Note: all estimated models incorporate selected sub-sample specific time dummies= 1..T(12) and country dummies=1...N(3),

parameters of optimization: Ilgtgamma- estimate of inverse logit of gamma parameter, lnsigma2- logit of sigma square,

The obtained evidence shows a positive trend in profit efficiency outcomes over the pre-crisis period (2000-2006) and evidence of a sudden deterioration that took its biggest scale over the recent financial crisis period (see Appendix 10). In that regards, the global scope and intensity of the recent financial crisis, can be seen as an important

contributor to decline of commercial banks' ability to generate profit more efficiently. Over 2007-2009 the analysed commercial banks nearly simultaneously experienced a reduction in average profit efficiency performance that hits its bottom level in 2008. On average, the least resilient to maintain profit efficiency in 2008 at the level as in the pre-crisis period were commercial banks located in the UK. They recorded over that year the lowest profit efficiency score (0.23) (see Appendix 10 Chart 4). The above correspondingly means that, at the given level of internal resources (on the supply (input prices) as well as on the demand side (output quantities)) the UK banks to generate profit, were able to utilise efficiently only 23% of it (relatively to the most efficient average market counterparts that operated fully efficiently at the profit frontier level). In comparison, commercial banks in the U.S. in 2008 were characterised by the profit efficiency score of approximately 0.33, while outcome for commercial banks in Japan amounts to circa 0.44. The obtained results give strong evidence that, those commercial banks in Japan alike its counterparts in the UK and the U.S. especially over the crisis period faced also a deterioration of their ability to generate profits efficiently. However, what is important to emphasise, is that profit efficiency performance in the Japanese commercial banking sector was among the least severely affected.

The best profit efficiency position of commercial banks in Japan can be justified by the number of potential explanations. Namely, as per the Financial Service Agency (2009) financial institutions in Japan recorded relatively small losses from involvement in sub-prime assets. In that respect, the scale of liquidity provision performed by Bank of Japan was much smaller and constituted less than 3% of GDP comparing to 8% in the US and 14% in the UK (Horton, 2009). In contrast to the UK, the U.S. where recent financial crisis developed through banking sector channel, in Japan, economic downturn of 2007-2009 escalated mainly through contraction in demand for Japanese products.⁶⁷

⁶⁷ In 2009 Japan's real GDP decreased by 5.2% the highest drop among the developed economies.

Correspondingly, the decline in profit efficiency performance and its magnitude in Japanese case can be seen as an indirect effect of transmission in economic problems from countries where the crisis originated.

The evidence that deserves special emphasis is that the all the analysed commercial banks considerably quickly improved their profit efficiency performance over the period, following directly the global financial crisis. Between 2008 and 2012 profit efficiency performance across analysed banking sectors in the UK, Japan and the U.S. was gradually improving. The highest profit efficiency performance over the post-crisis (2008-2012) belonged to commercial banks from Japan (Appendix 10 Chart 3). Similarly as before crisis, banks from Japan in every year of post-crisis outperformed banks located in the UK and the U.S.. In terms of average, the total growth of profit efficiency, during post-crisis period taking 2008 as comparison base for commercial banks located in the U.S. increased by – 91.05%, by 67.2 % for commercial banks in the UK and by 51.5 % in Japan.

4.6.2. Determinants of Profit Efficiency

Moving the current empirical investigation to the analysis of potential drivers of profit efficiency performance, the obtained evidence for commercial banks in the UK, the U.S. and Japan shows conclusively that over the all analysed sub-periods the bank assets liquidity constituted a main factor underlying banks' ability to generate profits efficiently (see table 14).

The findings confirm that bank liquidity level adequate to the scale of performed

In the first quarter of that year, Japan experienced the decline in export of 25.3%. (OECD stat). That facts carry special weight considering that Japanese economy is highly reliant on exports (Ueda, 2009).

by bank function of financial intermediation need to be considered as the core element supporting managerial actions towards efficient utilization of bank resources. The level of profit efficiency evaluated relatively to most efficient bank counterparts (on the market), affects the likelihood of bank's failure (Wheelock, et al., 2000). In that line, the less profit efficient banks through the liquidity deterioration channel can become more exposed to the risk of insolvency, negatively affecting their chances of survival on the market. Events of the recent financial crisis disclosed that the increasing share of non-performing loan in bank's assets positions has led not only to absorption of the bank capital level, but also increased the illiquid assets level, so that transformation into cash became not possible. The positive association between liquidity and profit efficiency over the post-crisis period may suggest that government liquidity provision contributed to play an important role in facilitating performance recovery of the analysed commercial banking sectors.

Estimated results for bank capital to assets ratio are found to be mainly negative (pre-crisis, post-crisis and full-sample models). However with no significant effect on bank profit efficiency level. Further, an average commercial banking market concentration in the UK, the U.S. and Japan proxied by HHI index has a negative coefficient for the pre-crisis and the full-sample model. However it has only statistically significant effect on profit efficiency level over the pre-crisis period.

The negative association of banking market concentration with average, profit efficiency outcomes suggests support for an argument in favour of the Quiet Life hypothesis. The implication of the above is that on average decrease in commercial banking profit efficiency in analysed countries was potentially driven by bank's passive, discretionary actions known as "quiet life". Bank that are able to rely on higher market power than their rivals operating in less concentrated market in the above light, are assumed to follow suboptimal behaviour, that generates increase in bank inefficiency (instead

of maximizing performance outcomes as close as possible to efficient feasible level). Included for the first time to the bank efficiency analysis is the consumer confidence index, empirically confirmed that over pre-crisis and full sample period on average consumer expectations about country future economic conditions were statistically significant and positively associated with bank profit efficiency. The above results are consistent with the hypothesis formulated in section 3 of that chapter. On the other hand, the findings for consumer confidence index over post-crisis period show also positive, but not statistically significant estimates. Over events of the recent financial crisis consumer expectations were adversely, not statistically associated with bank profit efficiency outcomes.

4.7. Conclusion

This research has given a new empirical account on profit efficiency and its potential determinants for commercial banking located in the UK, the U.S. and Japan. It extends previous studies, building the analysis on a relatively long span of time, namely the period between 2000-2012. The focus of the research on exactly that period of time allows bringing closer and analysing how events that took place on the financial market, including especially the recent financial crisis are potentially associated with commercial banks' performance in terms of profit efficiency outcomes.

Major evidence established by this research is that on average commercial bank's liquidity of assets played an important and significant role over the pre-crisis, crisis, post-crisis and over 2000-2012 period in driving profit efficiency level. Further, the slowdown of performance, experienced by the financial sector and the real economy sector over the recent financial crisis, corresponded with a sudden drop in commercial banks' ability to generate profit, at least as much efficiently as before

crisis. Finally, on average, an increase in commercial banking concentration especially over pre-crisis period encouraged a rise in bank discretion in the form of “quiet life”.

Demonstrated results carry noticeable implications for analysis of bank performance over the time of the recent financial crisis. Namely, accumulation of illiquidity costs, linked to an increasing share of low quality banks’ assets in total value of banks’ assets had contributed implicitly to an erosion of a bank’s ability to generate profit more efficiently. In that respect, albeit bank revenue that thrived during the pre-crisis period, mainly due to lending expansion especially to housing market become, over the crisis tied down by low quality of managerial decisions including loosening of credit risk standards. The past decisions, resulting in not sufficient controlling of credit risks, contributed to the development of serious liquidity constraints, that not only put a strain on profit efficiency performance but has also shaken the stability of the financial system in most developed countries in the World including those analysed such as the UK, the U.S. and Japan.

