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An overview of the UK banking sector since the Basel Accord: insights from a new regulatory database

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Abstract

This paper provides an overview of the dramatic changes in the UK banking sector over the 1989–2013 period, seen through the lens of a newly assembled database built from banks' regulatory reports. This database, which we refer to as the Historical Banking Regulatory Database (HBRD), covers financial statement and confidential regulatory information for all authorized UK banks and building societies at the consolidated (group) and standalone (bank) level. As a result, it permits both a more comprehensive picture of the UK banking sector as well as a more refined view of subsectors, such as small banks, than possible with other existing data sets (eg from external vendors or aggregate statistics). The overview focuses on developments in banks' CAMEL characteristics (Capital adequacy, Asset quality, Management skills, Earnings performance and Liquidity), and relates these developments to concurrent regulatory changes, such as the Basel Market Risk Amendment. We also suggest ways in which the database can be used for evidence-based research and policy analysis.

Key words: Bank regulation, regulatory data, database, CAMEL, capital, capital requirements, asset quality, management, earnings performance, liquidity, funding.

JEL classification: G21, G28, N2, G01.

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Summary

This paper describes the evolution of the UK banking sector during the years 1989-2013 through the lens of a newly-developed Historical Bank Regulatory Database (HBRD). It also suggests how this database may be used for future research and policy purposes.

Evolution of the UK banking sector and its regulation

We structure our analysis using the well-known CAMEL framework covering aspects of banking conditions related to **C**apital adequacy, **A**sset quality, **M**anagement skills, **E**arnings performance and **L**iquidity. We focus the analysis mainly on aggregate measures of each CAMEL factor to illustrate the breadth of the new database. We analyse the developments separately for small and large (top 8 in total assets) banks as these two groups present key differences. We overlay this analysis with a review of changes in regulation that interplayed with these developments.

Our findings are as follows:

- *Capital adequacy*, measured according to risk-based standards at the time, increased steadily in the run-up to the 2008-09 financial crisis, while it fell on a non-risk-adjusted basis. These trends were especially evident at the largest institutions due to a reduction in risk-weighted assets stemming from wholesale shifts in assets from the banking book to the trading book, which attracted a lower capital requirement with the introduction of the Basel Market Risk Amendment (MRA) in 1996. Large banks also had lower overall risk-based capital ratios, lower risk-based capital requirements and lower proportions of high-quality (Tier 1) capital relative to small banks.

- With regards to *asset quality*, large banks shifted portfolios from traditional lending to trading activities, reflecting in part the heightened incentives (to lower regulatory capital requirements) under the MRA. Small banks, on the other hand, increased lending as a share of their portfolios throughout 1989 to 2013. Actual and provisioned losses were high during the distressed period in the early 1990s and again during the 2008-09 financial crisis, particularly at large banks.

- *Management skills*, as measured by the cost-to-income (efficiency) ratio, remained relatively stable over the period 1989 to 2007, but worsened notably with the onset of the 2008-09 financial crisis as banks faced higher costs of dealing with mounting loan problems and misconduct charges.

- The distress periods of the early 1990s and again during the 2008-09 financial crisis can be seen clearly in banks' *earnings performance* measures. Post-crisis earnings measures remain low by historical standards as banks face challenges from legacy assets and low interest margins.

- Aggregate *liquidity* metrics generally worsened up until the crisis. Broadly speaking, large banks had higher levels of liquid assets but less stable funding (measured as deposits to assets and a proxy for the Net Stable Funding Ratio, NSFR).

Benefits of the database

A key benefit of the HBRD is its application to a wide set of highly relevant policy questions and the opportunities it presents to advance evidence-based policymaking. Important features of the database include:

1. Coverage

   a) Long time series, covering the evolution from Basel I to Basel III, five different reporting regimes, and several distress episodes (e.g., the UK small-bank crisis in the early 1990s, the dotcom turmoil in 2000-02 and the 2008-09 financial crisis).
   b) Broad cross-section, covering the UK banking sector (UK registered banks, foreign subsidiaries and building societies excluding branches of foreign domiciled banks).
   c) Both solo and group (consolidated) data.

