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Loan Loss Provisioning of UK Commercial Banks Pre- and Post-Global Financial Crisis

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Abstract

This paper undertook a research on 29 UK commercial banks between the periods of 2006 to 2012 for observing the loan loss provisioning of the selected banks pre- and post- global financial crisis. There are two models were applied for this research, which are X-efficiency model and GMM model. We tested four hypotheses: 1) Do UK commercial banks conduct their provisioning relying on the business cycle? 2) Does income smoothing behaviour exist in the UK commercial banks? 3) Does capital management exist in the UK commercial banks? 4) Is Bank efficiency endogenous to loan loss provisioning? If yes / no, how does it correlate with loan loss provisioning? Our results showed no evidence for UK banks to conduct income smoothing and capital management through loan loss provisioning. However, we found a negative relationship between bank efficiency and loan loss provisioning and market concentration problem for the selected banks. The result suggests that the FCA should pay more attention to the loan portfolios of high market power banks.

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1. Introduction

"*Loan loss provisions are recognized expenses to increase loan loss reserves on the balance sheet, they provide a potentially valuable measure of bank reassessments about expected losses in their loan portfolio*" Page 151, Glen and Mondragón-Vélez (2011).

Loan loss provisioning is one of the crucial aspects of bank management. Traditionally, it is an accounting technique that allows banks to create a provision for the future losses through loan loss reserves from the balance sheet. It is forward looking in that it allows banks to estimate the foreseeing losses during an economic upturn to cover the losses during an economic downturn. It was developed with the nature of being forward looking so as to help to smooth out the risk when future losses occur, thus eliminating the credit risk. However, due to the fact that future losses are hard to predict, bank managers have the freedom to underestimate or overestimate the future losses, and as a consequence some bank managers use loan loss provisioning not only for risk management, but also to achieve other incentives. Income smoothing, capital management and market signalling are the three main incentives for banks to conduct loan loss provisioning excluding for the purpose of risk management. Income smoothing is where banks try to present healthier financial reports by adjusting loan loss provisions to even out their earnings throughout economic downturn and upturn. Capital management refers to banks trying to achieve or maintain the capital adequacy level by adjusting loan loss provisions. Market signalling is where banks increase their loan loss provisions to show the market they have enough liquidity to cover their future expected losses. These three incentives of using loan loss provisioning are not what loan loss provisioning was created for according to the original Basel Accords. There are

plenty of studies which have found evidence to support the existence of the three incentives mentioned above such as, Anandarajan *et al.*, (2003), Hasan & Hunter (1999), Ma (1988) and Collins *et al.* (1995).

In order to stop banks from manipulating loan loss provisions, Basel II was launched in 1991 with the IAS 39 requirement that only allowed banks to build up their loan loss provisions for "expected losses". Since then, loan loss provisioning is no longer forward looking, but backward looking such that banks will decrease their loan loss provisions during times of economic upturn, and will need to increase their loan loss provisions during times of economic downturn. This backward looking loan loss provisioning controlled banks' manipulation of loan loss provisions; however, when the global crisis took place, the loan loss provisions for "expected losses" were far too small to cover the rapidly increased bad loans. Following the crisis taking place, the financial situation in the UK rapidly turned downwards, and even the largest five bank groups within the UK were massively influenced. The UK government then conducted a few financial reforms to alleviate the impact of the global financial crisis and also to prevent the financial system from another similar crisis taking place in the future. Our study aims to investigate the loan loss provisioning of UK commercial banks pre- and post-global financial crisis.

There are four main things we were aiming to test in this paper: 1) Do UK commercial banks conduct their provisioning relying on the business cycle? 2) Does income smoothing behaviour exist in the UK commercial banks? 3) Does capital management exist in the UK commercial banks? 4) Is Bank efficiency endogenous to loan loss provisioning? If yes / no, how does it correlate with loan loss provisioning?

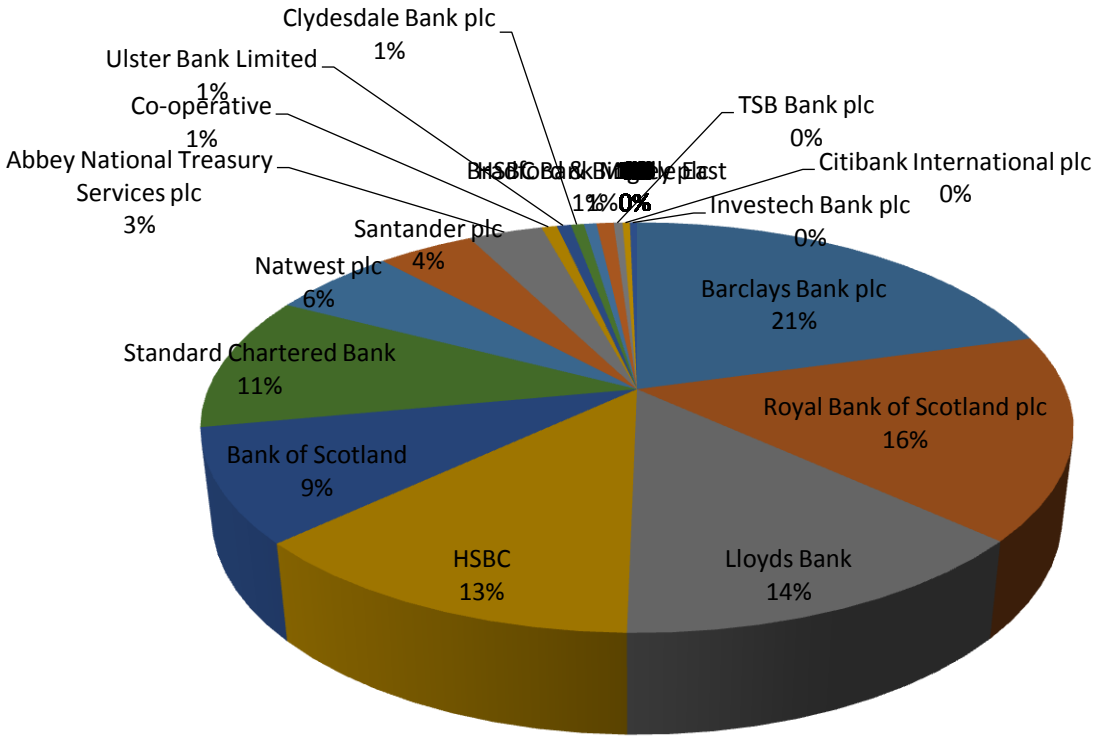
This paper will be structured in the following way: Section 2 will explain about the background of the UK banking system and recent reforms; Section 3 will discuss about the empirical literatures on income smoothing, capital management and market signalling; Section 4 will deal with modelling of GMM and X-efficiency with a sub section on X-efficiency result analysis; Section 5 will provide the final GMM result analysis; and the final section, Section 6, will proffer conclusions and suggestions to the UK regulatory bodies to improve the UK banking system.

2.Overview of the UK Banking Industry

2.1 Introducing the UK banking system

The UK has the 6th largest national economy in the world while London is the world's leading financial centre. There are plenty of banks operating in the UK, and some of them are even amongst the largest banks in the world. The types of banks in the UK can mainly be categorised as retail banks, commercial banks, investment banks and building societies. According to the data from bankscope, there are 531 banks operating in the UK as of 2013, including 157 UK incorporated banks and 251 subsidiaries of foreign banks. Most of the banks provide mortgage lending, saving, commercial retail, insurance and other financial services. Although there is a large number of banks operating in the UK banking system, it is highly dominated by five banks. From Figure 2.1it can be seen that Barclays owns the biggest portion of the total assets of all commercial banks in the UK with 21%; the Royal Bank of Scotland (RBS) comes second owning 16%; Lloyds bank owns 14%; HSBC owns 13% and Standard Chartered bank owns 11%. Also, most of these bank groups own more than one subsidiary. Natwest, for example, which owns 6% of the total assets, is one of the subsidiary banks of the RBS bank group. It reflects that the UK banking system has a high market concentration; and the UK is not the only country with this problem. The Chinese banking system is also dominated by the four biggest state-owned commercial banks, which are the People's Bank of China, China Construction Bank, Bank of China and Industrial and Commercial Bank of China, which together own nearly half of the total assets of all banks within China.

Figure 2.1: Distribution of Total Assets in UK Banking Industry in 2013 (Note: Sum of total assets= £6,557,416million)

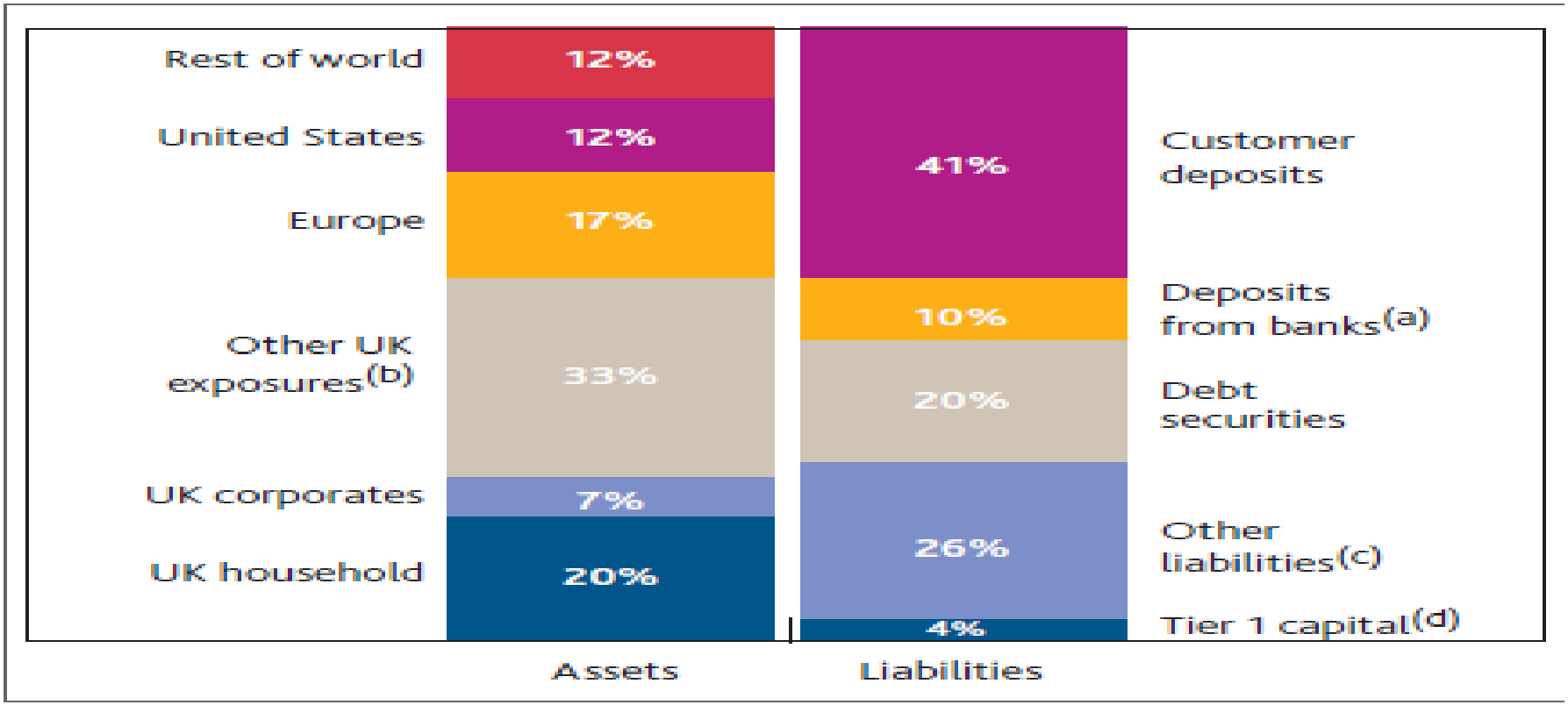


2. 2 Impact of the Global Financial Crisis on the UK banking system

In mid- 2007, the collapsing of the US housing market led to the subsequent price collapsing of security that was associated with the sub-prime mortgages sector, thus it became the sub-prime crisis (Hall, 2008). This crisis caused a great number of "too big to fail" banks to collapse in the US, such as Lehman Brothers, soon becoming a financial contagion which brought down the financial market in other industrial countries.

The UK was one of the most influenced countries, and none of the "too big to fail" banks within the UK were excluded from this crisis. Since the U.S housing market collapsed, big banks such as Lehman Brothers and Bear Stearns were reported to be hugely affected. This news destroyed the confidence of investors of the UK financial market, and banks in the UK and other European countries soon reacted to the news by increasing their interest rate to restrict their loan lending. Banks in the international interbank were reluctant to lend to each other regardless of how high the interest rate was. This is because banks were no longer able to raise funds in the wholesale market, while according to the Financial Stability Report (Figure 2.2), the UK financial system was made-up of 41% customer deposits, 29% wholesale funding and 21% insurance and pension liabilities. The liquidity of banks soon became dried up and the liquidity crisis then started in August 2007 in the UK.

Figure 2.2: "Major UK banks' aggregate balance sheet at end-2006 (Bank of England, April 2007)



Northern Rock was the first victim, announcing its failure to refinance its maturing loans in September 2007. It was a former building society, which used to be the 8th largest bank and the 5th biggest mortgage lender in the UK. Investors correctly forecasted that Northern Rock would be taken down by the subsequent sub-prime crisis, and conducted massive short-selling of its stocks, which led to the share price being half of its peak value in February, while its funding of off-balance-sheet conduits was already dried up (Hall, 2008). After Northern Rock failed to find a "white knight" to take it over, the government decided to make it nationalised in February 2008, until recently it was taken over by Virgin Money in 2012. The failure of Northern Rock reflects how fragile both Northern Rock and the UK financial market were (Hall, 2008). The sub-prime crisis worsened in 2008, with Bear Stearns and Lehman Brothers announcing their bankruptcy one after the other, and the credit crisis beginning in the UK after Lehman Brothers' failure in September 2008. Most of the building societies were hit by the crisis and requested for rescue from the government in September. Most of them were rescued under the "brokered takeover-rescues" or nationalisation. HBOS was taken over by Lloyds with 12 billion pounds under the "brokered takeover-rescues" in September (Elliott, *et al.*, 2008); the continued bleakness of the UK housing market led to the crash in profit while suffering the excessive exposure to the wholesale market and share price collapsing. The Cheshire and Derbyshire Building Societies were rescued by Nationwide Building Society through a merger due to huge tax losses. Bradford and Bingley became nationalised. In addition to building societies, commercial and investment banks were also having trouble raising their funding. In October 2008, right after the US bank rescue plan was established, the UK government also announced a Bailout Scheme to help other big banks to come through the crisis. Banks including Abbey,

HBOS, Barclays, HSBC, RBS, Standard Chartered, Lloyds TSB and Nationwide agreed to aggregate to increase 25 billion in their Tier 1 capital, while their capital ratio of Tier 1 would be raised to more than 9%. They could raise the capital in the market themselves, or become part-nationalised by selling preference shares or shares with permanent interest to the government (Sibert, 2009). After the banks settled negotiations with the government about the recapitalisation, the government then owned 44% of Lloyds TSB and HBOS, and it owned about 57% of shares of RBS which eventually increased to about 70%. In January 2009, the UK government announced the Special Liquidity Scheme and a qualitative easing policy to protect banks from having extreme tail losses, which increased the liquidity of banks and encouraged them to lend to each other again. In February 2009, The Banking Act 2009 was introduced as a permanent SSR (Special Resolution Regime) to help banks get through the downturn of the economy and sustainably develop in the future, hence protect and enhance the stability of the UK financial market.