Further research would be desirable to extend and acquire more knowledge on bank efficiency behaviour, focusing on the global impact of the recent financial crisis in commercial banking sectors, taking into consideration evidence from the all regions of the World.

IMPLICATIONS OF RESEARCH

The obtained evidence holds a number of implications for policy directions, related to commercial bank performance and its regulations in the post-crisis era.

A consideration for alternative frameworks to assess and monitor risk taking behaviour in banking sector especially nowadays, deserves special attention of policy makers. In that view, Prospect Theory (PT) is a concept that puts in the centre the presence of imperfections in human behaviour and its impact on risk practices. The application of PT can help to better understand a decision-making process, involving risk in banking which looking not far from now had failed leading to the recent financial crisis. To prevent potential reoccurrence of the banking crisis, the interest of policy makers should go beyond the standard models of risk management commonly used in banking based on statistical models alone. In that regards, it is vital to promote among policy makers a concept that offer a fuller explanation on the mechanism of risk taking, among them for example the one based on PT. Only than the future of a financial sector has a potential to stay stable and sustainable.

The presence of subjectivity bias has been confirmed in the current research of being associated with risk taking behaviour over the pre-crisis period. The latter suggests that the biases, such as a misjudgement like an underestimation of losses and overestimation of profits, potentially drove the risk-loving attitude within commercial banking sector in the analysed countries.

For the examined commercial banking sectors, the level of bank assets liquidity on average constitutes an important source of profit efficiency improvement. By underestimating the role of policies, to effectively monitor liquidity needs at the bank level as much as at the market level, a regain of trust and recovery of bank efficiency can appear not sufficient in the long run. Further, the positive

implications for commercial bank performance based on profit efficiency optimization has a state of the country's real economy and the future expectation on one. In that respect, consumer confidence index, used in the analysis as proxy for the aforementioned macroeconomic perspective, confirms, on average, the presence of the positive association with the efficiency level. On that basis, the latter results suggest, that the aggregates that affect consumer market confidence for example employment, inflation, consumption, savings have an enhancing positive effect on bank, profit efficiency outcomes.

The banking recovery after the financial crisis is not completed. It is a long-lasting, gradual process but the novel approach to risk management and efficiency goals can build a better, sound global commercial banking sector.

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Appendix 1. Definitions and sources of Used Variables

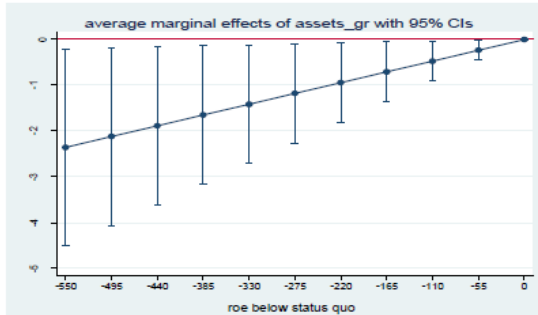
Variable Name	Definition	Source
Bank's Risk	Absolute difference between bank ROE in t and median of ROE in t.	Bankscope
Return on equity (ROE)	Ratio of pre-tax profit to bank equity (t-1). (in %)	Bankscope
Lagged return on equity below	Bank return on equity in t-1 below its median (status quo).	Bankscope
Lagged return on equity above	Bank return on equity in t-1 above its median (status quo).	Bankscope
Bank assets' growth	Annual growth rate of bank assets. (in %)	Bankscope
Equity to assets	Ratio of bank equity to total assets. (in %)	Bankscope
Loan loss	Ratio of bank loan reserves to total loans. (in %)	Bankscope
Fee income	Share of noninterest income in total revenue. (in %)	Bankscope

Appendix 2. Average Marginal Effects of Control Variables on Shortfall Risk Below and Above StatusQuo Across All Estimated Models (Significant & Insignificant)

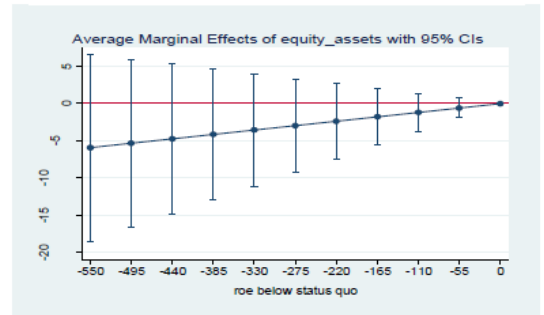
Model 2000-2006

Below Status Quo

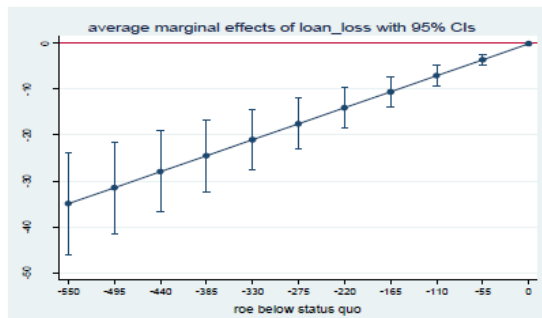
Assets growth effect



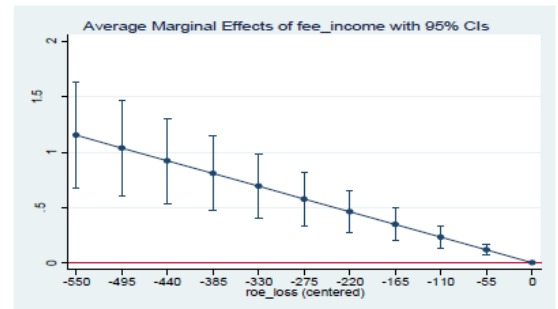
Equity to assets effect (insgn.)



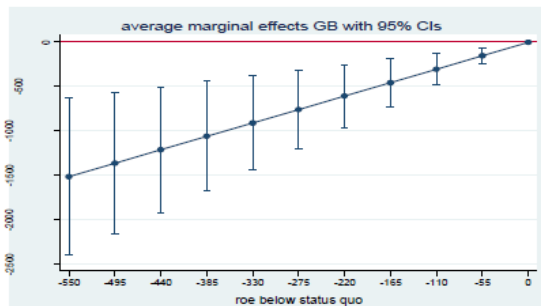
Loan Loss effect



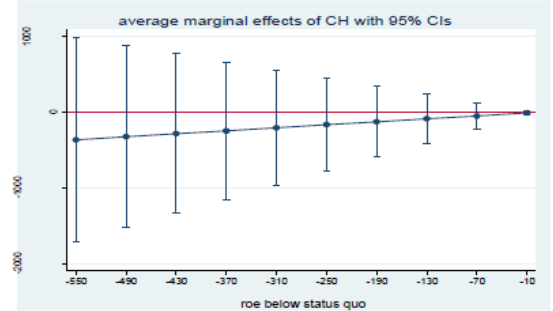
Fee Income effect



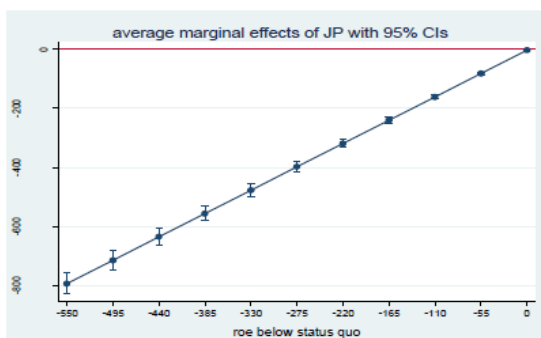
Country effect: UK



Country effect: Switzerland (insgn.)