2. Unique content not available from existing external sources.

   a) Supervisory information on required capital not currently available elsewhere.
   b) Level of consolidation is the same as used for regulatory purposes, which is not always the same as in public financial reporting; using the latter could be misleading when evaluating, for example, behaviour in response to changes in regulation.

3. Potential for future use with ease and confidence:

   a) Consistent definitions of variables, constructed using regulatory reporting instructions from the respective reporting regimes.
   b) Extensive data checks, with accompanying manual and metadata.
   c) Available to external users (subject to security clearance).[1]

Limitations of the data

The sample ends in 2013. While extending it beyond 2013 was outside the scope of this project, the intent is to update the database on regular basis. With the implementation of the Capital Requirements Regulation, such work will involve linking new regulatory returns under FINREP and COREP with variables constructed using the previous Bank of England and Financial Services Authority regulatory regimes.

Future use of the database in research and policy

We suggest ways in which the historical developments we have explored could be investigated in a more granular way, and more generally how the database could be used to address both current policy issues and research questions covered in the literature. We believe the new database offers considerable scope for advancing the evidence base on the impacts of regulatory changes on bank behaviour and ex post policy reviews.

[1] For external access, please see www.bankofengland.co.uk/research/Pages/onebank/externaleng.aspx.

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1 Introduction

The UK banking sector underwent considerable change over the 25 year period from 1989 to 2013. Booms were followed by busts – most starkly in the 2008-09 financial crisis and to a lesser extent in the early 1990s.[2] The sector grew increasingly concentrated through mergers between both large and small banks. The scope of banks' activities changed, moving from a traditional model of lending and deposit taking to a new model of trading and wholesale funding, and then partly back again. The regulatory landscape changed dramatically both domestically and internationally. The international framework moved from the rudimentary Basel I agreement, focused exclusively on setting capital requirements for credit risk in the banking book, to complex Basel II, permitting wider use of internal models for establishing capital requirements. Domestically, regulation evolved in ways that are partly unique to the UK, with bank-specific supervisory add-ons to capital and liquidity requirements that can be helpful in overcoming identification challenges for causal inference.

This paper has three aims. First, we give an overview of these developments using a newly assembled database, the Historical Bank Regulatory Database (HBRD). Second, in reviewing these developments we discuss the content of the database. This effort is complemented by a separate manual and comprehensive documentation, giving potential users a better understanding of the data and scope for policy analysis and research application. Third, we suggest future avenues for research on the topics where this note can only scratch the surface.

HBRD allows doing bank-level analyses that are not possible using other databases. For example, the evolution of capital requirements for individual banks and groups. HBRD also allows financial analysis at the same level of consolidation used for regulatory purposes unlike public financial reporting and other Bank of England or BIS confidential bank-level data which are at a different level of consolidation (see Gracie and Logan, 2002).

We structure the overview using the "CAMEL" framework – capital adequacy, asset quality, management, earnings performance, and liquidity.[3] In particular, we analyse a number of well-known proxies, aggregated for large (top 8 by asset size) and small banks, for each of the CAMEL factors across 1989 to 2013.[4] This analysis shows that *capital adequacy*, as measured using risk-based standards, increased steadily, especially leading up to the 2008-09 crisis and for the largest institutions. For large banks this change was due mainly to a decrease in average risk-weighted assets; the level of capital to total (non-risk-weighted)

[2] See Goddard, et al (2009) for an overview of the 2008-09 financial crisis in the UK banking sector, and Balluck, Galiay, Ferrara, and Hoggarth (2016) and Logan (2001) for more detail on the small-bank crisis in the early 1990s.

[3] US regulators use quantitative and qualitative information to set CAMELS ratings. The "S" stands for sensitivity to market risk and was added in 1996. We omit this category since we lack information on it. For details, see e.g. Feldman and Schmidt (1999).