Sibert (2009) concluded that the policy makers in the UK were not as prepared as the ones in other countries. It criticises the UK government for lending to Northern Rock as their first attempt, because the government attempted to give liquidity provision to Northern Rock for more than a short term, but it turned out that the bank was more illiquidated than the government thought. Sibert (2009) thinks that the government should have let Northern Rock fail as the bank had no systemic importance. It also states there are two problems of the UK recapitalisation scheme. Firstly, the scheme did not require the banks to "write down or write off the toxic assets". It made the UK banks seem unhealthy as they had raised their capital while holding the toxic assets. Secondly, banks must make their concessions to join the scheme. Banks need to negotiate and agree with some of the government

arrangements by joining the scheme, which might damage the benefits of the bank manager such as bonuses and share owning ratio, making them vote against participating in the scheme. Sibert (2009) suggests to the UK government that it must "take care to pay them a competitive compensation", whilst also suggesting that the UK government should not meddle in the banks' lending decisions to create further distortions when the economy is bad. The Financial Stability Report that was published by Bank of England (June 2010), states a few concerning issues regarding the future development of the UK banking system. Firstly, although big UK banks strengthened their resilience during 2009 by following the requirements of the bailout scheme and increasing their capital ratios, building societies face problems in remaining resilient as they have limited sources to raise funding while the financial market is so inactive. Also, it is uncertain whether banks can continue to be resilient in the future. Secondly, Greek sovereign debt shifted the risk to other European countries and reduced the UK government funding for further bailouts. Thirdly, it is difficult for banks to refinance themselves substantially, since the big banks within the country need to replace around 800 billion pounds of their loans and liquid assets. These issues are forcing the UK government to make changes on the UK regulations in order to monitor and protect the UK financial system.

2.3 UK Banking Regulations and Reforms

Before 1997, the main financial sectors in the UK financial system were the Bank of England and HM Treasury, wherein Bank of England was responsible for maintaining the monetary stability and financial stability and HM Treasury was responsible for executing and developing the government's public finance and economic policy. In 1998, the Bank of England Act 1998 was introduced to reform the structure of the UK financial system due to a few notable financial scandals that took place in the 90s, and the competence of the Bank of England as a banking supervisor was questioned. Then the Financial Services Authority (FSA) was created, which was diverted from the Bank of England to be in charge of banking supervision and responsible for the daily regulation of all financial institutions (Black, 2010). Eventually, it became the third main financial sector, until the global financial crisis took place and damaged the UK financial system heavily, after which the FSA was criticised for not fully conducting its given responsibilities effectively and efficiently. Consequently, the UK government have implemented regulation reforms to help the financial system recover from the crisis and protect it from a similar crisis in the future.

The UK government implemented the Banking Act 2009 in February 2009. The aim of implementing this new Banking Act was to protect and strengthen the stability, reliance and public confidence of the UK financial and banking system. A number of new tools and regulations were introduced in the Banking Act 2009 to protect the depositors, public funds and assets in order to minimise the impact of the financial crisis to both the institutions and the public. It introduced a permanent framework providing tool called the Special Resolution Regime (SRR) for the UK authorities to help the UK banks to get through the impact of the global financial crisis. The

functions of the SRR were summarised as follows (Bank of England, 2009). The SRR allows the authorities to: 1. transfer all or part of the business of a bank to a purchaser of private sector, 2. transfer all or part of the property of a bank to a Bank of England's subsidiaries and pending for future sale, 3. recapitalise a failed financial institution by respecting the hierarchy of claims in insolvency, 4. place a bank into public ownership by using the treasury resolution tool, 5. apply to put a bank into the Bank Insolvency Procedure (BIP) for rapid payments to insured depositors, 6. apply for the use of the Bank Administration Procedure (BAP) to administrate some parts of the bank, the bank which is not transferred.

In March 2009, Lord Turner, chairman of the Financial Services Authority (FSA) published a review to reveal his opinion about the recent crisis and how the UK financial regulation and supervision should reform to prevent another similar financial crisis in the future. He recommended a few significant changes to the banks' capital and liquidity requirements that should be made. He suggested that the minimum regulatory requirements should increase as the quality and quantity of overall capital in the global banking system are increasing; and significantly increasing the capital required "against trading book activities and fundamental review of the market risk capital regime" (Hall, October 2009). Also, he stated that regulators should immediately react to the macroeconomics change to ensure the Basel II capital regime does not over carry procyclicality to worsen the banks' performance. Basel II interacted with fair-value accounting, which required banks to build up their LLP only for "incurred losses" which limited the bank's Tier 2 capital and forced the bank to raise Tier 1 capital or reduce lending to cover losses (Quagliariello, 2009). Its procyclical approach changed the capital structure of many banks, such as Northern Rock, which was mainly reliant on the wholesale fund market; and after the crisis

took place, its sources of fund-raising were cut immediately after the wholesale market leaving it without enough loan loss provision to cover its massive insolvent loans. As a result, he suggests that the regulator should implement a countercyclical capital adequacy regime to let banks build up their buffers during the economy upturn to defend themselves when the downturn comes. At the end, he recommended that a "backstop maximum gross leverage ratio" should be introduced to prevent excessive growth in the absolute size of the balance sheet (Hall, October 2009). The Basel Committee on Banking Supervision (BCBS) supported most of the recommendations from Turner and issued an agreed "enhancements" package in July 2009, in which it agreed to revise the three pillars and the market risk framework of Basel II regulations in the light of the financial crisis. Throughout the global financial crisis, liquidity was the main issue that institutions and regulators encountered, and Turner suggests that bank liquidity related supervision and regulation should be regarded as being as important as the capital regulation. He also notices the inappropriate incentives structures also contributed to the financial crisis. He suggests the remuneration policies should focus on restricting the top executives and traders' incentive to over taking risk, and risk management should be integrated for remuneration decisions. As the chairman of FSA, Turner believes that the FSA should complete implementing the post- Northern Rock Supervisory Enhancement Program (SEP), to increase its analysis on performance of banks and key risks, further invest in prudential skills and pay more attention to remuneration policies. In addition to the above mentioned aspects, he also makes comments on deposit insurance, the UK bank resolution regime, institutions' risk management and governance.

In July 2009, both the Labour government and Conservative party published their proposals for the UK financial reform. The Labour party mainly focused on four areas, which are regulatory framework, governance and co-ordination of UK financial institutions; solution for systemically significant institutions; systemic risk management; and International regulatory and supervisory framework (Hall, October 2009). The government proposed a new statutory committee to replace the existing "Standing Committee", which would be called the Council for Financial Stability (CFS) and would be responsible for testing and analysing emerging risks for financial stability and co-ordinating an appropriate response (HM Treasury, 2009). The government proposed to strengthen the prudential regulation and supervision of FSA by following the suggestion of Lord Turner, and enhance its regulatory powers by allowing it to take action to misconduct institutions, giving it "stand-alone" power to restrict short-selling and introducing an element called "pre-funding" into deposit taking sub-scheme of FSCS to protect the tax payers (HM Treasury, 2009). The government proposed dealing with systemically significant institutions through strengthening market discipline and prudential regulation; and in order to reduce the impact of the failure of the firms, the government suggested bolstering the legal and operational infrastructure and introducing a new insolvency regime to enhance the failure resolution mechanisms (Hall, October 2009). The systemic risk within the UK financial system created a serious macroeconomic consequence, and the government believed improving accounting standards to enhance transparency is a good approach for managing the systematic risks across institutions, with the FSA needing to strictly conduct its supervising duty to make sure the approaches across the institutions are consistent. The government endorsed Turner's suggestion to reduce procyclicality and build up countercyclical capital buffers during economic

upswings. It also advocated the use of applying a maximum leverage ratio and improving access to funding market during times of economic downturn or financial crisis. The government believed enhancing the supervision and regulatory international framework is also important while strengthening the domestic regulatory system to better protect the global financial system from financial crisis. It suggested to reduce the national discretions allowable under the EU legislation, which can make the international regulatory more coherent and improve the quality of regulation. Also, it was deemed necessary to reinforce the rules and safeguards for international branches, and stronger enforce the EU legislations. At the same time, the government would give the FSA a new duty to promote the international regulation and supervision. The proposal of the Conservative Party focused on both macro-prudential and micro-prudential reforms. Similarly to the Labour government, the Conservative Party also endorsed Turner's recommendations of capital and liquidity for improving both micro- and macro-prudential policy and tools. Differing from the Labour government's opinion, it suggested abolishing the FSA and transferring its micro-prudential powers back to the Bank of England, while its consumer protection would be transferred to the Consumer Protection Agency (CPA), a new agency. Then, the newly introduced SRR would operate under the Bank of England instead, which would lead to the abolition of the Tripartite System. Therefore, the Bank of England would be responsible for both micro- and macro-prudential regulation, and the Financial Policy Committee and Monetary Policy Committee would also be made to assist the Bank of England in monitoring and maintaining financial stability.

After consultations, the Coalition Government published the new financial reform in June 2011. The reform confirmed the adoption of the Conservative Party's proposals

to abolish the Tripartite System of regulation and FSA, building up a new macro-prudential regulator called the Financial Policy Committee (FPC) which acts under the Bank of England for monitoring and responding to systematic risks. A new regulatory body was also established called Prudential Regulation Authority (PRA), which is responsible for micro-prudential regulation and supervision and operates as an independent subsidiary of the Bank of England. A new independent conduct of business regulator was also established, called the Financial Conduct Authority (FCA) for supervising the behaviour of business cross financial services and markets to protect the interest of all participants and users. The government also endorsed the Independent Commission on Banking's main recommendations, by way of increasing the equity capital ratio from 10% to 12.5% if a countercyclical buffer was introduced, as catered for in Basel III, and increasing the ratio to 15.5% if banks imposed a "resolution buffer"; large UK banking groups and UK global systemically-important banks are allowed to have 17% of risk-weighted assets for minimum "primary loss-absorbing capacity", and the minimum is raised to 20% for banks with doubts surrounding their resolvability. After further consultation and a few changes made on the regulatory reform in 2012, the government planned to implement the new system in 2013. The Financial Stability Report from the Bank of England (November 2013), stated that the economic is recovering in the UK and brought some positive influences to the bank's capital position and financial stability.

2.4. Provisioning Practice in the UK

The World Bank (2002) described Loan Loss Provisioning (LLP) as "a method that banks use to recognize a reduction in the realizable value of their loans". Some countries set up loan classification for banks to review and manage their loan portfolios, whereas some countries do not have a detailed loan classification regime

and thus require bank managers to develop internal policies to classify their loans (Laurin & Majnoni, 2003). The UK is one of the latter countries, where the supervisor does not require banks to adopt a particular form of loan classification system. It requires banks to develop proper updated internal risk management and the government also has a supervisory agency to issue the prudential regulation on loan classification, which was the FSA before 2013 and has recently become the PRA. It is a common approach for European countries to have principle-based rules for LLP, which only provides general guidance on determining adequate provisioning, and most of these countries require banks to follow the Basel Accords' requirements for capital and loan management.

Basel I was adopted in 1988 by the G10 industrial countries, and it introduced the minimum levels of capital requirements for internationally active banks, such that banks must achieve the minimum level of 8% Risk Asset Ratio (RAR) to show that they have adequate capital to avoid financial failure (Caprio, 2013). Furthermore, it divided capital into two tiers, wherein Tier 1 capital involves shares and other disclosed reserves, and Tier 2 involves undisclosed reserves and general provisions. It required that banks could only own 50% of Tier 2 capital of total capital whilst general reserves are limited to a maximum of 1.25% to be counted as risk weighted assets. It also set up risk weight for "on-balance-sheet assets", such as 50% risk weight for residential mortgages. After a few years of observation, the Basel committee have found some notable issues. It is relatively easier for banks to raise their capital while the economy is booming than busting, banks' capital ratios and financial situation rely on the business cycle (Jackson, 1999). It shows that banks conducted themselves with a countercyclical approach, and that some banks use this approach to achieve other incentives through manipulating LLP, such as over- or

under-estimating the future losses to increase or decrease the LLP throughout the accounting periods. Also, Basel I was found to be weak in risk-sensitive measures of credit risk and to have a weak influence on strengthening the risk management for banking systems (Cannata & Quagliariello, 2009). In order to better address and manage risks, and also improve the found weakness from Basel I, Basel II was launched in 2001. It is based on the Basel I framework and expanded from one pillar to three pillars, which are minimum capital requirements, supervisory, and market discipline. For pillar 1, it keeps most of the capital adequate requirements from Basel I, except that it expands the categories for risk weighted assets into three categories, which are credit risk, operational risk and market risks. Basel II further considered the operational risk of banks, implementing basic indicator, standardised and advanced measurement approach. Majority banks are allowed to continue applying "standardised approach" based upon Basel I in general, whereas sophisticated banks are allowed to structure their own model, and small banks need to follow the traditional requirements instead. Basel II also implements a standardised approach and internal ratings-based approach for managing credit risks. Pillar 2 is a newly developed pillar, which states principles for bank supervisors to conduct. It requires banks to have an overall capital adequacy accessing procedure to maintain the capital level. Also, it states that the supervisor should review and evaluate the internal capital adequacy assessments and strategies of the bank to ensure they are meeting the capital adequacy requirement, and for banks that do not satisfy the requirements, supervisor should take appropriate supervision towards it. Banks should always be expected to achieve the capital requirement and supervisor has the ability to require banks to hold capital exceeding the capital requirement. Early intervention is encouraged by Pillar 2 such that supervisors are expected to take

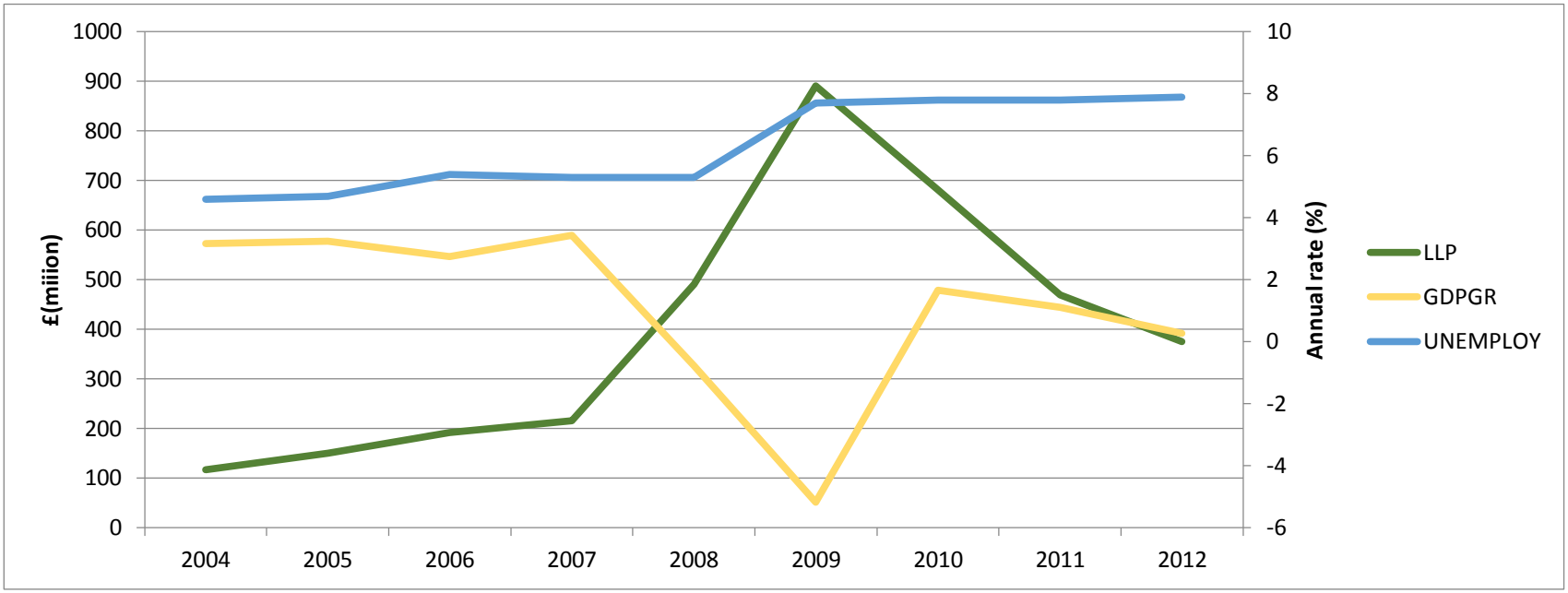
action early to prevent capital falling below the minimum requirement, and supervisors should require rapid remedial action when capital is not restored or maintained (Caprio, 2013). Pillar 3 is the complement to the previous two pillars. The Basel committee believes that encouraging market disciplines can better monitor the bank manager to assess and manage the risk and capital within the bank through implementing disclosure requirements. Basel II considers LLP and capital as the two most important "macro-prudential policy tools", wherein LLP should be built up for "expected losses" and capital should be built up for "unexpected losses" (BCBS, April 2009). Basel II adopted the IAS 39 and required banks to use the "incurred loss" model to build up their loan loss provision in order to restrict banks from manipulating LLP. It resulted in banks changing their behaviour from countercyclical provisioning to procyclical provisioning. From Figure 2.3[1], we can see that during 2004 to 2007, the GDP growth rate was stable at around 3%, which indicated the economy in the UK was constantly growing thus the economic environment was good. The LLP of UK commercial banks was between £110 million and £200 million with a tendency of growing. When the 2008 global financial crisis arrived, however, GDP growth rate faced a massive drop from approximately 3.4% to a low of approximately -5.2%, where unemployment rate started to raise from 5% and reached to the peak of nearly 8% in 2009. During that period, LLP rapidly increased and reached the peak at nearly £900 million. Weze (2010) describes procyclicality as a backward looking approach that does not recognise the built-up credit risks during an economic boom and results in excessive risk taking and credit expansion. The Turner review and government's White Papers were published in 2009, and