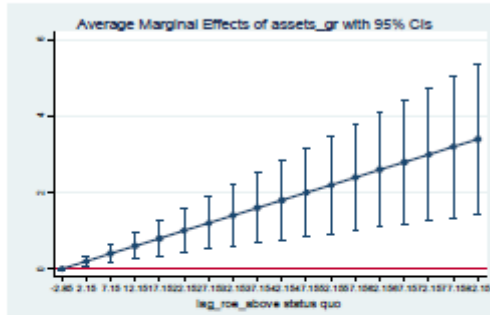
Country effect: Japan



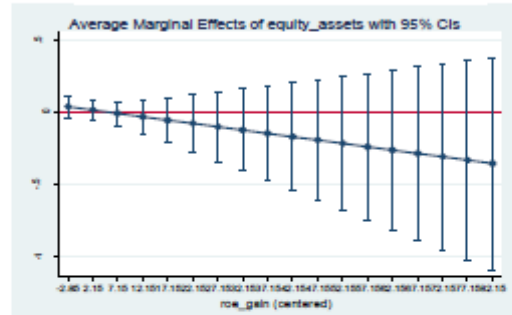
Model 2000-2006

Above Status Quo

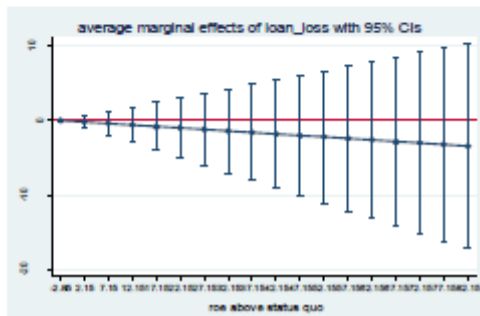
Assets growth effect



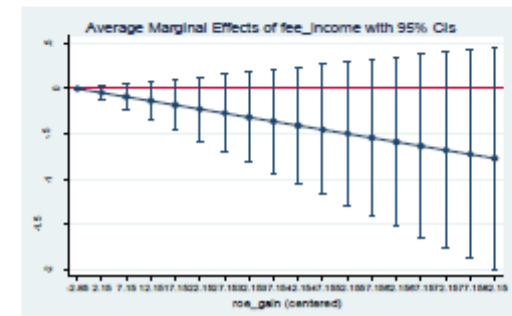
Equity to assets effect (insgn)



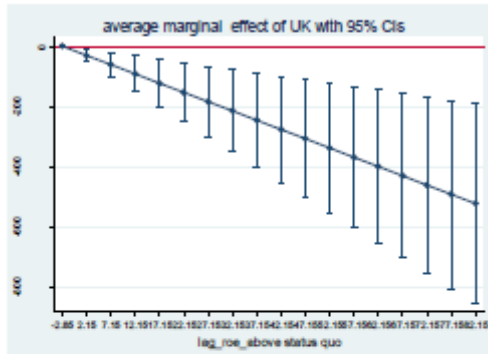
Loan Loss effect (insgn)



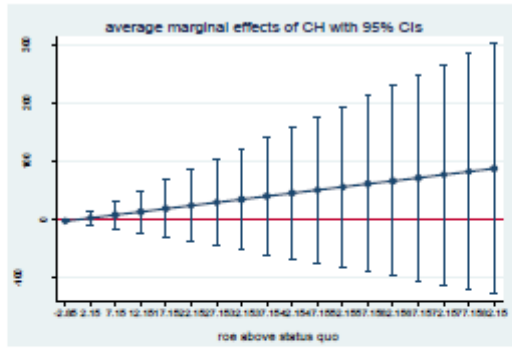
Fee income effect (insgn)



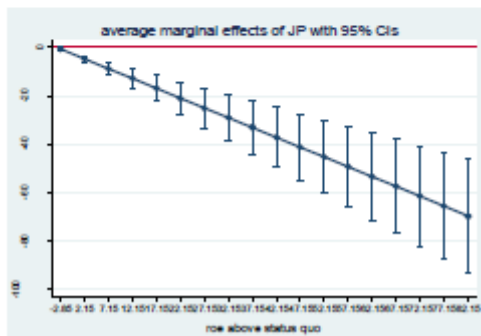
Country effect: UK(insgn)



Country effect: Switzerland (insgn)



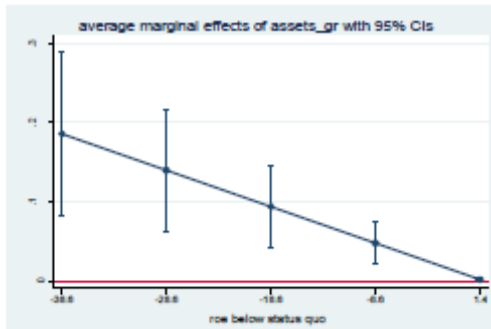
Country effect: Japan



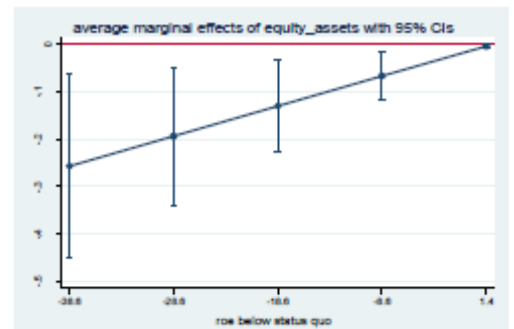
Model 2007-2009

Below Status Quo

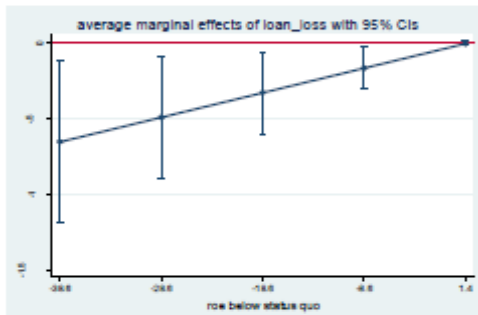
Assets growth effect



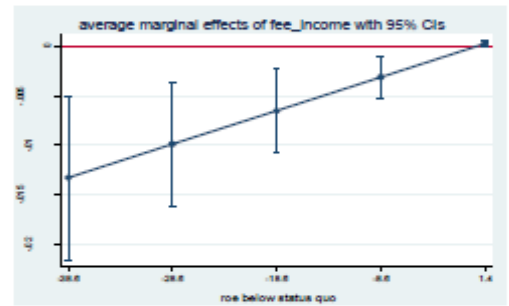
Equity to assets effect



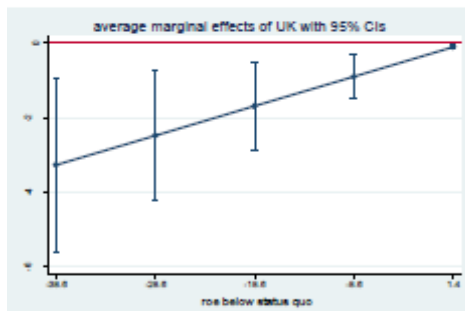
Loan loss effect (insgn.)



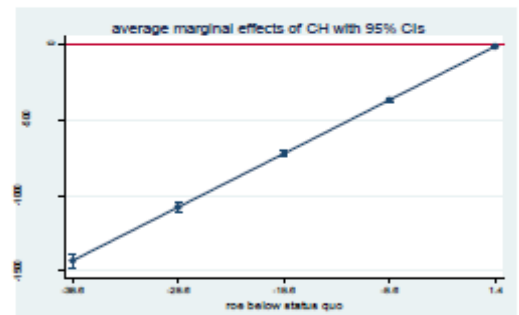
Fee income effect (insgn.)



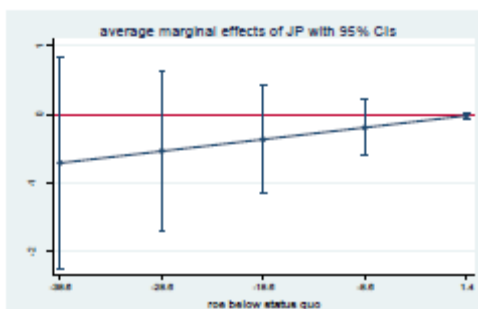
Country effect: UK



Country effect: Switzerland

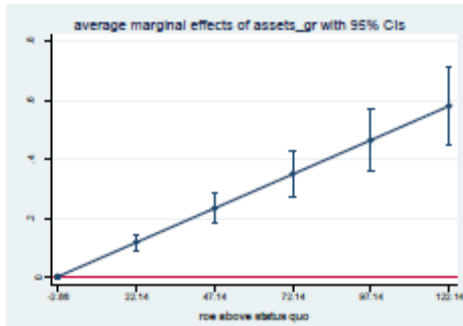


Country effect: Japan (insgn)



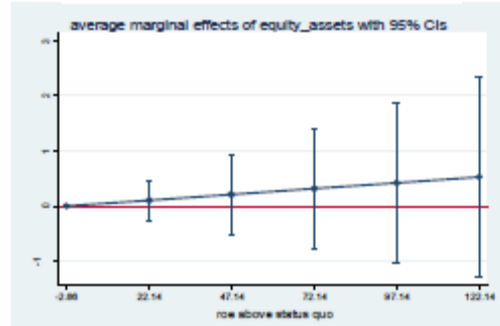
Model 2007-2009

Assets growth effect

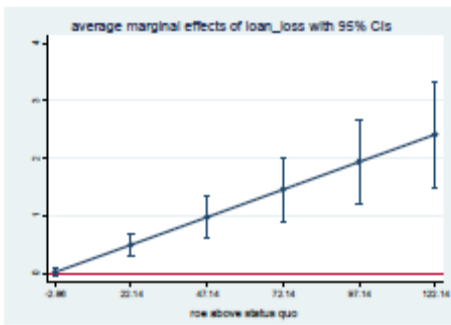


Above Status Quo

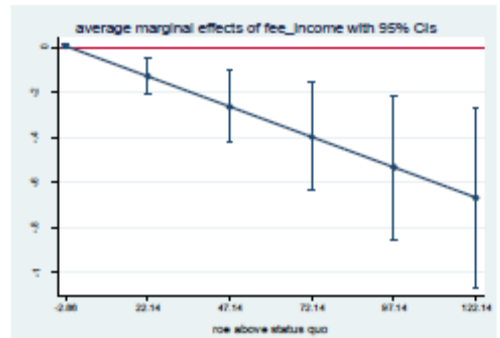
Equity to assets effect (insgn.)



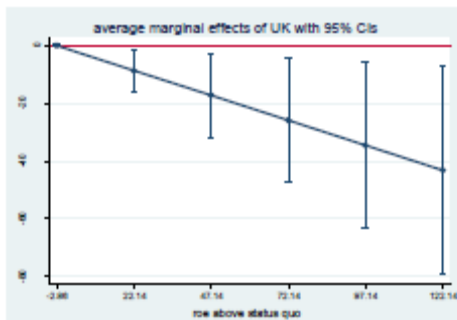
Loan loss effect



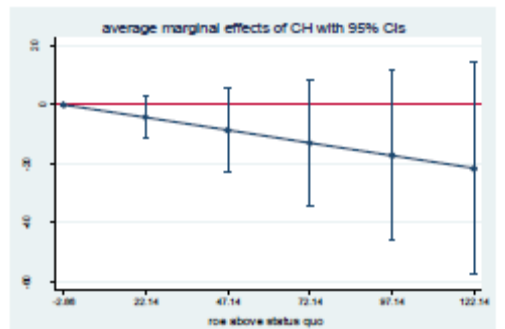
Fee income effect



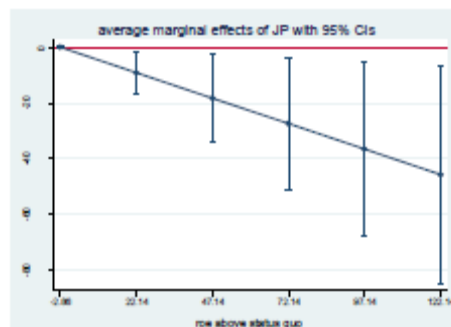
Country effect: UK



Country effect: Switzerland (insgn.)