1. My initial idea is to investigate the period from 2001 to 2013, but there are not enough observations on Bankscope, thus I chose the period from 2004 to 2012 instead.

suggested that banks implement a countercyclical buffer. The GDP then started to rapidly grow in positive rate again during 2010, and the growth rate was around 0.2% in 2012. Meanwhile LLP started to rapidly decrease in 2009, and it dropped to around £380 million in 2012. The tendencies of both the LLP and GDP growth rates during 2010 to 2012 seem to move along with each other, which implies that banks had already implemented the countercyclical buffer; and the increase of GDP growth rate also shows that the UK economy was recovering. Basel III was introduced in 2009 to "give banks sufficient time to adjust through earnings retention and capital-raising efforts" (Hannoun, 2010), and it was officially launched in January 2013. Basel III is a risk-based framework, it keeps the three pillars' structures from Basel II whilst enhancing them with detailed risk, capital and liquidity requirements. During the crisis, the collapse of banks' retained earnings reduced the common equity and caused credit losses and write down, therefore, Basel III increased the requirement for common equity capital from 2% to 4.5%, and set a 1.5% limit for additional tier capital, which led to a Tier 1 capital ratio of 6% for general banking risk. The total capital requirement remained at 8%, thus the requirement for Tier 2 capital is reduced 2% compared to Basel II. Procyclicality is inherent in banks and has worsened the impact of global financial crisis indirectly (Hannoun, 2010). In order to boost up the capital and credit of banks again, Basel III implemented a capital conservation buffer of 2.5%, a countercyclical buffer from 0%-2.5% depending on the macroeconomic circumstances and an additional capital surcharge between 1% and 2.5% for systemically important financial institutions (SIFIs). Basel III also implemented a "non-risk-based leverage" ratio to supplement the "risk-based" capital requirements owing to a large number of banks reporting a strong Tier 1 risk-based ratio while they were building up high levels of leverage both on- and off- balance

sheet (Hannoun, 2010). The leverage ratio involves both on- and off- balance sheet items in the measure to prevent excessive leverage build up by the financial institutions through their balance sheets. Due to the fact that most banks during the crisis had encountered serious liquidity issues, Basel III consequently introduced the liquidity coverage ratio to ensure that banks maintain sufficient high liquid assets to meet their liquidity needs throughout a month; if not, the bank would be asked to submit a plan for restoration to reach the liquidity requirement.

Figure 2.3: Loan Loss Provisions, Unemployment Rate and GDP Growth Rate from 2004-2012



3. Literature Review

The prior research of LLP (Loan Loss Provision) focused on investigating the income smoothing activities of banks, which was conducted from an accounting perspective. More recent pieces of work have tried to find the connection between LLP and the business cycle. Ahmed, Takeda, & Thomas (1999) categorised LLP into the non-discretionary and the discretionary component (these will be discussed in section 3.2), wherein the discretionary component was further differentiated as income smoothing, capital management and financial signalling. The non-discretionary component is closely related to credit risk, while banks set aside their LLP based on several factors which include the loan default rate, changes of macroeconomic environment and risk tolerance; non-discretionary practices are normally conducted by considering the above factors and others (Floro, 2010). The discretionary component of the bank's provisioning decisions, as Floro (2010) described, "arises from the uncertainty and subjectivity in the process of estimating expected losses". It is important to investigate how banks manage their reserves while going through different stages of the business cycle, which reflects characteristics of both the banks and the researched market. Also, the discretionary practices show the incentives of banks towards LLP, which is important for the regulator and investors to know.

3.1 Business cycle and LLP

The most important concept to be considered throughout the investigation of the relationship between business cycle and LLP is pro-cyclicality. “Banks are prone to business cycles”, said Mahapatra (March 2012). When the economy is booming, GDP and employment rates grow, which generates a greater demand for credit in

the market, meaning banks rapidly become flexible towards credit standards and lend out more loans. At this stage, debtors tend to have less loan defaulting behaviour and the need for banks to hold LLP is less. Therefore, LLP always seems to be underfunded when the economy is booming. However, when the economy is subsiding, the GDP and employment rates start to decline, meaning there is hardly any demand for loans and the credit quality of debtors gets worse, which leads those debts to become non-performing loans. Mahapatra (March 2012) described it as "the cyclical property of credit losses". The consequence is that banks become less profitable and are required to hold higher LLP to cover these non-performing loans. Then banks start to restrict lending which spills the risk over to the financial market, having a detrimental effect on the economy. It reflects that procyclical provisioning is backward looking, which does not make LLP until the credit loss events take place. There are a considerable numbers of studies which suggest that banks behave procyclically in both the Asian and Western banking systems. Floro (2010) conducted a study on 32 Filipino commercial banks from 2001 to 2009, with the result showing that GDP is significantly negatively correlated with LLR, which indicates that Filipino banks behave procyclically. Anandarajan & Hasan (2003) undertook research of the Spanish banking system 'involving 970 observations of commercial and saving banks during the period of 1986 to 1995. The paper disclosed that the unemployment rate is correlated with LLP positively, which shows that the banks were forced to increase their provisioning under the pressure of the macroeconomic environment, implying the existence of procyclicality. Bouvatier & Lepetit (2008) conducted their study on European provisioning systems between the years of 1992 and 2004, and they found the existence of procyclical provisioning except for in Spain. In Bouvatier & Lepetit (2012), they expanded the geographical

areas of their research by including "Europe, Japan, the United States, Central & South America and South & East Asia", investigating the procyclical provisioning effects on the lending growth in these areas over the period of the late 90s to 2008. The result of Bouvatier & Lepetit (2012) not only shows the existence of procyclical behaviour of banks in all the researched geographical areas, but also proves that the backward-looking provisioning system is responsible for exacerbating the procyclical behaviour of banks. The reason why the provisioning system in Europe is procyclical is because Basel II adopted one of the International Accounting Standards, IAS 39, as one of the important regulations. IAS 39 measures provisions under the "incurred loss model", requiring banks to conduct their provisioning based on "incurred loss", so that provision for loss can only be held until default or such events occur; Basel II additionally requires banks to use LLP to cover expected losses, and unexpected losses should be covered by the capital instead (BCBS, April 2009). The Basel committee adopted such an approach to prevent banks from using LLP for other purposes, such as earning management. Several criticisms were made about involving the "incurred loss model" into banking provisioning after the global financial crisis occurred. It was suggested that the backward looking approach results in banks with little provisions to cover the increasing bad debts, worsening the effect of the global financial crisis, although this new framework stopped banks manipulating the Tier 2 capital to a certain degree by adding conditions to their holding LLP. However, in order to achieve the capital adequacy ratio, some banks changed their financial structure, such as Northern Rock. It raised funding relying on the wholesale fund market, and eventually got taken down right after the global financial crisis happened. Procyclical provisioning increases the credit risk that banks will face in times of economic downturn, due to the increasing incidence of loan default, and the

quick market reaction may push banks into the troubles of credit crunching or even collapsing. The conclusion of Bouvatier & Lepetit (2012) supports the idea that in order to incline the cyclical effect of bank lending, the Basel committee should adopt a countercyclical provisioning approach instead.

Countercyclicality is the opposite approach to procyclicality, since it is a dynamic provisioning tool which is forward looking. Yellen (2011) described countercyclicality as a macroprudential policy tool to "address these cyclical vulnerabilities in systematic risk". It allows banks to build up their LLP while their earning grows in order to cover the increasing losses during the economic downturn (Mahapatra, March 2012). Banks with countercyclical provisioning will prepare more provisioning and slow the credit growth during economic upturn. Conversely, they boost the credit growth during the economic downturn. This approach helps banks to reduce their credit crunching risk and develop in a more stable and sustainable way. The Spanish Model is the most famous dynamic provisioning model. The Spanish central bank implemented the model to deal with the rapid boost of credit risk in 2000 (de Lis, *et al*., 2001). The credit growth of Spanish banks increased with great speed in the late 90s, they relied on the procyclical provisioning by holding extremely low LLP during the economy upturn while the credit risk occurred and risks spread to the economy. Therefore, the Spanish Model was adopted to adjust to this situation. The model introduced three types of LLP: general provision, specific provision and statistical provision; wherein the general provision was for incurred losses without suspect loans, the specific provision was for delinquent loans for which there was some level of risk and fear of an overdue payback time, and the statistical provision was "the difference between the latent risk (risk parameter dependent upon the credit growth) and the specific provision" with upper and lower limits (Mahapatra, March 2012).

After the model was implemented, the business cycle became stronger and more sustainable. Soon afterwards, a French supervisor brought up an approach called dynamic provisioning, which is similar to the Spanish Model France (2001), some European countries, such as Portugal, Holland and France also involved some forward looking components. There are plenty of empirical studies which emphasise that dynamic provisioning has a great effect on income smoothing and bank capital stabilisation, which can lead to reducing credit fluctuation and improving bank profits (Jimenez and Saurina, 2005; Borio *et al.*, 2001). Although dynamic provisioning seems like the "perfect" approach for all the banks to undertake, it still faces some challenges. First of all, some people argue that dynamic provisioning is just an accounting trick. Using Spain as an example, although Spain seems to be the least affected country during the global financial crisis within Europe, whose bank system was credit with the most prudential and wise banking system . Recently, more and more regulators believe that the country concealed its losses behind the scene through earning management to present better financial reports, which appears to be in conflict with the "fair value" estimation of LLP requirement by international accounting standards (Weil, 2012). This leads to the second challenge for dynamic provisioning: whether dynamic provisioning could ever be able to interact with accounting standards. From the previous experience, it is not likely to be possible as accounting standards do not tolerant with expect losses measure for LLP (rephrase). After the global financial crisis took place, the International Accounting Standard committee decided to replace IAS 39 by IFRS 9, which allows banks to use current and past information to conduct reasonably forecast. Although it relaxes the limit for building up LLP, it is still a backward looking framework, hence is still conflicting with the approach of dynamic provisioning. The third issue is data challenges. Some

countries may have a credit register for creating the model, but for countries who do not have this, the system will need to use the data provided by banks themselves. This can cause bias in result analysis. In addition, the applied data are the data collected in the past, 'such that banks may only rely on past information to prevent the recurrence of certain events, whilst not being prepared for the occurrence of others

3.2. Incentives of Bank Provisioning

LLP is built up by banks in order to draw the future expected losses that may occur in their existing portfolio. Bank managers are given substantial discretion to set off their LLP due to the fact that the future losses of the portfolio are hard to predict. However, instead of using this discretion to better estimate the more accurate expected losses of portfolio, managers manipulate their LLP to achieve other incentives (Anandarajan *et al.*, 2003). There are three main incentives for which managers manipulate LLP: (a) income smoothing, (b) capital management and (c) signalling.

(a) Income Smoothing

Banks use LLP as an accounting tool to manage their earnings for the long term. There are a few reasons why banks manipulate LLP. First of all, banks can use LLP to smooth out the operating profit and present better, healthier financial reports to the public. During periods when the economy is poor, banks will understate the expected losses they have to boost up the earning, and while the economy is strong, banks will release the previous understated losses to increase the LLP to even out the operating profit and reduce the tax liability. Scheiner (1981) found that operating income is positively correlated with LLP which implied LLP could be flexibly used to

adjust the earnings in financial statements, although its conclusion rejected the hypothesis of income smoothing. In later studies, there is an increasing numbers of studies which point to the existence of income smoothing in banks. Ma (1988) found the result that banks in the U.S. used both LLP and charge-off to manage their earning, wherein it showed that banks tend to raise their LLP while while their earnings are high, and reduce it 'when their earnings are low. Hasan & Hunter (1996) investigated the performance of Japanese multinational banks in the U.S. between 1977 and 1986 to see whether income smoothing behaviour existed in the U.S. banking system. The result proved the existence of income smoothing behaviour, and furthermore, the paper found no significant impact of the Tax Reform Act of 1986 on the banks' income smoothing behaviour. In addition to this paper conducted in the U.S., there exists research investigating about European banks which found similar results. Secondly, income smoothing can reduce the volatility of the earnings of the banks, making banks appear to be better and more sustainably developed which can attract more investors and satisfy the existing shareholders. Hasan & Hunter (1999) states that commercial banks have more incentive to conduct income smoothing behaviour than saving institutions as they have shareholders and the corporate board to please. Anandarajan *et al*., (2003) conducted an investigation on the Spanish banking system with mixed observations of commercial and saving banks, whose result found the existence of earning management.

(b) Capital and Risk Management

According to the Basel Committee for Banking Supervision (April 2009), LLP and capital are the most important "macroprudential policy tools" to maintain the stability of the banking system. In Basel II, the duty for these two "macroprudential policy tools" is specified, wherein LLP is used for covering the “expected losses” and

capital is for “unexpected losses” (BCBS, June 2004). The regulatory capital is divided into two tiers: Tier 1 and Tier 2 capital. Tier 1 capital is made up of paid-up share capital and other disclosed reserves, such as nominal shares and cash; Tier 2 capital is made up with liabilities of banks and general loan loss reserves. The Basel Accords require banks to achieve a minimum capital adequacy ratio of 8% of which the risk weighted assets that exceed the limit of 1.25% in the Tier 2 capital cannot be counted as part of Tier 2 capital (BCBS, June 2004). It is essential for banks to achieve the capital ratios to show the bank supervisors that they have enough capital to deal with the future unexpected losses. It is common that banks tend to rise to their LLP to achieve the minimum capital ratio when they have low Tier 1 capital. The reason why they increase LLP instead of Tier 1 capital is because: most of the Tier 1 capital are shares, it is costly and time consuming for banks to issue shares to raise the capital, and LLP is just a non-cash expense which is much less costly. Moyer (1990) examined the incentives of managers of commercial banks to apply accounting adjustment for achieving capital regulations. The result found that LLP is applied as a mechanism to boost up the capital ratio by increasing loan loss reserves, which suggests that commercial bank managers tend to apply accounting adjustment on measuring LLP to increase Tier 2 capital, hence increase the capital ratio. Beatty *et al.*, (1995) based their study on the investigation that Moyer (1990) conducted. They found a similar result to Moyer (1990), that bank managers exercised the discretion and concealed the accurate financial information to achieve the capital requirement. Both studies found an inverse correlation between LLP changes and capital ratios. Some studies have found different results. Collins *et al.* (1995) conducted investigations on 160 banks and found a positive correlation between LLP and capital management. Kim and Kross (1998) examined how LLP

and capital management are correlated *pre-* and *post-* the 1989 capital regulation took place. They found that LLP was positively correlated with capital ratio before 1989 and found no correlation between the two after 1989. Ahmed et al. (1999) had similar findings.