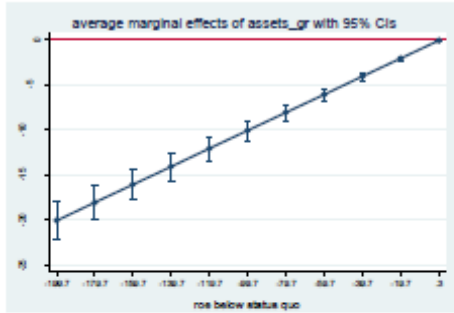
Country effect: Japan



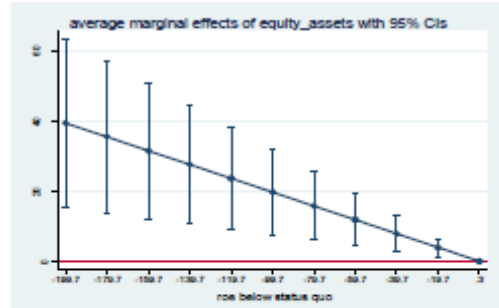
Model 2010-2013

Below Status Quo

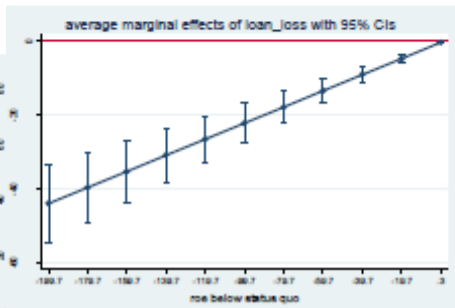
Assets growth effect



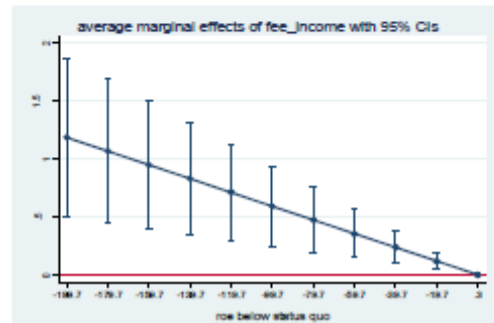
Equity to assets effect



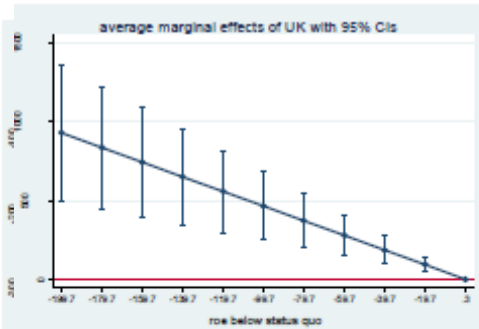
Loan Loss effect



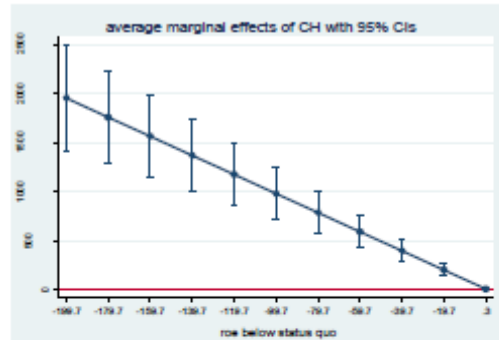
Fee Income effect (ingn.)



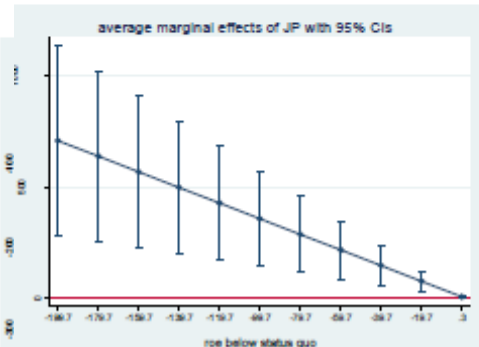
Country effect: UK



Country effect: Switzerland



Country effect: Japan



[34]

**Appendix 3. Results of the Diagnostic Statistical Test
Test for Presence of Random Effect - Breusch
Pagan Lagrange Multiplier Test.**

Hypothesis		LM Test	p-value	Decision
Model 2000-2006				
Below	$H_0 : \text{Var} (u) = 0$ $H_1 : \text{Var} (u) \neq 0$	0.41	0.2618	Failed to reject H_0 (RE not stat. significant)
Above	$H_0 : \text{Var} (u) = 0$ $H_1 : \text{Var} (u) \neq 0$	0.43	0.2572	Failed to reject H_0 (RE not stat. significant)
Model 2007-2009				
Below	$H_0 : \text{Var} (u) = 0$ $H_1 : \text{Var} (u) \neq 0$	0.00	1	Failed to reject H_0 (RE not stat. significant)
Above	$H_0 : \text{Var} (u) = 0$ $H_1 : \text{Var} (u) \neq 0$	7.97	0.0024	Reject H_0 (RE stat. significant)
Model 2010-2013				
Below	$H_0 : \text{Var} (u) = 0$ $H_1 : \text{Var} (u) \neq 0$	0.74	0.1944	Failed to reject H_0 (RE not stat. significant)

Above	$H_0 : \text{Var}(\mathbf{u}) = 0$ $H_1 : \text{Var}(\mathbf{u}) \neq 0$	0.38	0.2692	Failed to reject H_0 (RE not stat. significant)
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Appendix 4. Wald Test – Check for Significance of Loss Aversion.

$$H_0: | \text{marginal effect on lag_roe_below} | = | \text{marginal effect on lag_roe_above} |$$

$$H_1: | \text{marginal effect on lag_roe_below} | \neq | \text{marginal effect on lag_roe_above} |$$

Hypothesis	Wald Test	p-value	Decision
Model 2000-2006	10.27	0.0014	Reject H ₀
Model 2007-2009	3290.03	0.0000	Reject H ₀
Model 2010-2013	62.92	0.0000	Reject H ₀

Appendix 5. Results of One-tailed Statistical Testing-

Below Status Quo & Above Status Quo

Hypothesis on lag_roe_coefficient	p-value	Outcome
Model 2000-2006		
BELOW STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) \geq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) < 0$	p= 0	Marginal effect on return on equity $t-1$ is statistically smaller than zero
ABOVE STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) > 0$	p=4.460 e-43	Marginal effect on return on equity $t-1$ is statistically greater than zero
Model 2007-2009		
BELOW STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) \geq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) < 0$	p=0.34	Marginal effect on return on equity $t-1$ is statistically neither smaller than zero nor greater than zero
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) \leq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) > 0$	p=0.65	
ABOVE STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) > 0$	p=0.007	Marginal effect on return on equity $t-1$ is statistically greater than zero

Hypothesis on lag_roe_coefficient	p-value	Outcome
Model 2010-2013		
BELOW STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) \leq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{below}) > 0$	p=4.752e-07	Marginal effect on return on equity $t-1$ is statistically greater than zero
ABOVE STATUS QUO		
$H_0: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{return on equity}_{t-1} \text{lag_roe}_{above}) > 0$	p=9.54e-142	Marginal effect on return on equity $t-1$ is statistically greater than zero

**Appendix 6. Results of One-tailed Statistical Testing-
Hypotheses on Coefficients for Variables
of Interests**

Model 2000-2006		
Hypothesis on coefficients	p-value	Outcome
BELOW STATUS QUO		
$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p>p=0.069</p> <p>p=0.993</p>	Marginal Effect on equity to assets _{t-1} is statistically neither smaller than zero nor greater than zero
$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p>p=0.029</p> <p>p≈1</p>	Marginal Effect on assets growth _{t-1} is statistically smaller than zero
$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p>p=2.220e-16</p> <p>p≈1</p>	Marginal Effect on loan loss _{t-1} is statistically smaller than zero
$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) > 0$ $H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) < 0$	<p>p≈1</p> <p>p=8.306e-10</p>	Marginal Effect on fee income _{t-1} is statistically smaller than zero

Model 2000-2006		
Hypothesis on coefficients	p-value	Outcome
ABOVE STATUS QUO		
$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{above}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{above}) < 0$ $H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{above}) > 0$	<p>$p=0.72$</p> <p>$p=0.27$</p>	Marginal Effect on equity to assets _{t-1} is statistically neither smaller than zero nor greater than zero
$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{above}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{above}) < 0$ $H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{above}) > 0$	<p>$p \approx 1$</p> <p>$p=6.970e-65$</p>	Marginal Effect on assets growth _{t-1} is statistically greater than zero
$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{below}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{below}) < 0$ $H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{above}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{above}) > 0$	<p>$p=0.058$</p> <p>$p=0.94$</p>	Marginal Effect on loan loss _{t-1} is statistically neither smaller than zero nor greater than zero
$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{below}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{below}) > 0$ $H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{above}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{above}) < 0$	<p>$p=0.99$</p> <p>$p=0.000069$</p>	Marginal Effect on fee income _{t-1} is statistically smaller than zero