(c) Signalling

Beaver *et al.* (1989) is an early study to discuss the hypothesis that the growth of LLP is a strong market signal for the shareholders and potential shareholders of the management and earning power of the bank. The paper concluded that

the increasing LLP implies the bank has sufficient liquidity to withstand the future hit to earnings. Beaver and Engel (1996) further investigated about whether capital market assign different prices to discretionary and non-discretionary LLP. The result concluded that growth of LLP would be a good signal only when a loan default problem exists in the market, otherwise there is no correlation between the two. Also, they observed that the capital market tend to negatively priced non-discretionary components and positively priced discretionary components, which implied that the growth of discretionary components of LLP are regarded as a good signal for the market. Liu *et al.* (1997) based their study on the findings on Beaver and Engel (1996) in order to investigate what kind of characteristics banks that use the discretionary LLP for market signalling would have. The result concluded that the good market signalling effect of discretionary LLP is more significant for banks with the problem of provision bad loans (rephrase) and insufficient regulatory capital. UniCredit, the biggest Italian bank, announced its annual net loss of €14 billion on 11th March 2014. The bank then "took €9.3bn of Loan loss provisions in the fourth quarter, taking its total for the year to €13.7bn... and said its provisions covered 52

per cent of its bad loans at the end of last year, against 45 per cent at the end of September"; after the announcement, the 'the price of shares increased to €6.43 with a growth rate of 6.5%, and analysts believe that the future profitability will be better than expected (Arnold & Sanderson, 2014). This is a real life case study that proved the finding of Liu *et al.* (1997).

4. Methodology

4.1 Data Description

This paper aims to examine an unbalanced panel of the performance of UK top 29 listed commercial banks between 2006 and 2012 (Figure 4.1). There are a few reasons for selecting these particular 29 banks for this research. First of all, although there are 135 commercial banks in UK, most of them are either too small to be influenced by global financial crisis or some are operating in UK as foreign banks. Secondly, the 29 banks above are also chosen based on their amount of total assets in each year, which ensures the size of the chosen banks are big enough to be influenced by the financial crisis. The chosen period for this dataset is between 2006 and 2012, because the global financial crisis took place in late 2007, then started to spread around the world contagiously between 2008-2010. Therefore, it can provide a thorough performance of UK banks pre and post global financial crisis by observing this period. Also, as De Young (1997) suggested in his paper, dataset with 6 years is sufficient to ensure while estimating efficiency that there would be few random error terms. The dataset in this paper covers 7 years, which is suitable for efficiency estimating. The dataset is kept as an unbalanced panel instead of a balanced panel to allow as many available observations as possible for further efficiency and GMM (General Method of Moments) measures. As table X shows below, the numbers of selected banks in 2006 to 2012 (Table 4.2), it shows that the numbers of banks each year are between 25 to 29, thus the dataset is nearly a balanced panel.

Figure 4.1: The chosen UK top 29 banks

	Bank Name
1	Abbey National Treasury Services Plc
2	ABC International Bank Plc
3	Ahli United Bank (UK) Plc
4	AIB Group (UK) plc
5	Bank of Scotland Plc
6	Barclays Bank Plc
7	Bradford & Bingley Plc
8	C. Hoare & Co
9	Capital One (Europe) plc
10	CIT Bank Limited
11	Clydesdale Bank Plc
12	Co-operative Bank Plc (The)
12	DB UK Bank Limited
14	Europe Arab Bank Plc
15	HSBC Bank plc
16	ICICI Bank UK PLC
17	Investec Bank Plc
18	Lloyds Bank Plc
19	MBNA Limited
20	Morgan Stanley Bank International Limited
21	N M Rothschild & Sons Limited
22	National Westminster Bank Plc - NatWest
23	Royal Bank of Scotland Plc (The)
24	Sainsbury's Bank plc
25	Santander UK Plc
26	Standard Bank Plc
27	Standard Chartered Bank
28	Ulster Bank Limited
29	VTB Capital Plc

Figure 4.2: Summary of the numbers of selected banks in 2006 to 2012

Year	Numbers of banks
2012	29
2011	26
2010	27
2009	28
2008	28
2007	25
2006	26

4.2 Generalised Method of Moments estimator (GMM) Modelling

LLP and loan growth change over time and tend to be influenced by the lag terms. Therefore, it is more appropriate to apply dynamic data analysis methods instead of statistic panel data analysis, such as fixed or random effect models, which do not involve lag terms in the regression. The dynamic panel data specification base on our selected data can be presented by:

$$LLP_{it} = \alpha + \sum_{p=1}^{P} \alpha_t \ LLP_{it-p} + \ \beta(L)X_{it} + \eta_{it} + \ \varepsilon_{it} \qquad \textit{Equation 4.2.1}$$

$$|\alpha| < 1, i = 1, \dots, N, t = 1, \dots, T,$$

Where the LLP_{it-p} is the lags of LLP_{it} , the subscripts i denotes the cross sectional dimensions and t denotes the time dimensions of the panel, which are under the conditions stated above, $(L)X_{it}$ represents the lag polynomial vector of capital management, income smoothing, business cycle and x-efficiency, η_{it} represents the unobserved individual bank specific effect and ε_{it} is the error term. By applying Arellano & Bond (1991) GMM first difference transformation to estimate Equation 4.2.1, the equation will be transformed into:

$$\Delta LLP_{it} = \sum_{p=1}^{P} \alpha_t \ \Delta LLP_{it-p} + \ \beta(L)\Delta X_{it} + \ \Delta\varepsilon_{it} \qquad \textit{Equation 4.2.2}$$

GMM is the most frequently used dynamic data analysis method that was proposed by Arellano and Bond (1991), and further developed by Arellano & Bover (1995) and Blundell & Bond (1998). GMM is created to estimate panel data with dynamic perspective by involving dependent and independent variables with lags of $p + 1$ or more. Also, Arellano and Bond tempted to eliminate the problem of autocorrelation and individual fixed effects by first differencing the equation 4.2.1, and used the

lagged dependent variables to capture the dynamic nature of LLPs. In the equation 4.2.2, the unobserved individual bank specific effect is correlated with the lags of dependent variables, which leads to the inconsistent of standard errors estimators. Therefore, by applying equation 4.2.2, the unobserved individual bank specific effects are removed. There are a great numbers of LLP empirical studies applied GMM for result measuring. Bouvatier & Lepetit (2012) applied GMM estimation to investigate the impact of LLP on bank lending; *Dimitrios et al., (2012)* applied GMM for examining the determinants of non-performing loans of Greek banking system; Laeven & Majnoni (2003) used it to analyse the cyclical patterns of big global commercial banks' LLP; and Perez et al., (2008) used it to examine the Spanish banks' incentives to LLP. Erickson & Whited (2002) argued that "the benefit of the two-step approach is that the numbers of equations and parameters in the non-linear GMM step do not grow with the number of perfectly measured regressor, conferring a computational simplicity not shared by the asymptotically more efficient one-step GMM estimators that we also describe". Therefore, this paper adopts a two-step GMM estimator, and STATA13, the econometric software is used to conduct the regression. The complete specification presents below:

$$LLPAA_{it} = \alpha_0\,(constant) + \alpha_1 LLPAA_{it-1} + \alpha_2 ETA_{it} + \alpha_3 EQAA_{it} + \alpha_4 REAA_{it} + \alpha_5 OTHERS_{it} + \alpha_6 LORES_{it} + \alpha_7 LLR_{it} + \alpha_8 GDPGR_{it} + \alpha_9\, UNEMPLOY_{it} + \alpha_{10} XEFF_{it} + \varepsilon_{it} \qquad \textit{Equation 4.2.3}$$

The Equation 4.2.3 is built up to investigate the loan loss provisioning behaviour of UK commercial banks. The variables are chosen specifically to test whether bank managers use LLP to achieve the incentives of income smoothing and capital management, also whether UK banks conduct loan loss provisioning rely on the business cycle. All the variables are scaled by total assets to reduce the size effect,

which may lead to the problem of heteroskedasticity. The variables are further discussed below.

$LLPAA_{it}$ (Loan Loss Provision to Average Asset): is the dependent variable of the model to represent the level of loan loss provisions of bank i in year t. In this paper, we also involve $LLPAA_{it-1}$, the lag term of $LLPAA_{it}$ as one of the independent variables to capture the autoregressive component in the emergence of time series persistency and capture adjustment costs which constrain complete adjustment to an equilibrium level (Fonseca & Gonzalez, 2008).

ETA_{it} (Earning before Tax to Average Assets): is an independent variable for testing the existence of income smoothing behaviour of banks. Earnings before tax is the difference between net operational profits and LLP, thus the changes of LLP influence the outcome of earning before tax. Bank managers tend to use LLP as a tool to even their earning over the accounting period. Bouvatier and Lepetit (2014) applied EBT to test the existence of income smoothing of banks, and found a positive relationship between LLP and EBT for banks with concentrated ownership structure. Some studies found positive relationship between the two. Hasan & Wall (2004) applied earning before tax and provision to total assets for investigating the existence of income smoothing behaviour of US and non-US banks, a positive relationship was also found for Canadian banks and proved the existence of income smoothing.

$EQAA_{it}$ (Equity to Average Assets): is used as an independent variable to test the incentive for bank to conduct capital management through LLP. Bouvatier & Lepetit (2014) applied $\frac{Equity_{ijt-1}}{Total\ Assets_{ijt}}$ to investigate the existence of capital management in European commercial banks within 2004 to 2009, it believed that banks are more

likely to use LLP for capital management while they have low regulatory capital in order to keep the adequacy of their capital ratio, thus it assumes banks conduct capital management through LLP if LLP was negatively correlated with $\frac{Equity_{ijt-1}}{Total\ Assets_{ijt}}$. However, there are a few limitations of their approach. First of all, $\frac{Equity_{ijt-1}}{Total\ Assets_{ijt}}$ can only test whether banks conduct Tier 1 capital management through LLP, it ignores banks' incentive towards Tier 2 capital management through LLP. Second of all, Tier 1 equities are mainly made-up with cash and other disclosed equity and reserves, such as nominal shares. If there was a negative correlation found between LLP and $\frac{Equity_{ijt-1}}{Total\ Assets_{ijt}}$, it can be either influenced by cash, which is indirectly influenced by LLP as changes of LLP influence retained earnings in the income statement while retained earnings are parts of cash, thus banks may deliberately change LLP to boost up cash to increase their Tier 1 capital; or it can be influenced by other disclosed equity and reserves, which most of them are mainly shares. If then the correlation between the two were proved to be negative, there is evidence of banks use LLP for capital management. Therefore, in order to get through the limitations to investigate whether banks use LLP for capital management, we involve three more independent variables: $REAA_{it}$, $OTHERS_{it}$ and $LORES_{it}$.

$REAA_{it}$ (Retained Earnings to Average Assets): is an independent variable we use to extend Bouvatier *et al.*, (2014)'s approach on testing the existence of capital management in banks. Retained earnings are part of cash in the equity of Tier 1 capital, we used $\frac{Retained\ Earnings_{it}}{Average\ Assets_{it}}$ to measure the change of retained earnings of bank i over time t, if it was correlated with LLP, then it proved the assumption of UK

commercial banks are likely to manipulate LLP to raise cash to increase Tier 1 capital to maintain their capital adequacy level.

$OTHERS_{it}$ (Other Equity to Average Assets): is the other independent we use to extend Bouvatier *et al.*, (2014)'s study on banks' incentives towards capital management. This variable is measured by $\frac{(Total\ Common\ Equity - Retained\ Earnings)_{it}}{Average\ Assets_{it}}$ and if it was correlated with LLP, then the assumption of banks manipulate LLP for capital management does not stand.

$LORES_{it}$ (Loan loss Reserves to Average Loans): Loan loss reserves (LLR) is counted as Tier 2 capital of banks under the Basel Accords, banks use the loan loss reserves to charge-off losses in their loan portfolio, that they adjust the LLR by building up loan loss provision to cover the expected future losses in loan (Brophy, 2011). In the study of Ng & Roychowdhury (2013), its result showed that bank failure risk is negatively associated with Tier 1 capital, while it is positively associated with Tier 2 capital and the association is stronger when an increasing of LLR was reported. They used LLR to total loans as an independent variable which measures "the changes in loan loss reserves as a percentage of total loans" (Ng & Roychowdhury, 2013) to conduct the regression. Its result supported the finding of Ahmed et al. (1999) that the abnormal increases in loan loss reserves reflects the incentive of banks to manage capital upwards, and proved that LLR are positively associated with Tier 2 capital and bank failure risk. If LLR was correlated with LLP, it will indirectly prove that LLP was associated with Tier 2 capital and imply the potential incentive of banks to achieve capital management through Tier 2 capital. Therefore, $\frac{LLR_{it}}{Average_{it}}$ is used as an independent variable to test the existence of capital management through Tier 2 capital.

LLR_{it} (Loan Loss Provision to Net Interest Revenue): is an independent variable that reflects the asset quality of banks. Net interest revenue for banks is the differences between the interest received from loans outstanding and interest payment to the customers' deposits. The higher the net interest revenue, the better investment decision banks have made. Due to the fact that the interest rates of banks' assets and liabilities can be under either fixed rate or floating rate, a bank who holds variable rates assets and liabilities are more vulnerable to the changes of interest rates, because the risk of their holding assets and liabilities is high and implies a higher potential of holding more loan loss provisions. Therefore, the ratio of loan loss provision to net interest revenue represents "the relationship between expected future losses in the banks' income statement and the interest income generated over the same period" (Kim & Mckenzie, 2010).

$GDPGR_{it}$ (GDP growth rate): is one of the macroeconomics independent variable for investigating the relationship between LLP and business cycle. It is the rate of growth of GDP, which is mainly driven by the changes of personal consumption, government spending, gross private investment and net exports. It indicates the health of economic environment of a country, when GDPGR goes up, it indicates the economic driven elements grow, thus the economy is booming and reduce the potential rate of loan defaulting, the same theory applies when GDPGR goes down, the economic driven elements decline leads to the economy busting and more likely to increase the loan defaulting rate. Banks either conduct procyclical provisioning, where they decrease the LLP when the economy is booming, and increase the LLP when the economy is busting; or conduct countercyclical provisioning, where they increase the LLP when the economy is booming, and decrease the LLP when the economy is busting. The result of empirical results are mixed, Bouvatier & Lepetit

(2008) and Bouvatier & Lepetit (2012) found the existence of procyclical provisioning, that a positive relationship between LLP and GDPGR ; Jimenez and Saurina (2005), Borio *et al.*, (2001) and Bikker and Metzemakers (2005) found the existence of countercyclical provisioning.

$UNEMPLOY_{it}$ (Unemployment rate): is the other macroeconomic independent variable, which is also for investigating the correlation between business cycle and LLP. Unemployment rate, different from GDPGR which indicates the current changes of the business cycle instead of the degree of changes (Bikker & Hu, 2002). It can be a supplemental variable for observing the interaction between business cycle and LLP. Anandarajan & Hasan (2003) and Bikker and Metzemakers (2005) found a positive relationship between LLP and unemployment rate, which indicates the existence of procyclical provisioning.

$XEFF_{it}$ (X-efficiency): is the most important independent variable included for this study to investigate whether bank efficiency has an impact on loan loss provisioning. There are a few papers studied about the correlation between problem loans or LLP with bank efficiency. Berger & Humphrey (1991) found that failing banks are more likely located far from the efficiency frontier, where failing banks normally hold high ratios of problem loans and they tend to have low cost efficiency. Resti (1995) even found that the correlation between the two in non-failing banks. DeYoung (1997) found that there is a positive correlation between cost efficiency and the management quality of banks, while a few latter studies found a very strong correlation between management quality of banks and asset quality rate. Therefore, a negative correlation between cost efficiency and problem loans is proven. We tempted to found a significant negative correlation between the cost efficiency and

LLP as the previous findings. The methodology and result measures of X-efficiency is further discussed in the section of 4.3, X-efficiency Modelling and Analysis.