Model 2007-2009		
Hypothesis on coefficients	p-value	Outcome
BELOW STATUS QUO		
<p>$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) < 0$</p> <p>$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) > 0$</p>	<p>p=0.039</p> <p>p=0.96</p>	<p>Marginal Effect on equity to assets_{t-1} is statistically smaller than zero</p>
<p>$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) < 0$</p> <p>$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) > 0$</p>	<p>p≈1</p> <p>p=0.005</p>	<p>Marginal Effect on assets growth_{t-1} is statistically greater than zero</p>
<p>$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) < 0$</p> <p>$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) > 0$</p>	<p>P=0.231</p> <p>p=0.76</p>	<p>Marginal Effect on loan loss_{t-1} is statistically neither smaller than zero nor greater than zero</p>
<p>$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) > 0$</p> <p>$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) < 0$</p>	<p>P=0.71</p> <p>p=0.288</p>	<p>Marginal Effect on fee income_{t-1} is statistically neither smaller than zero nor greater than zero</p>

Model 2007-2009		
Hypothesis on coefficients	p-value	Outcome
ABOVE STATUS QUO		
$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p=0.75</p> <p>p=0.244</p>	Marginal Effect on equity to assets _{t-1} is statistically neither smaller than zero nor greater than zero
$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p=0.75</p> <p>p=1.107e-14</p>	Marginal Effect on assets growth _{t-1} is statistically greater than zero
$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p=0.998</p> <p>p=0.0015</p>	Marginal Effect on loan loss _{t-1} is statistically greater than zero
$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) > 0$ $H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) < 0$	<p>p=0.999</p> <p>p=0.000023</p>	Marginal Effect on fee income _{t-1} is statistically smaller than zero

Model 2010-2013		
Hypothesis on coefficients	p-value	Outcome
BELOW STATUS QUO		
$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p style="text-align: center;">$p \approx 1$</p> <p style="text-align: center;">$p = 5.405e-16$</p>	<p style="text-align: center;">Marginal Effect on equity to assets_{t-1} is statistically greater than zero</p>
$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p style="text-align: center;">$p = 0$</p> <p style="text-align: center;">$p = 1$</p>	<p style="text-align: center;">Marginal Effect on assets growth_{t-1} is statistically smaller than zero</p>
$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) < 0$ $H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{below}}) > 0$	<p style="text-align: center;">$P = 2.321e-06$</p> <p style="text-align: center;">$p = 0.999$</p>	<p style="text-align: center;">Marginal Effect on loan loss_{t-1} is statistically smaller than zero</p>
$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) > 0$ $H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{below}}) < 0$	<p style="text-align: center;">$p = 0.598$</p> <p style="text-align: center;">$p = 0.401$</p>	<p style="text-align: center;">Marginal Effect on fee income_{t-1} is statistically neither smaller than zero nor greater than zero</p>

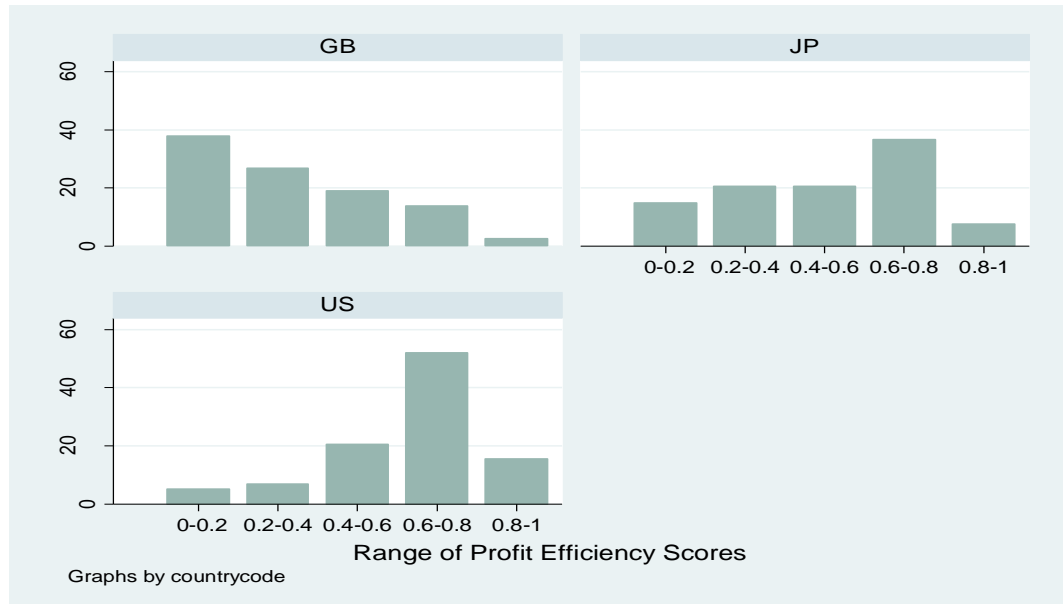
Model 2010-2013		
Hypothesis on coefficients	p-value	Outcome
ABOVE STATUS QUO		
$H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{equity assets}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p=0.00021</p> <p>p=0.999</p>	Marginal Effect on equity to assetst-1 is statistically smaller than zero
$H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{assets gr}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p=0.99</p> <p>p=0.0039</p>	Marginal Effect on assets growtht-1 is statistically greater than zero
$H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) < 0$ $H_0: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{loan loss}_{t-1} \text{lag_roe}_{\text{above}}) > 0$	<p>p≈1</p> <p>p=1.550e-15</p>	Marginal Effect on loan losst-1 is statistically greater than zero
$H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) \leq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) > 0$ $H_0: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) \geq 0$ $H_1: ME(\text{fee income}_{t-1} \text{lag_roe}_{\text{above}}) < 0$	<p>p=1.032e-08</p> <p>p=1</p>	Marginal Effect on fee incomet-1 is statistically greater than zero