ε_{it} is a standard error of the model.

4.3 X-efficiency Modelling and analysis

Modelling

Farrell (1957) stated there are two components reflect the efficiency of a firm: allocative component and technical component; wherein allocative component reflects the ability of a firm to use the inputs in optimal proportions with the given price information and production technology; technical component reflects the ability of a firm to use the given set of inputs to generate maximal output. It is necessary to introduce a production frontier to compute the two efficiency measures above, and the frontier can be obtained parametrically, such as Stochastic Frontier Analysis (SFA), or non-parametrically, such as Data Envelopment Analysis (DEA). This paper will apply parametrically SFA to compute the efficiency measure instead of DEA, because DEA takes no account of measuring statistical noise and random errors, and "all derivations from the frontier are assumed to be the result of technical inefficiency" (Coelli T. J. *et al.*, 2005). There are plenty of studies conduct Stochastic frontier measures, such as Fries & Taci (2005), Battese (1992) and Cebenoyan (1993).

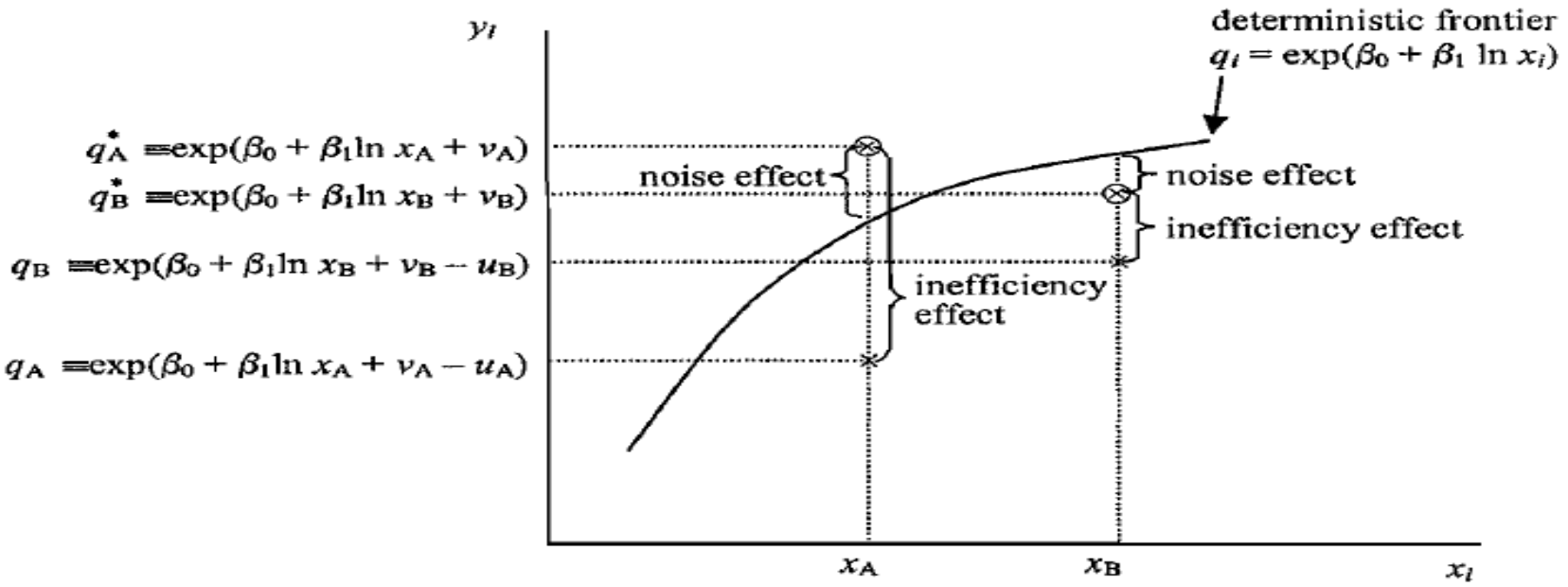
The Cobb-Douglas stochastic frontier model is formed as below (Coelli T. J. *et al.*, 2005):

$$lnq_i = \beta_0 + \beta_1 lnx_i + v_i - u_i \ ,$$

$$Or \qquad q_i = \exp\left(\beta_0 + \beta_1 lnx_i + v_i - u_i\right)$$

$$u_i > 0 \ , \ v_i \ may \ take \ any \ value \qquad \textit{Equation 4.3.1}$$

Figure 4.3: Stochastic Frontier (Battese & Coelli, 1992)



In which the estimator $\beta_0 + \beta_1 lnx_i$ measures deterministic component, $v_i - u_i$ measures the error term which v_i measures traditional random noise and u_i measures the technical inefficiency. The frontier Figure 4.3 was plotted base on the input and output of firm A and firm B (the equation of the firms show on the figure x), and the deterministic frontier shows the dimishing returns to scale. The frontier output of firm A, $q *_A$ lies beyond the frontier when $v_A > 0$, while the frontier output of firm B, $q *_B$ lies below the frontier when $v_B < 0$; and the observed output of firm A, q_A appears below the frontier when $v_A - u_A < 0$, while the observed output of firm B, $q *_B$ further below the frontier as $v_B - u_B < 0$ as firm A. Technical efficiency (TE) under the most common output-oriented measure presents as below (Coelli T. J. *et al.*, 2005), where TE measures should be between the value of 0 to 1:

$$TE_i = \frac{q_i}{\exp\left(x'_i\beta + v_i\right)} = \frac{\exp\left(x'_i\beta + v_i - u_i\right)}{\exp\left(x'_i\beta + v_i\right)} = \exp\left(-u_i\right) \qquad \textit{Equation 4.3.2}$$

Xiang et al., (2011) applied a "mixed two-stage efficiency methodoloy" on their panel data of 23 banks in UK, Canada an Austrilia between 1988 and 2008. They focused on estimating technical, profit and cost efficiency of the panel data by SFA, involved uncontrollable environment factors in the first stage, and in the second stage, they apply panel regreesion model to investigate the impact of efficiency to internal management. In this paper, we only conduct the first stage efficiency investigation of Xiang et al., (2011), because this paper aims to investigate the correlation of TE estimates and banks' LLP performance by using TE estimates as one of the independent variables, and the involved uncontrollable environment factors for TE estimating are GDPGR, MSG, CR5 and ASSGDP to see whether macroeconomics has an impact of the efficiency of UK banks.

GDPGR: is the GDP growth rate, which is generally used for showing the economic health of a country base on various aspects, such as government expenses, personal consumptions, net export and so on.

MSG: is annual Broad Money Growth, which is the measure of money supply including not only narrow money, but also scriptural money of banks and other sources of money.

CR5: is the concentration ratio of the market shares of the five biggest firm in the market.

ASSGDP: is measured by $\frac{Summed\ Average\ Assets\ of\ Banks}{GDP} \times 100\%$ to indicate the size of the bank system of a country.

is the TE estimates are measured under a translog cost function in the following form:

$$\ln TC = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln y_{it} + \sum_{j=1}^{n} \beta_j \ln p_{jt} + \frac{1}{2}\sum_{i}^{n}\sum_{i}^{k} \delta_{ik} \ln y_{it} \ln y_{kt}$$
$$+ \frac{1}{2}\sum_{j}^{m}\sum_{h}^{m} \gamma_{jh} \ln p_{jt} \ln p_{ht} + \sum_{i}^{n}\sum_{j}^{m} \delta_{ij} \ln y_{it} \ln p_{jt} + \ln \varepsilon_{it}$$

Equation 4.3.3

Where, y_{it} and y_{kt} denote the output prices, p_{it} and p_{ht} denote the output prices (need to expand), and ε is the error term. The homogeneity condtion is satisfied when:

$$\sum_{j}^{m} \beta_j = 1 \, , \sum_{j}^{m} \delta_{ij} = 0 \, , \sum_{j}^{m} \gamma_{jh} = 0 \qquad \textit{Equation 4.3.4}$$

According to See & Coelli (2012), "Gamma is the ratio of the variance parameters of the random errors and technical efficiency effects", the measure of gamma is between 0 to 1, and the ideal result should be between 0.2 to 0.7 (*Equation 4.3.5*).

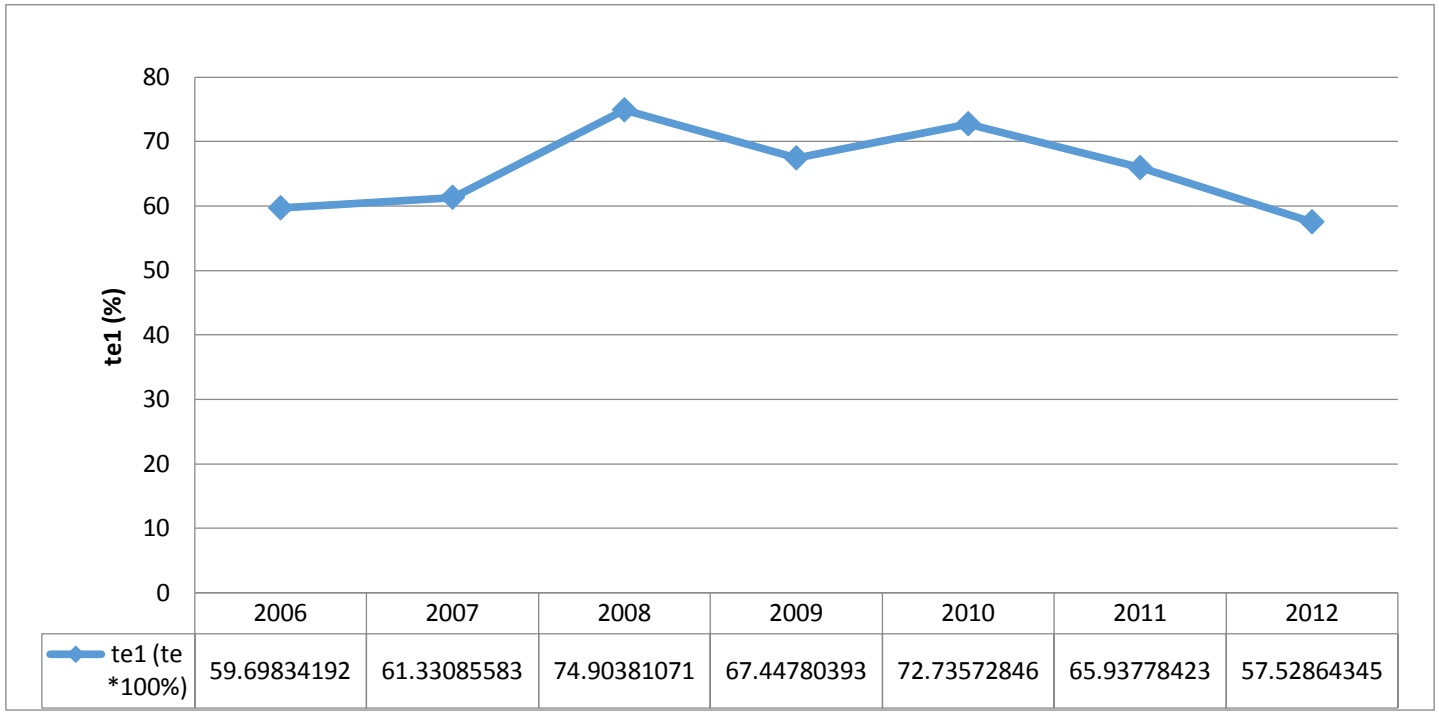
$$u_{it} = (1 - y)\left[\delta_i + \delta_i \sum z_i\right] + \varepsilon_{it} y \qquad \textit{Equation 4.3.5}$$

4.4 X-Efficiency Result Analysis

Our study used STATA 13 to test the SFA translog cost function to test the efficiency of the UK commercial banks during the period of 2006 and 2012. The TE score can be used to reflect how well a bank converts its inputs into outputs (Zeitun & Benjelloun, 2012). The Summary of TE estimators (Appendix 1) shows that the mean efficiency score of the 187 observations over the period between 2006 and 2012 is around 0.6577, which means the UK commercial banks should approximately reduce 34% of their inputs to achieve efficiency in general. The standard deviation of the dataset is 0.1520, where the minimum TE score is 0.010 and the maximum TE score is 0.880 which shows that banks with the minimum TE score need to decrease about 99.1% of their inputs to achieve efficiency, and banks with the maximum TE score should decrease only around 12% to achieve efficiency. We used the average efficiency scores each year between 2006 and 2012 to plot a line chart (Figure 4.4) for showing the efficiency changes of all selected 29 UK commercial banks pre- and post-global financial crisis. We can see that the efficiency of banks did not change much between 2006 and 2007 with only a slight increase. We then see a rapid increase of efficiency of the selected banks during 2007 to 2008, which then dropped nearly 10% from the peak of 2008 in 2009. Although the sub-prime crisis took place and Northern Rock was collapsed in 2007, but most of the UK banks were collapsed or required for financial rescue in late 2008. Therefore, the efficiency of banks decreased between 2008 and 2009. Then the efficiency of banks started to increase again between 2009 and 2010, while government published the rescue package for banks, the Bank of England released the Banking Act 2009 which introduced Special Resolution Regime, a permanent regime to help banks to recover from the crisis, FSA chairman Lord Turner and both

labour and conservative party announced their regulation reform plans in 2009. That is why the general efficiency of banks seem to recover during 2009 and 2010. However, since 2010, the efficiency of banks were continuously decreasing from 2010 to 2012. That is due to the Eurozone debt crisis took place in 2010, countries such as Greece, Portugal, Ireland and Spain were facing trouble to finance themselves (BBC News Business, 2012). According to the Financial Stability Report in December 2011(Bank of England, December 2011), it stated that the bank risk and sovereign from the Eurozone countries was still remain to threaten the UK financial stability since it took place in 2010. Therefore, the general efficiency of UK banks decreased in 2011. The Financial Stability Report in June 2012 (Bank of England , June 2012) stated that UK banks tempted to hold higher capital level to improve their bank resilience to pervent the Eurozone sovereign spill over, it leads to decline in expected profit of UK banks while the cost of development funding is high and the progress of capital building is slow. Therefore, the general efficiency of UK banks continued decreasing in 2012.

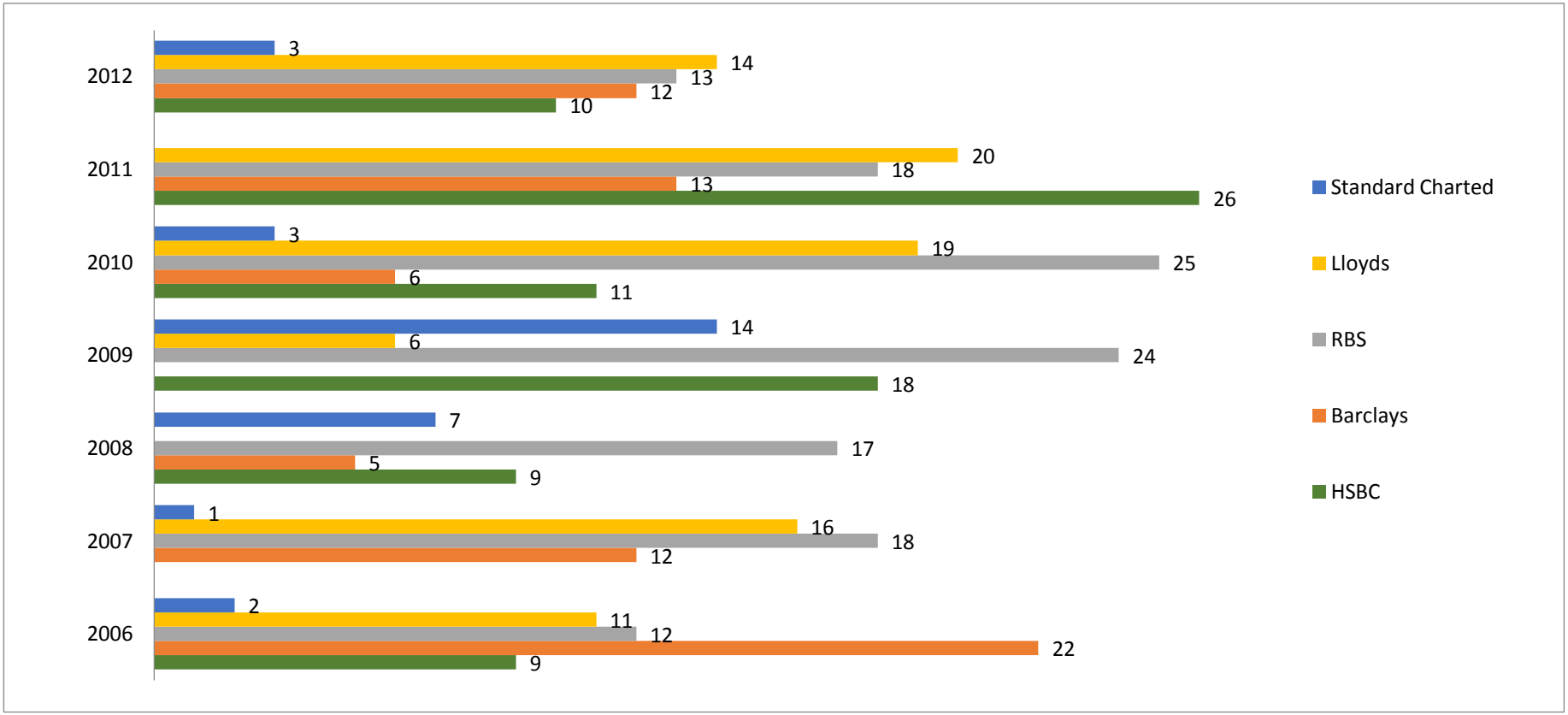
Figure 4.4: Overall Banks' Efficiency pre- and post- global financial crisis during 2006 to 2012



Furthermore, We ranked the efficiency scores of the selected UK commercial banks during 2006 and 2012 to see the changes of their efficiency ranking pre- and post-global financial crisis (Appendix 2(1-6)), where the closer the ranking to "1", the more efficient the bank is. There are some missing values on the some observations because unbalance panel dataset is applied for this study. We plotted a cluster bar chart base on the efficiency scores ranking we just made to see how efficiency the biggest 5 UK commercial bank groups were during 2006 to 2012 (Figure 4.5).We can see that the most efficient bank of the five banks is Standard Charted Bank. Most of its efficiency rankings were remain top 3 of all banks except in 2008, its ranking dropped from 1st in 2007 to 7th in 2008, and further dropped to 14th in 2009. The most inefficient bank is RBS, although it is never the most inefficient ranked bank within the 5 banks, its efficiency rankings were all above top 10 of all banks. In fact, RBS announced the biggest loss in UK corporate history with £24billion in 2008 (BBC News, 2008), and in 2009, it announced £3.6bn losses for 2009 and struggled to pay the billions of bad loans it had (BBC News, 2010). We can see from the chart that after the rescue, the efficiency rankings of RBS was from 14th in 2008 rapidly dropped to 24th in 2009 and 25th in 2010, and became one of the least efficient banks, although its efficiency rankings climbed up since 2010 and reached to the level of pre-crisis at 12th in 2012. Therefore, we considered RBS as the most inefficiency bank within the biggest 5 banks. Similar to RBS, most of the efficiency rankings of Lloyds bank were above top 10 except in 2009 it was ranked as the 6th most efficient bank of 28 banks. The efficiency rankings of HSBC were very fluctuating over the years. The highest efficiency ranking of HSBC was 9th in both 2006 and 2008, then it massively dropped to 18 in 2009 with a slightly improve in 2010, which is due to HSBC was facing $26bn bad debt losses in 2009 and the

losses declined to $14bn in 2010. But soon it became the least efficient bank of all banks in 2011, while the bank needed to set aside fine payment for mortgage mis-selling before the crisis take place, and it paid out $4.2bn in 2012 for coving the fine (BBC News Business, 2013) and its ranking climbed back to top 10 of all banks. Barclays was one of the few banks that turned down the government bailout in 2008, it was ranked as the 5th and 6th most efficiency banks in 2008 and 2010, while it was ranked above top 10 in the rest of the years. The reason why its ranking climbed up in 2008 is due to it sold its "iShare" unit for £4.4billion and announced a profit while it passed all the regulatory stress tests (Menon & MacAskill, 2009).

Figure 4.5: Efficiency Ranking for the Biggest 5 bank groups during 2006 to 2012

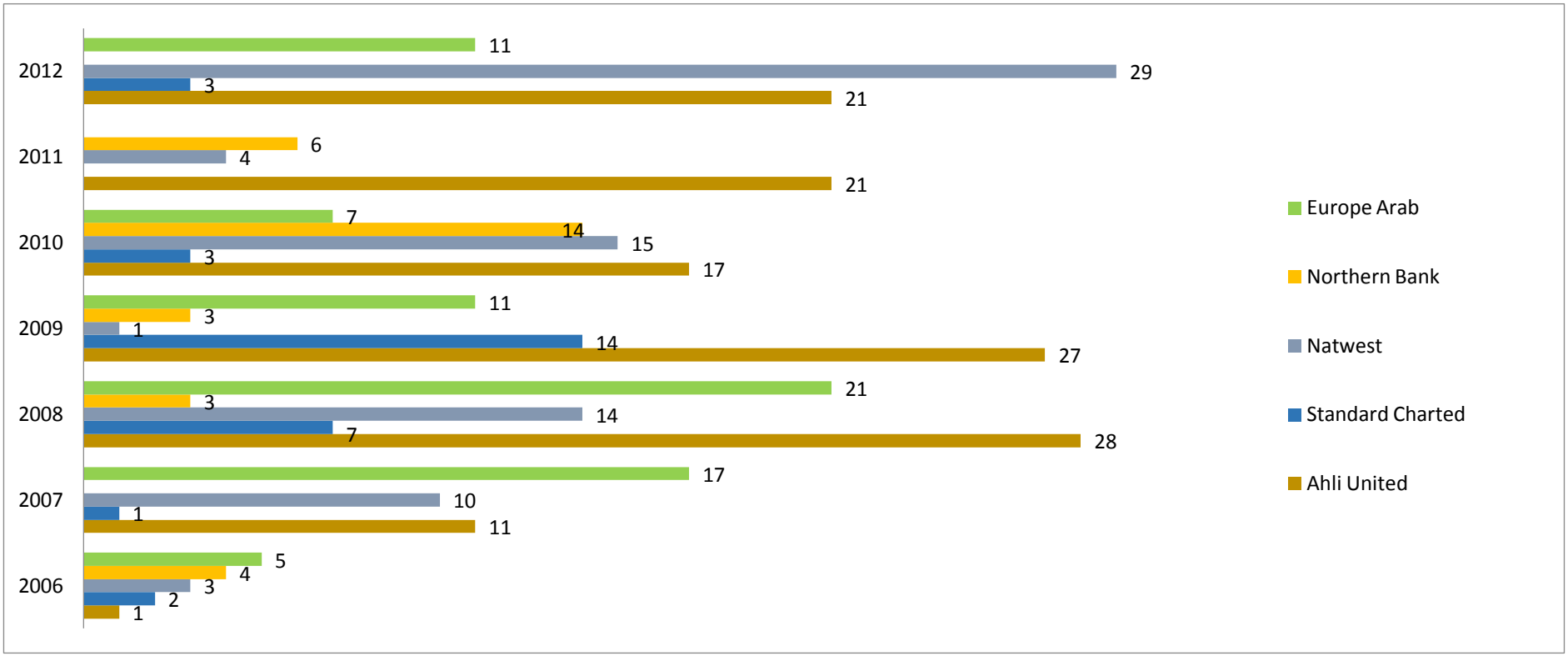


We also plotted a cluster bar chart to see the changes pre- and post-global financial crisis of efficiency ranking for the most efficient banks in 2006. We can see on the chart that the most efficient bank in 2006 was Ahli United bank, its efficiency rankings dropped rapidly since then and became one of the inefficient banks in the later years, in 2008. It was even ranked as the 28th efficient bank out of 28 banks and became the most inefficient banks. Standard Charted, one of the biggest five banking groups in the UK which is ranked as the 2nd efficient bank in 2006. It was ranked as the most efficient bank in 2007, although its rankings then dropped to 14 in 2009 due to the 17.5% increase of operating expenses and 23% decline of pre-tax profit from 2008 (Standard Chartered, 2009). Natwest is ranked as the 3rd efficiency bank in 2006 and its rankings were very fluctuating. Its rankings started to drop in 2007 and 2008, it was massively improved in 2009 but then started to drop again and it was ranked as the most inefficiency bank in 2012. Northern Bank was ranked the 4th efficient bank in 2006, its rankings were stable compare to the rest of the banks and ranked as top 10 over the years except in 2010, it was ranked as the 14th efficient bank. The fifth ranked efficient bank in 2006 was Europe Arab. Its efficiency rankings, like most of other banks, dropped rapidly since the global financial crisis took place that its ranking was 21 out of 28 banks in 2008. Although the rankings in the later years improved, they were never as good as the ranking before the crisis.

In conclusion, the changes of the efficiency of UK banks are various pre- and post-global financial crisis, most of the banks tend to show a decrease in efficiency performance during 2008 to 2010, except banks such as Standard Chartered and Barclays. Also, we divided the banks into two groups to analyse, which are the biggest 5 banking groups and the most efficient banks in 2006. We found that the efficiency of the biggest 5 banking groups are neither the most efficient nor inefficient

banks in the market, although some of them with very inefficient ranking during the global financial crisis period. The most efficiency banks in 2006, most of them were not remain to be efficient anymore after the crisis took place and the changes of efficiency were various.

Figure X: The Efficiency Ranking for The Top 5 Efficiency banks in 2006



5. Result Analysis

We used GMM to conduct this study due to two important reasons. First of all, we wanted to involve lag terms to observe the dynamic nature of LLP. Secondly, GMM allowed us to test whether the variables we chose are endogenous, exogenous or predetermined to our dependent variable, which is LLP. We assumed that bank efficiency is endogenous to LLP in this study. Berger & DeYoung (1997) conducted their study on the relationship between problem loans and bank efficiency, and they used four hypotheses to test the correlation between problem loans and cost efficiency of banks: the bad luck hypothesis assumes that problem loans are increased due to external events which increase the expenses for banks to manage their bad loans; the bad management hypothesis assumes that poor internal management leads to cost inefficiency and thus increases bad loans; the skimping hypothesis assumes that both cost efficiency and loan quality of banks are influenced by resources allocated; and the moral hazard hypothesis assumes that banks with low capital tend to have more risky loan portfolios and increase bad loans. They avoid involving non-performing loans as one of the variables in the cost function, because "it is exogenous to the extent that the non-performance is from bad luck, and endogenous to the extent that the non-performance is from bad management or skimping" Berger & DeYoung (1997). Their results are mixed. On the one hand, they support the bad luck hypothesis and indicate that high levels of bad loans increase the company's cost to manage them thus reducing the bank efficiency. On the other hand, they also support the bad management hypothesis of their selected banks in general and indicate that decreases in cost efficiency normally follow with increases of the non-performing loan. Its subset data which involve consistently efficient banks over time also supported the skimping hypothesis

and indicated that both cost efficiency and quality of loans are increased by the amount of allocated resources. Therefore, its result proves that problem loans can be either endogenous or exogenous to non-performing loans. Owing to the fact that LLP is the "non-expense" cash banks set aside for problem loans, our study assumed that XEFF might be endogenous to LLP.

We chose two instrument variables for controlling the potential endogeneity issue of XEFF, which are AASS (average assets) and COST (cost to income ratio). We believe they are good instruments for TE because AASS indicate how much the bank owns in general every year; the more assets the bank owns, the more efficient they are and implies the scale of economy. COST indicates how efficient the bank is by converting its cost (input) into its income (output); the higher the ratio, the less efficient the bank is.

There are two stages of our regression: In the first stage, we use ivreg2 to test whether AASS and COST are good instruments for XEFF. In the second stage, we run the actual GMM test with xtabond2. There are 7 tests to pass at the first stage. The first test is for examining whether the instruments are individually significant. The result (Figure 5.1) shows that both COST AND AASS are highly significantly[2] with p-value = 0, thus both instruments are individually significant. They are also positively correlated with XEFF. Theoretically the relationship between COST and XEFF should be negative, and our result shows that it is positive. We believe it implies the potential that high market power exists due to the fact that the UK

2

This paper considers 3 significance levels: $p \leq 1\%$ is highly significant, $p \leq 5\%$ is significant and $p \leq 10\%$ is weakly significant.

banking system is dominated by the 5 biggest groups, and they do not pay much effort to improve their efficiency and cost. We believe that is the reason why COST is positively correlated with XEFF.

Figure 5.1: Regression with XEFF as dependent variable

			Number of obs	=	90
			F(11, 78)	=	21
			Prob > F	=	0
Total (centered) SS	=	98040.68981	Centered R2	=	0.5527
Total (uncentered) SS	=	156537.1734	Uncentered R2	=	0.7199
Residual SS	=	43853.88323	Root MSE	=	23.71

XEFF	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LLPAA						
L1.	2.887194	1.482808	1.95	0.055	-0.06485	5.839238
LORES	-1.07275	0.966811	-1.11	0.271	-2.99753	0.85202
GDPGR	-0.10953	0.925719	-0.12	0.906	-1.95249	1.733439
UNEMPLOY	15.82755	2.019095	7.84	0	11.80784	19.84726
ETA	1.967286	0.880837	2.23	0.028	0.213675	3.720897
REAA	0.001045	0.001096	0.95	0.343	-0.00114	0.003227
OTHERS	-0.01573	0.006247	-2.52	0.014	-0.02817	-0.00329
EQAA	-2.81572	0.787277	-3.58	0.001	-4.38307	-1.24837
LLR	0.122349	0.041414	2.95	0.004	0.0399	0.204797
COST	0.470179	0.118652	3.96	0	0.233962	0.706397
AASS	2.52E-05	4.80E-06	5.24	0	1.56E-05	3.47E-05
_cons	-94.6266	11.18037	-8.46	0	-116.885	-72.3682

The second test is to examine whether the instruments are jointly significant. The result Figure 5.2 shows that the F-statistic is highly significant with prob > F = 0.0000, hence the two instruments are highly jointly significant.

Figure 5.2: F-statistics test

F test of excluded instruments:
F(2, 78) = 24.38
Prob > F = 0.0000

Angrist-Pischke multivariate F test of excluded instruments:
F(2, 78) = 24.38
Prob > F = 0.0000

The third test is the Kleibergen-Paap Wald F statistic test. Arndt, Jones, & Tarp (2010) described the Kleibergen-Paap Wald F statistic test as being for testing "the strengths of the partial correlation between the included endogenous variable and the excluded instruments". Baum, Schaffer, & Stillman (2007) suggested that users should apply either with the Staiger and Stock (1997) "rule of thumb" in which the declaring instruments are considered to be weak if the first stage F-statistic of a model with a single endogenous regressor should be less than 10, or the critical values complied by Stock-Yogo (2005). Our model applied both. The result (Figure 5.3) shows that the Kleibergen-Paap Wald rk F statistic is 24.38 which passed Staiger and Stock's requirement. Stock & Yogo (2005) provides tables of critical values depending on the estimator being used; and weak instrument asymptotic distributions are obtained in these critical values (Staiger and Stock, 1997). We tested the Stock-Yogo weak ID test for our fourth test to confirm whether our instruments still remain strong under the Stock-Yogo test. The instruments are considered to be strong if the Kleibergen-Paap Wald rk F statistic is bigger than the critical values of the Stock-Yogo weak ID test. The critical values for our model are listed in Figure 5.3; the 10% maximal bias rate of instrument variable size is 19.93, and our Kleibergen-Paap Wald rk F statistic is 24.38 which is above the critical values and implies our instruments are strong enough to identify our equation.