Appendix 7. Definition of Variables Used

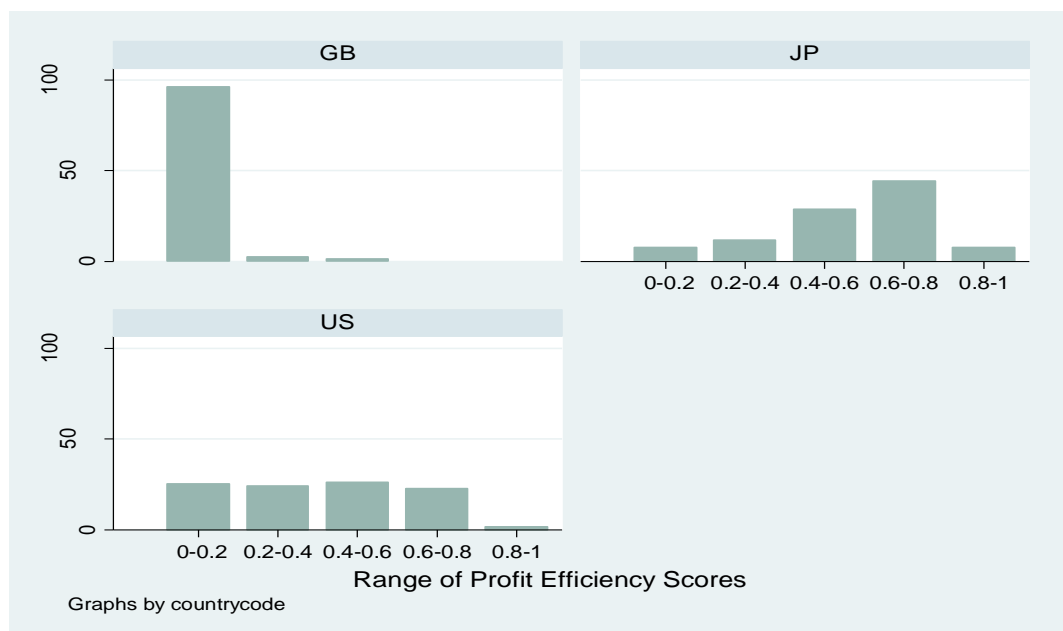
Variable Name	Definition	Source
Profit Frontier		
Ln (PBT)	Bank profit before tax scaled by bank equity. (in ln)	Bankscope
Ln(Y ₁)	Bank loans for non-bank borrowers scaled by bank equity. (in ln)	Bankscope
Ln(Y ₂)	Bank interbank loans scaled by bank equity. (in ln)	Bankscope
Ln(Y ₃)	Bank securities scaled by bank equity. (in ln)	Bankscope
Ln(Y ₄)	Non-interest income scaled by bank equity. Proxy for off-balance sheet bank output activity (in ln)	Bankscope
Ln(W ₁)	Total interest expenses to total funding. Proxy for bank price of funding. (in ln)	Bankscope
Ln(W ₂)	Bank operating expenses to fixed total assets. Proxy for bank price of fixed assets. (in ln)	Bankscope
Ln(E)	Bank equity the proxy for differences in risk aversion among analysed commercial banks	Bankscope
Efficiency Effect Model		
Equity to assets	Ratio of bank equity to total assets.	Bankscope
HHI	Bank industry concentration index. Sum of market shares over all banks in the market. Market share approximated by the share in the total value of market in terms of bank assets. Common indicator of market structure.	Own calculations on the base of Bankscope
CCIND	Consumer Confidence Index	Datastream
liqass_	Bank liquid assets to total assets.	Bankscope

Appendix 8. Frequency Percentage of Profit Efficiency Scores over Time by Analysed Countries

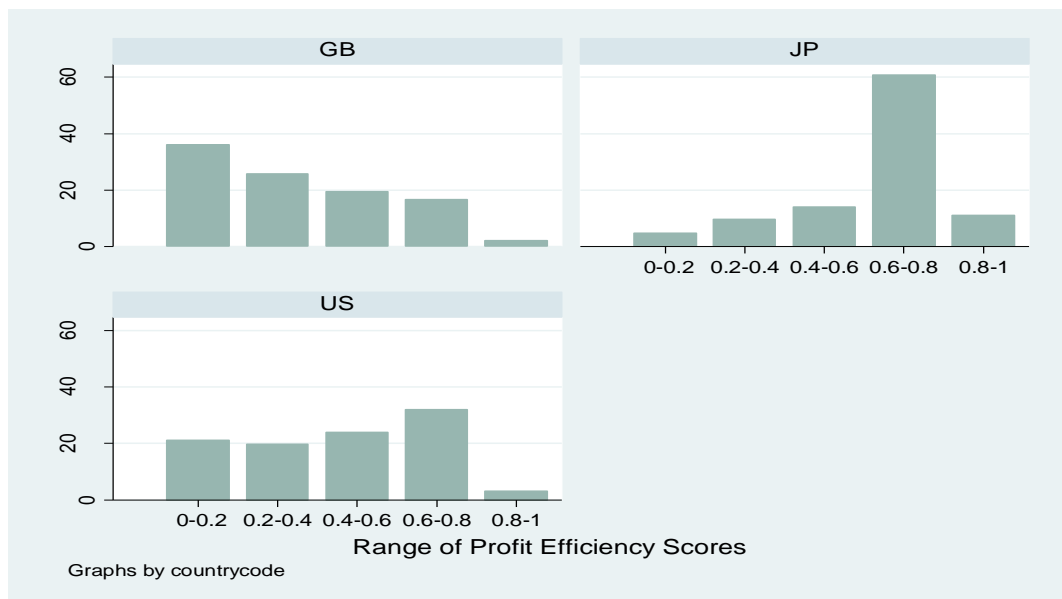
Pre-Crisis Model -2000-2006



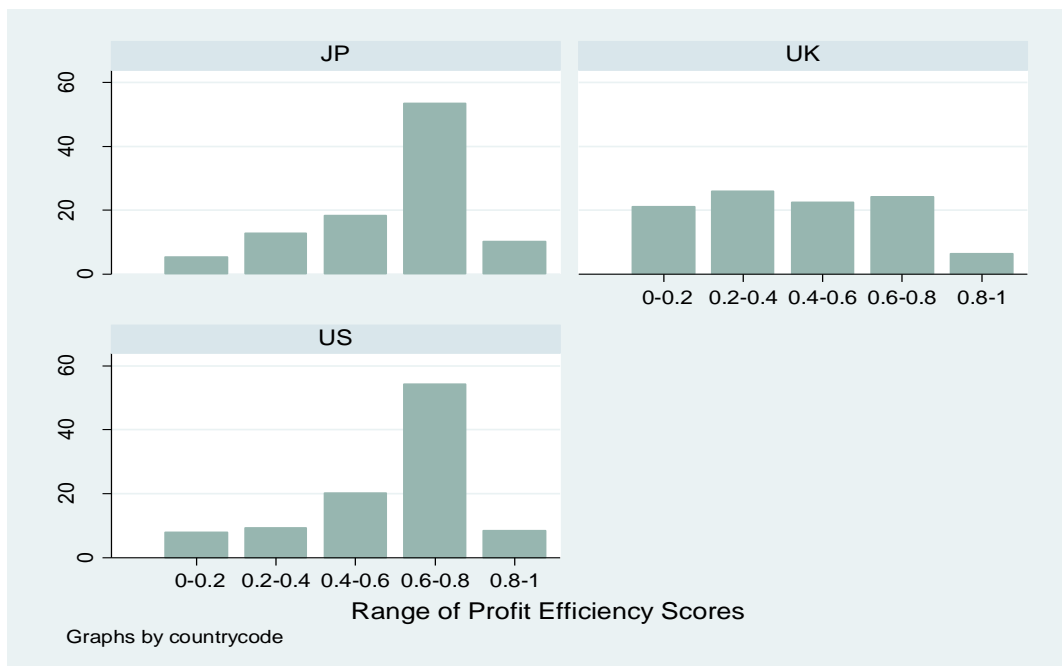
Crisis Model -2007-2009



Post-crisis Model-2008-2012



Full Sample Model-2000-2012



Appendix 9. Average Profit Efficiency Scores for UK, Japan and US across All Analysed Models