Figure 5.3: Kleibergen-Paap Wald test and Stock-Yogo weak ID test

Summary results for first-stage regressions

			(Underid)		(Weak id)
Variable	F(2, 78)	P-val	AP Chi-sq(2)	P-val	AP F(2, 78)
XEFF	24.38	0	56.27	0.0000	24.38

NB: first-stage test statistics heteroskedasticity-robust

Stock-Yogo weak ID test critical values for single endogenous regressor:

10% maximal IV size	**19.93**
15% maximal IV size	**11.59**
20% maximal IV size	**8.75**
25% maximal IV size	**7.25**

Source: Stock-Yogo (2005). Reproduced by permission.

NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

Underidentification test

Ho: matrix of reduced form coefficients has rank=K1-1 (underidentified)

Ha: matrix has rank=K1 (identified)

Kleibergen-Paap rk LM statistic Chi-sq(2)=7.39 P-val=0.0249

Weak identification test

Ho: equation is weakly identified

Cragg-Donald Wald F statistic	**11.05**
Kleibergen-Paap Wald rk F statistic	**24.38**

Stock-Yogo weak ID test critical values for K1=1 and L1=2:

10% maximal IV size	**19.93**
15% maximal IV size	**11.59**
20% maximal IV size	**8.75**
25% maximal IV size	**7.25**

Source: Stock-Yogo (2005). Reproduced by permission.

NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

The fifth test is the Stock-Wright LM S Statistic which is based on the reduced form regression and is robust to the presence of weak instruments (Baum et al., 2007). We applied this test to see whether the instruments are jointly weak. We obtained a p-value of 0.1279 (Figure 5.4), which fails to reject the null hypothesis. However, Roodman (2009) warned that the Stock-Wright test should be used with caution as its results can sometimes be confusing and misleading. Therefore, we failed the test, and we do not consider our instruments to have the conditions of orthogonality.

Figure 5.4:

Weak-instrument-robust inference

Tests of joint significance of endogenous regressors B1 in main equation

Ho: B1=0 and orthogonality conditions are valid

Anderson-Rubin Wald test	F(2,78)=	1.74	P-val=0.1826
Anderson-Rubin Wald test	Chi-sq(2)=	4.01	P-val=0.1346
Stock-Wright LM S statistic	Chi-sq(2)=	4.11	P-val=0.1279

NB: Underidentification, weak identification and weak-identification-robust

The sixth test is the Hansen J test and it is under a 2-step GMM estimation. Hansen J test is for evaluating the over-identifying restrictions and possibly weak instrumental variables employed. We conducted the test to check whether our applied instruments are valid and whether an absence of correlation exists between the model's error term and the applied instruments. The p-value of our Hansen test was 0.1587, which is approximately 0.2, where Roodman suggested the benchmark of Hansen test should be between 0.2 and 0.7 ideally. Therefore, we passed the test. Our final test of the first stage, the seventh test, is the endogeneity test for testing whether XEFF is endogenous to LLP. The p-value of the test was 0.2612 which is insignificant according to the 10% significant level. Therefore, we reject the null

hypothesis that XEFF is endogenous to LLP, and due to the fact that XEFF is actually exogenous to LLP, we needed to conduct a second stage regression of xtabond2 test to conduct another two-step GMM regression that treats XEFF as an exogenous variable in the regression.

Figure 5.5 (1): 2-step GMM estimation

			Number of obs	=	90
			F(10, 79)	=	0.89
			Prob > F	=	0.5447
Total (centered) SS	=	165.5890155	Centered R2	=	0.0394
Total (uncentered) SS	=	192.6473901	Uncentered R2	=	0.1743
Residual SS	=	159.0615221	Root MSE	=	1.329

LLPAA	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
XEFF	-0.01639	0.012382	-1.32	0.185	-0.0406634	0.007874
LLPAA						
L1.	-0.04884	0.032859	-1.49	0.137	-0.1132453	0.015559
LORES	-0.06473	0.046022	-1.41	0.16	-0.1549322	0.02547
GDPGR	-0.05376	0.043067	-1.25	0.212	-0.1381723	0.030646
UNEMPLOY	0.36525	0.289218	1.26	0.207	-0.2016065	0.932106
ETA	0.053787	0.048984	1.1	0.272	-0.0422198	0.149794
REAA	-7.5E-05	0.000036	-2.1	0.036	-0.0001459	-4.93E-06
OTHERS	-0.00016	0.00024	-0.68	0.499	-0.0006332	0.000308
EQAA	-0.10916	0.049004	-2.23	0.026	-0.2052088	-0.01312
LLR	0.000451	0.001625	0.28	0.781	-0.0027339	0.003636
_cons	-0.82486	1.352792	-0.61	0.542	-3.476279	1.826568

Underidentification test (Kleibergen-Paap rk LM statistic):		7.389
	Chi-sq(2) P-val =	0.0249
Weak identification test (Cragg-Donald Wald F statistic):		11.052
(Kleibergen-Paap rk Wald F statistic):		24.383
Stock-Yogo weak ID test critical values:	10% maximal IV size	19.93
	15% maximal IV size	11.59
	20% maximal IV size	8.75
	25% maximal IV size	7.25
Source: Stock-Yogo (2005). Reproduced by permission.		
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.		
Hansen J statistic (overidentification test of all instruments):		1.987
	Chi-sq(1) P-val =	0.1587

Figure 5.5 (2):

-endog- option:

Endogeneity test of endogenous regressors: 1.263

Chi-sq(1) P-val = 0.2612

Regressors tested: XEFF

Instrumented: XEFF

Included instruments: L.LLPTA LORES GDPGR UNEMPLOY ETA RETA OTHERS EQTA LLR

Excluded instruments: COST AASS

Our second stage regression was GMM regression and we used it to analyse UK banks' incentive of using LLP. We applied the XTABOND2 command on STATA, which was created by David Roodman. Arellano-Bond built up the difference GMM estimator in 1991, and later Arellano-Bover and Blundell-Bond made the additional assumption that "first difference of instrument variables are uncorrelated with the fixed effects" (Roodman, 2009), and it is called system GMM estimators; Roodman introduced XTABOND2 to implement system GMM.

The summary statistics of the chosen variables are presented in Figure 5.6; the observations of all the variables are between 151 and 189. The mean of Retained Earning to Average Asset was about 461%, and the mean of other Tier 1 equity (OTHERS) was around 19% over 2006 to 2012. Tier 1 capital of banks is the sum of Retained earnings and other Tier 1 equity, thus it implied the potential of banks to achieve their Tier 1 capital requirement through retained earnings instead of other Tier 1 equity during 2006 to 2012. The standard deviation of REAA and OTHERS are around 1679 and 390, both of which are exceptionally high. This result indicates that banks manage their Tier 1 capital in various ways.

Figure 5.6: Summary statistics of the chosen variables

Variable	Obs	Mean	Std. Dev.	Min	Max
LLPAA	189	0.5996	1.3914	-2.9845	11.3023
ETA	151	0.7526	5.7398	-38.3824	16.5824
EQAA	189	11.5789	30.0925	1.238	384.773
REAA	152	460.9131	1679.147	-425.6518	14447.52
OTHERS	189	18.5282	390.3675	-3791.134	2605.557
LORES	189	1.2652	2.8574	-7.3814	20.3463
LLR	160	65.3344	55.1824	0.323	380.952
GDPGR	189	0.3858	2.6668	-5.1704	3.4272
UNEMPLOY	189	6.7693	1.2221	5.3000	7.9000
XEFF	187	30.9670	33.6707	0.0092	88.0202

The result of our second stage GMM is shown in Figure X; there were 91 observations, the number of instruments is 4, which is smaller than our numbers of groups which is 24. We planned to test the incentives of UK banks to conduct loan loss provisioning. We input LLPAA L1, a lag variable of LLPAA to test whether LLP is influenced dynamically. We chose GDPGR (GDP growth rate) and UNEMPLOY (unemployment rate) to see whether banks conduct loan loss provisioning in a procyclical way or a countercyclical way. ETA (Earnings before Tax to Total Asset) is chosen to test the existence of income smoothing behaviour in UK banks. EQAA (Equity to Average Asset), REAA (Retained Earnings to Average Asset), OTHERS (Other Equity to Average Assets) and LORES (Loan loss Reserves to Average Loans) were chosen for investigating the existence of capital management. LLR (Loan Loss Provision to Net Interest Revenue) was applied to indicate the quality of loans. XEFF (technical efficiency) was applied to test whether LLP is influenced by the bank efficiency. We assumed that bank efficiency was endogenous to LLP in the first stage test, and we rejected the null hypothesis, therefore we will continue our investigation by putting XEFF in the model as an exogenous variable.

The result of the lag term of LLPAA, LLPAA L1. was insignificant with the p-value of 0.309. We ran an Arellano-Bond test, which is for testing autocorrelation with the null hypothesis that the model has no autocorrelation. The p-values under both AR(1) and AR(2) are 0.162 and 0.216 so that both of them failed to reject the null hypothesis. Therefore, there is no autocorrelation between LLPAA and its lag terms. Although Roodman (2009) mentioned that users should expect autocorrelation for AR(1) due to mathematical considerations. We considered that because our research covers the pre- and post-financial crisis period, there might be rapid changes of LLP for different banks in different years.

The result showed that UNEMPLOY is positive and significant[3] with a p-value of 0.016, thus indicating that UK banks conducted procyclical provisioning during 2006 to 2012, while GDPGR is insignificant with a p-value of 0.314. There are plenty of studies which only use GDP growth rate to investigate the macroeconomic impact to LLP, but there are also some criticisms about it as a variable. Bikker & Metzemakers (2002) applied unemployment rate in addition to GDP growth rate to conduct their research on loan loss provisioning, because they thought that unemployment rate "captures longer term imbalances in the economy". Kearns (2003a) argued in his study that decreases in economic growth may not be sufficient without accompanying increases in unemployment to generate a sharp deterioration in the asset quality of the credit institutions. In fact, from our plotted graph Figure 2.3, it showed a significant correlation between LLP and unemployment rate. Therefore, we used unemployment rate on its own to define whether the provisioning of UK banks has a cyclical pattern, and it showed that UK banks conducted procyclical

3. For GMM, we also considered three significant levels: p-value ≤ 0.01 is highly significant, p-value ≤ 0.05 is significant and p-value ≤ 0.10 is weakly significant.

provisioning during the period of 2006 to 2012. We believe it is due to the fact that Basel II required banks to build up their LLP for only "expected future losses", although both the Basel committee and UK government announced their proposal to change the procyclical provisioning approach of banks, but those proposals were not officially implemented as new rules until 2013. Therefore, UK banks were conducting procyclical provisioning during the period of 2006 to 2012.

Our result for EBT is insignificant with a p-value of 0.114, which rejected the assumption that UK banks have an incentive to conduct income smoothing through LLP. It is not surprising for us to find such a result since the UK is one of the G-10 countries and has been adopting the Basel Accords since the 90s. Basel II introduced IAS 39 to stop banks from income smoothing by requiring them to build up their LLP based on "fair value" measures. Also, UK used to have a FSA before 2013 who acted as a bank supervisor to monitor the behaviours of banks. Therefore, we believe it is possible that UK banks did not conduct income smoothing during 2006 to 2012.

We have also found no evidence for capital management for UK banks. The result of EQAA, REAA AND LORES are all insignificant with the p-values of 0.202, 0.262 and 0.109, and the only significant variable is OTHERS of which the p-value is 0.025. The result indicates that UK banks did not use LLP to adjust the outcome of retained earnings for boosting up the Tier 1 capital. It also indicated that UK banks did not use LLP to increase the Tier 2 capital. Thus, the null hypothesis that UK banks conduct capital management through LLP was rejected. In fact, since the Basel II was launched in 2001, it restricted banks from holding too much LLP, causing many banks to change their financial structure to maintain their capital level through other means, such as wholesale fund market and share markets. Therefore, we believe

there might be a potential for UK banks to have used LLP for the incentive of capital management before the Basel II was launched, but not afterwards. The variable of OTHERS was significant and positively correlated to LLP which might indicate the potential existence of market signalling. Due to the fact that most of the other equities in Tier 1 capital are shares, Beaver and Engel (1996) found that increases of LLP can be a good sign only when the problem of loan default exists in the market. The global financial crisis took place as of 2007 and a loan default problem existed pre and post the crisis. Therefore, a signification correlation between other Tier 1 equity and LLP might imply the existence of market signalling.

XEFF was found to be significant with a p-value of 0.019 and a negative correlation with the LLP, which indicates that the bank holds more LLP when the bank becomes less efficient. There are plenty of studies which proved this to be true; Berger & Humphrey (1992) found a negative correlation between cost efficiency and LLP for failing banks, while Resti (1995) also proved the existence of this correlation for non-failing banks. Therefore, we believe that the UK banks are just like the other banks that Berger & Humphrey and Resti investigated previously, wherein their LLP is negatively influenced by their efficiency. And the variable LLR was insignificant with a p-value of 0.703, which indicated that LLP was not influenced by the quality of assets during 2006 to 2012.

In conclusion, our result found that UK commercial banks were provisioning procyclically during the period of 2006 to 2012. We found no evidence of income smoothing and capital management, but a potential of market signalling. We also found that the efficiency of UK commercial banks was negatively correlated to their provisioning.

Figure 5.7: second stage GMM

Group variable: bankid	Number of obs	=	91
Time variable : Year	Number of groups	=	24
Number of instruments = 16	Obs per group: min	=	1
Wald chi2(10) = 37.18	avg	=	3.79
Prob > chi2 = 0.000	max	=	6

LLPAA	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
LLPAA						
L1.	0.7677511	0.7540427	1.02	0.309	-0.7101454	2.245648
LORES	-0.1141397	0.0712617	-1.6	0.109	-0.25381	0.0255306
GDPGR	-0.0397171	0.0394081	-1.01	0.314	-0.1169555	0.0375213
UNEMPLOY	1.729516	0.7168912	2.41	0.016	0.324435	3.134597
ETA	0.0835109	0.0528967	1.58	0.114	-0.0201648	0.1871866
REAA	0.0001423	0.0001267	1.12	0.262	-0.0001061	0.0003907
OTHERS	-0.0006951	0.0003093	-2.25	0.025	-0.0013013	-0.000089
EQAA	-0.1174557	0.0920962	-1.28	0.202	-0.2979609	0.0630495
LLR	0.0013978	0.0036636	0.38	0.703	-0.0057828	0.0085783
XEFF	-0.0323378	0.0137951	-2.34	0.019	-0.0593757	-0.0052999
_cons	-10.25631	4.586375	-2.24	0.025	-19.24544	-1.267179

Instruments for first differences equation

Standard

D.(LORES GDPGR ETA REAA OTHERS EQAA LLR XEFF)

Instruments for levels equation

Standard

LORES GDPGR ETA REAA OTHERS EQAA LLR XEFF

_cons

GMM-type (missing=0, separate instruments for each period unless collapsed)

DL(1/2).L.LLPTA

Arellano-Bond test for AR(1) in first differences: z = -1.40 Pr > z = 0.162

Arellano-Bond test for AR(2) in first differences: z = 1.24 Pr > z = 0.216

Sargan test of overid. restrictions: chi2(5) = 0.84 Prob > chi2 = 0.975

(Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(5) = 1.69 Prob > chi2 = 0.891

(Robust, but weakened by many instruments.)