	Pre-crisis Model 2000-2006	Crisis Model 2007-2009	Post-crisis Model 2008-2012	Full-sample Model 2000-2012
UK	0.330	0.355	0.341	0.435
JP	0.508	0.570	0.637	0.606
US	0.633	0.405	0.448	0.595

Appendix 10. Evolution of Profit Efficiency Scores for Analysed Commercial Banks over Time by Analysed Countries

Chart 1 Pre-Crisis Model -2000-2006

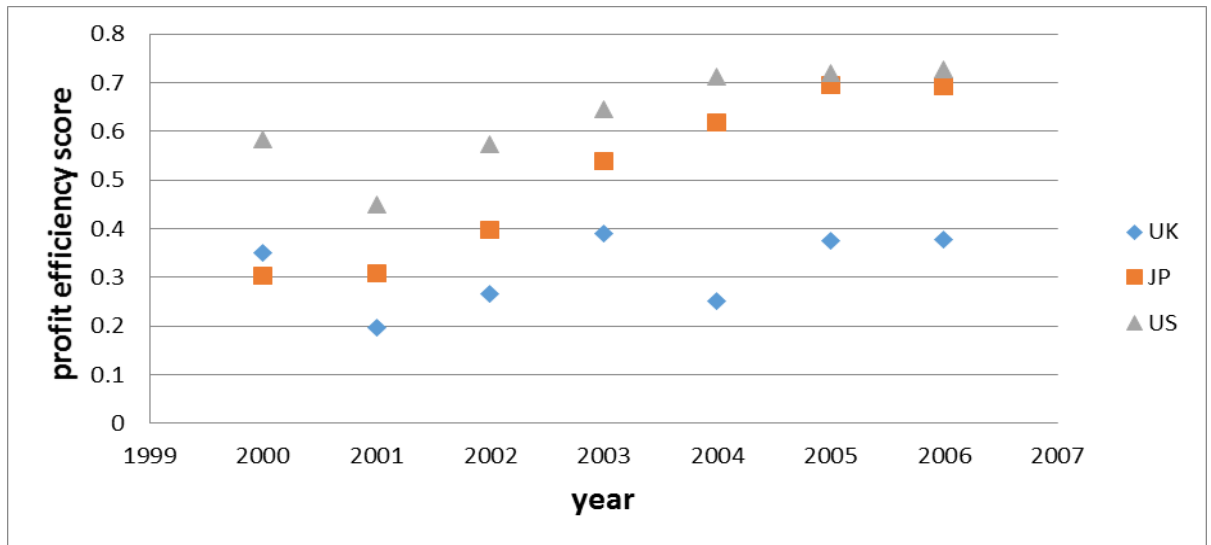


Chart 2 Crisis Model -2007-2009

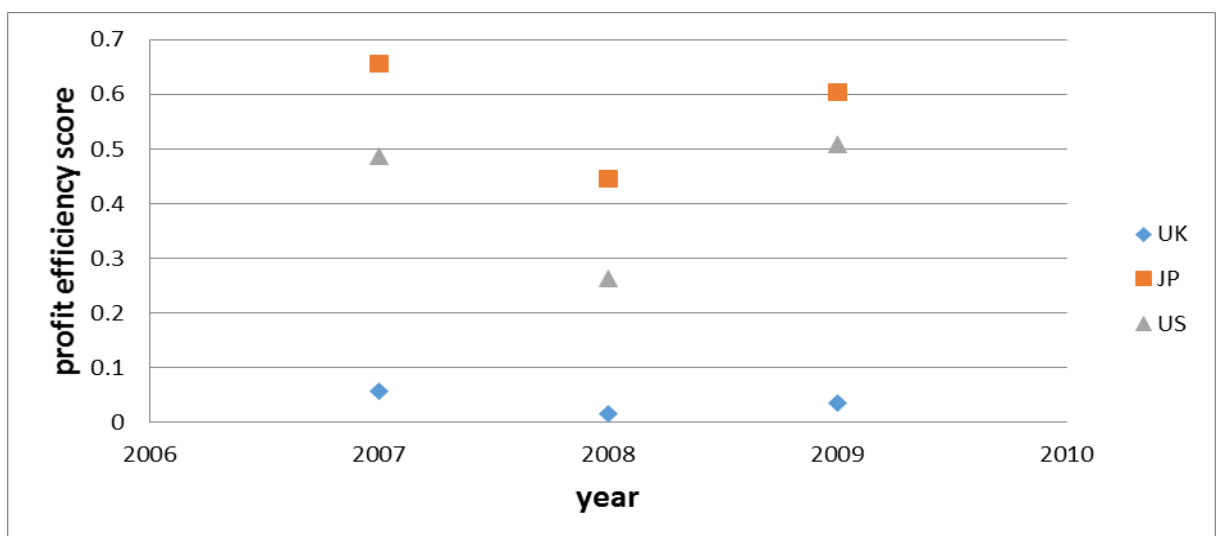


Chart 3 Post-crisis Model-2008-2012

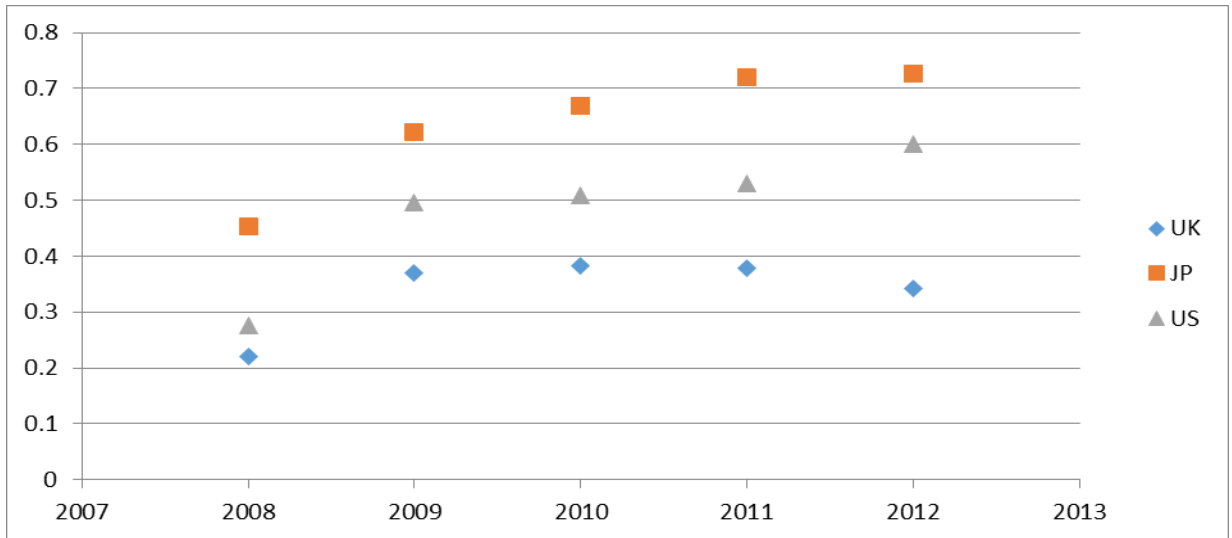


Chart 4 Full Sample Model-2000-2012