6. Conclusion

This paper investigated the loan loss provisioning of UK commercial banks pre- and post- crisis. Following the global financial crisis taking place, the performance of banks varied considerably from that of before the crisis, and loan loss provisions, as one of the most important management tools, can reflect the quality of the banks' loans and whether banks have enough liquidity to cover their future losses. Also, the UK government and Basel Committee implemented some new financial reforms after the crisis took place that are related to loan loss provisioning for banks. Therefore, we undertook this study to observe how UK banks conducted loan loss provisioning pre- and post- crisis, and there are some suggestions we would like to offer to the FCA in order to help the UK banking system to develop more sustainably.

Our results indicated that UK commercial banks did conduct their provisioning relying on the business cycle, and that they conducted their provisioning procyclically. This is due to the Basel II IAS 39 requirement, which restricted banks from building up a buffer for foreseeing future losses. When the crisis took place, problem loans rapidly increased and the capital buffers of banks were insufficient to cover the increasing bad loans. In 2009, the government and Basel Committee both agreed with Turner's suggestion to let banks adopt a countercyclical buffer to relieve the over-procyclicality influence of Basel II, and the new reformed rules and Basel III were implemented in 2013. Therefore, we believe the procyclical provisioning problem we found during 2006 to 2012 will not be a concern anymore following this development.

Our result showed no existence of income smoothing. We found no correlation between earnings before tax and loan loss provisions, because the Basel II IAS 39 requirement limited banks' loan loss provisions holding. Therefore, we believe the UK commercial banks do not conduct income smoothing. However, Basel III has

already been implemented in which banks are encouraged to conduct a countercyclical buffer and also introduce many resilient tools to ensure banks have enough capital to cover their future losses. We think that the FCA should pay attention to the income smoothing problem again in the future.

We also found no evidence for capital management. We divided the investigation into two aspects; manipulating loan loss provisions to increase Tier 1 capital and manipulating loan loss provisions to increase Tier 2 capital. All the variables we applied were insignificant except for the other Tier 1 equity which was significant with LLP, which we believed may imply market signalling. Therefore, we suggest that the FCA should pay attention to the potential problem of market signalling.

Our result opposed the idea that bank efficiency is endogenous to loan loss provisioning, but as an exogenous variable, it is negatively correlated with loan loss provisioning, which indicated that when the efficiency of banks decreased, it led to the increase of loan loss provisioning. We also found that bank efficiency is positively correlated with cost to income ratio and implied that the problem of high market power existed in the UK financial industry. Therefore, it reflected that the high market power banks in the UK were more likely to have a big portion of loan loss provisions. We think the FSA should pay attention to this problem, and we believe the problem can be solved by splitting up large bank groups.

This study could be expanded in the future to investigate bank structural reform and its potential impact on the efficiency of UK commercial banks, and also the comparison of UK bank provisioning changes before and after adopting the Basel III Accords.

Appendices

Appendix 1: Summary of TE estimations

Variable	Obs	Mean	Std. Dev.	Min	Max
te	187	0.657686	0.151965	0.009199	0.880474
te1	187	0.657686	0.151965	0.009199	0.880474
te1_LB95	187	0.283892	0.124027	0.001899	0.616442
te1_UB95	187	0.959406	0.112339	0.027865	0.996456

Appendix 2 (1):

Bank Name	Year	te	Ranking
CIT Bank Limited	2012	0.8151317	1
Standard Bank Plc	2012	0.7737759	2
Standard Chartered Bank	2012	0.7698292	3
DB UK Bank Limited	2012	0.753988	4
Morgan Stanley Bank International Limited	2012	0.7418036	5
MBNA Limited	2012	0.7166609	6
C. Hoare & Co	2012	0.689115	7
Bradford & Bingley Plc	2012	0.6706394	8
ICICI Bank UK PLC	2012	0.6633337	9
HSBC Bank plc	2012	0.6483423	10
Europe Arab Bank Plc	2012	0.6461545	11
Barclays Bank Plc	2012	0.6278169	12
Royal Bank of Scotland Plc (The)	2012	0.6214717	13
Lloyds Bank Plc	2012	0.605588	14
Clydesdale Bank Plc	2012	0.5957866	15
Sainsbury's Bank plc	2012	0.5898932	16
Abbey National Treasury Services Plc	2012	0.5811263	17
Santander UK Plc	2012	0.569598	18
Co-operative Bank Plc (The)	2012	0.5580378	19
Investec Bank Plc	2012	0.5330009	20
Ahli United Bank (UK) Plc	2012	0.5197735	21
VTB Capital Plc	2012	0.4915144	22
Ulster Bank Limited	2012	0.4893882	23
AIB Group (UK) plc	2012	0.4893765	24
N M Rothschild & Sons Limited	2012	0.4532271	25
Capital One (Europe) plc	2012	0.4408365	26
ABC International Bank Plc	2012	0.4174919	27
Bank of Scotland Plc	2012	0.2014005	28
National Westminster Bank Plc - NatWest	2012	0.0092044	29

Appendix 2 (1):

Bank Name	Year	te	Ranking
CIT Bank Limited	2012	0.8151317	1
Standard Bank Plc	2012	0.7737759	2
Standard Chartered Bank	2012	0.7698292	3
DB UK Bank Limited	2012	0.753988	4
Morgan Stanley Bank International Limited	2012	0.7418036	5
MBNA Limited	2012	0.7166609	6
C. Hoare & Co	2012	0.689115	7
Bradford & Bingley Plc	2012	0.6706394	8
ICICI Bank UK PLC	2012	0.6633337	9
HSBC Bank plc	2012	0.6483423	10
Europe Arab Bank Plc	2012	0.6461545	11
Barclays Bank Plc	2012	0.6278169	12
Royal Bank of Scotland Plc (The)	2012	0.6214717	13
Lloyds Bank Plc	2012	0.605588	14
Clydesdale Bank Plc	2012	0.5957866	15
Sainsbury's Bank plc	2012	0.5898932	16
Abbey National Treasury Services Plc	2012	0.5811263	17
Santander UK Plc	2012	0.569598	18
Co-operative Bank Plc (The)	2012	0.5580378	19
Investec Bank Plc	2012	0.5330009	20
Ahli United Bank (UK) Plc	2012	0.5197735	21
VTB Capital Plc	2012	0.4915144	22
Ulster Bank Limited	2012	0.4893882	23
AIB Group (UK) plc	2012	0.4893765	24
N M Rothschild & Sons Limited	2012	0.4532271	25
Capital One (Europe) plc	2012	0.4408365	26
ABC International Bank Plc	2012	0.4174919	27
Bank of Scotland Plc	2012	0.2014005	28
National Westminster Bank Plc - NatWest	2012	0.0092044	29

Appendix 2 (2):

Bank Name	Year	te	Ranking
Standard Bank Plc	2011	0.8173043	1
DB UK Bank Limited	2011	0.8091771	2
Clydesdale Bank Plc	2011	0.7998602	3
National Westminster Bank Plc - NatWest	2011	0.7880237	4
N M Rothschild & Sons Limited	2011	0.7781099	5
Northern Bank Limited	2011	0.7553789	6
Abbey National Treasury Services Plc	2011	0.7454667	7
MBNA Limited	2011	0.7419242	8
VTB Capital Plc	2011	0.7337529	9
Capital One (Europe) plc	2011	0.7249781	10
Bank of Scotland Plc	2011	0.7026615	11
C. Hoare & Co	2011	0.7008757	12
Barclays Bank Plc	2011	0.6995963	13
AIB Group (UK) plc	2011	0.6911919	14
Investec Bank Plc	2011	0.6857833	15
Ulster Bank Limited	2011	0.6811772	16
Morgan Stanley Bank International Limited	2011	0.6352849	17
Royal Bank of Scotland Plc (The)	2011	0.6108042	18
Sainsbury's Bank plc	2011	0.6064252	19
Lloyds Bank Plc	2011	0.5751721	20
Ahli United Bank (UK) Plc	2011	0.5694967	21
Co-operative Bank Plc (The)	2011	0.5220416	22
Santander UK Plc	2011	0.5219479	23
ABC International Bank Plc	2011	0.4712717	24
CIT Bank Limited	2011	0.4351948	25
HSBC Bank plc	2011	0.3409229	26

Appendix 2 (3):

Bank Name	Year	te	Ranking
AIB Group (UK) plc	2010	0.8802016	1
CIT Bank Limited	2010	0.8487684	2
Standard Chartered Bank	2010	0.8409292	3
Standard Bank Plc	2010	0.8313626	4
Sainsbury's Bank plc	2010	0.8201928	5
Barclays Bank Plc	2010	0.8110162	6
Europe Arab Bank Plc	2010	0.8101999	7
ICICI Bank UK PLC	2010	0.7893457	8
MBNA Limited	2010	0.7813738	9
Investec Bank Plc	2010	0.7654088	10
HSBC Bank plc	2010	0.7597656	11
Bradford & Bingley Plc	2010	0.7575643	12
Capital One (Europe) plc	2010	0.7547881	13
Northern Bank Limited	2010	0.74754	14
National Westminster Bank Plc - NatWest	2010	0.7445496	15
Bank of Scotland Plc	2010	0.7381331	16
Ahli United Bank (UK) Plc	2010	0.7310482	17
Abbey National Treasury Services Plc	2010	0.7092113	18
Lloyds Bank Plc	2010	0.6899919	19
DB UK Bank Limited	2010	0.6698917	20
Morgan Stanley Bank International Limited	2010	0.6465238	21
Ulster Bank Limited	2010	0.6196808	22
ABC International Bank Plc	2010	0.5678562	23
Co-operative Bank Plc (The)	2010	0.5394813	24
Royal Bank of Scotland Plc (The)	2010	0.5366113	25
N M Rothschild & Sons Limited	2010	0.5198532	26
Santander UK Plc	2010		27

Appendix 2 (4):

Bank Name	Year	te	Ranking
National Westminster Bank Plc - NatWest	2009	0.8230393	1
Bradford & Bingley Plc	2009	0.8181159	2
Northern Bank Limited	2009	0.7917895	3
Capital One (Europe) plc	2009	0.7816244	4
Standard Bank Plc	2009	0.7729817	5
Lloyds Bank Plc	2009	0.7726594	6
VTB Capital Plc	2009	0.7653149	7
Sainsbury's Bank plc	2009	0.756067	8
AIB Group (UK) plc	2009	0.7540321	9
Clydesdale Bank Plc	2009	0.7498907	10
Europe Arab Bank Plc	2009	0.742454	11
C. Hoare & Co	2009	0.7412099	12
Co-operative Bank Plc (The)	2009	0.7208906	13
Standard Chartered Bank	2009	0.7071119	14
ICICI Bank UK PLC	2009	0.6993359	15
MBNA Limited	2009	0.6931207	16
N M Rothschild & Sons Limited	2009	0.6834691	17
HSBC Bank plc	2009	0.6788426	18
CIT Bank Limited	2009	0.6772956	19
DB UK Bank Limited	2009	0.6692243	20
Morgan Stanley Bank International Limited	2009	0.6527473	21
Ulster Bank Limited	2009	0.6376354	22
Santander UK Plc	2009	0.6179705	23
Royal Bank of Scotland Plc (The)	2009	0.6024207	24
Investec Bank Plc	2009	0.5513887	25
Bank of Scotland Plc	2009	0.5054066	26
Ahli United Bank (UK) Plc	2009	0.464782	27
Abbey National Treasury Services Plc	2009	0.0545644	28

Appendix 2 (5):

Bank Name	Year	te	Ranking
Bank of Scotland Plc	2008	0.8690557	1
Santander UK Plc	2008	0.8411982	2
Northern Bank Limited	2008	0.8205301	3
Standard Bank Plc	2008	0.8078628	4
Barclays Bank Plc	2008	0.7985088	5
Ulster Bank Limited	2008	0.7867854	6
Standard Chartered Bank	2008	0.7853609	7
VTB Capital Plc	2008	0.7804638	8
HSBC Bank plc	2008	0.778811	9
Abbey National Treasury Services Plc	2008	0.7763059	10
Co-operative Bank Plc (The)	2008	0.7721782	11
ABC International Bank Plc	2008	0.7619062	12
Bradford & Bingley Plc	2008	0.7589909	13
National Westminster Bank Plc - NatWest	2008	0.7565195	14
AIB Group (UK) plc	2008	0.7556236	15
DB UK Bank Limited	2008	0.7549121	16
Royal Bank of Scotland Plc (The)	2008	0.752332	17
MBNA Limited	2008	0.7507229	18
Clydesdale Bank Plc	2008	0.7506123	19
C. Hoare & Co	2008	0.7500142	20
Europe Arab Bank Plc	2008	0.7431388	21
N M Rothschild & Sons Limited	2008	0.7243929	22
Capital One (Europe) plc	2008	0.7152933	23
Morgan Stanley Bank International Limited	2008	0.7024975	24
Investec Bank Plc	2008	0.7013421	25
Sainsbury's Bank plc	2008	0.6815824	26
ICICI Bank UK PLC	2008	0.5519598	27
Ahli United Bank (UK) Plc	2008	0.5441657	28

Appendix 2 (6):

Bank Name	Year	te	Ranking
Standard Chartered Bank	2007	0.8013879	1
Santander UK Plc	2007	0.7979671	2
VTB Capital Plc	2007	0.7888626	3
Co-operative Bank Plc (The)	2007	0.7678229	4
ICICI Bank UK PLC	2007	0.7620231	5
DB UK Bank Limited	2007	0.7386084	6
Abbey National Treasury Services Plc	2007	0.725418	7
C. Hoare & Co	2007	0.6942962	8
Clydesdale Bank Plc	2007	0.688663	9
National Westminster Bank Plc - NatWest	2007	0.6835378	10
Ahli United Bank (UK) Plc	2007	0.6680391	11
Barclays Bank Plc	2007	0.651045	12
Bradford & Bingley Plc	2007	0.6275578	13
Ulster Bank Limited	2007	0.6129746	14
Standard Bank Plc	2007	0.6113692	15
Lloyds Bank Plc	2007	0.6056253	16
Europe Arab Bank Plc	2007	0.583522	17
Royal Bank of Scotland Plc (The)	2007	0.5688289	18
Bank of Scotland Plc	2007	0.5534576	19
Capital One (Europe) plc	2007	0.5344545	20
N M Rothschild & Sons Limited	2007	0.5309371	21
AIB Group (UK) plc	2007	0.3705573	22
Morgan Stanley Bank International Limited	2007	0.1797814	23
Investec Bank Plc	2007	0.1726686	24
HSBC Bank plc	2007		25

Appendix 2 (7):

Bank Name	Year	te	Ranking
Ahli United Bank (UK) Plc	2006	0.8464834	1
Standard Chartered Bank	2006	0.822879	2
National Westminster Bank Plc - NatWest	2006	0.810307	3
Northern Bank Limited	2006	0.7912394	4
Europe Arab Bank Plc	2006	0.7347756	5
MBNA Limited	2006	0.7346746	6
VTB Capital Plc	2006	0.7254726	7
Santander UK Plc	2006	0.7242107	8
HSBC Bank plc	2006	0.7186346	9
Morgan Stanley Bank International Limited	2006	0.6945778	10
Lloyds Bank Plc	2006	0.6731654	11
Royal Bank of Scotland Plc (The)	2006	0.6362047	12
Co-operative Bank Plc (The)	2006	0.6340825	13
Clydesdale Bank Plc	2006	0.616127	14
C. Hoare & Co	2006	0.61143	15
Ulster Bank Limited	2006	0.5929445	16
Capital One (Europe) plc	2006	0.5461295	17
Bradford & Bingley Plc	2006	0.5255448	18
Abbey National Treasury Services Plc	2006	0.5016586	19
AIB Group (UK) plc	2006	0.4782881	20
N M Rothschild & Sons Limited	2006	0.4727991	21
Barclays Bank Plc	2006	0.4374852	22
Bank of Scotland Plc	2006	0.3958292	23
Investec Bank Plc	2006	0.3209892	24
DB UK Bank Limited	2006	0.2904498	25
ABC International Bank Plc	2006	0.1851866	26

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