[4] Discussed in more detail below, this period encompasses a number of different reporting regimes. Our sample period ends in 2013, which corresponds with a major change in reporting requirements by EU banks. Future work will focus on extending the HBRD beyond 2013.

assets was relatively stable from the early 1990s to around 2003, decreasing in the four year leading up to the 2008-09 crisis. In general, over the period 1989 to 2013 large banks also had lower overall capital ratios, lower individual capital requirements and lower proportions of high-quality (Tier 1) capital relative to small banks. With regards to *asset quality*, our data show that large banks shifted their portfolios away from traditional lending to trading activities, while small banks increased lending as a share of their portfolios. The shift from traditional "banking book" assets to "trading book" assets drives some of the decreases in average risk weights described above. Net loan loss rates as well as provisioned losses were high during the distressed period in the early 1990s, while the 2008-09 global financial crisis had a smaller impact in this respect, particularly for small banks. A simple measure of *Management* efficiency (used in the literature by e.g., Berger and DeYoung, 1997; Fiordelisi et al., 2011; Cihak and Schaeck, 2013), was relatively stable during the period leading up to the crisis. With the onset of the crisis, efficiency measures worsened as banks faced higher costs of dealing with mounting loan problems and misconduct charges. The distress periods can also be seen clearly in banks' *earnings* levels, as well as the poor earnings performance metrics that continued after the global financial crisis. In contrast to the increase in aggregate risk-based capital measures, aggregate *liquidity* metrics generally worsened up until the crisis. This pattern is consistent with the observation in Goodhart (2011) that liquidity ratios of international banks worsened during this period as well as the preceding twenty years, whereas for capital ratios the early decline reversed. In particular, the levels and quality of liquid assets generally decreased up until the crisis, decreased further during the crisis, and rebounded substantially afterwards. Broadly speaking, large banks had more liquid assets but less stable funding (measured as deposits to assets and a proxy for the Net Stable Funding Ratio, NSFR).[5]

As part of the overview, we also consider the changes in regulation that occurred over time and attempt to provide some initial insights into their implications for UK bank behaviour as seen in the dataset. We focus mainly on the changes to capital requirements and how they manifest in the CAMEL factors. We do this through a simple, qualitative review of broad patterns in these factors juxtaposed against some of the most notable changes in regulations that banks faced during this period. This rudimentary exercise naturally raises a number of interesting research questions and issues, for example, about causal links and the drivers of bank behaviour, for which HBRD could prove useful.

Related to this idea, in the second part of the analysis we advance ideas on further research and policy applications of the database. While this paper gives a broad overview of developments, this section suggests ways in which the granular information in the database could be exploited to understand these developments better. Such an improved understanding

[5] The NSFR measures the stability of funding relative to the illiquidity of assets. It is expressed as a ratio of the available stable funding (where more stable sources are given higher weights) to the required stable funding (where more long-term, illiquid assets get higher weight). It is expected that a regulatory requirement for an NSFR of at least 1 will be implemented by 2018.

could ultimately contribute to improved policy making. To that end, we ground the proposed ideas in current policy debates and recent literature.

The database provides information on both a consolidated (group) level and a solo (bank) level. Importantly, the scope of the consolidation is the same as that used by UK regulators when imposing requirements. This can differ from the scope of consolidation used in, for example, financial accounting, and when it does such disparity can bias conclusions. This note focuses on the group level, since that is likely where important management decisions are taken (e.g., see Berger et al., 1995 on this issue in the US). However, we think future analyses of the group-solo interaction would be fruitful (particularly considering that the UK differs from the US in that there is no "source of strength" doctrine for banking groups) and could shed light on the changing importance of UK interaction activity and/or their interaction with the non-bank sector.[6] The data are provided at a biannual frequency for the consolidated data and quarterly frequency for the solo data.

An additional benefit of the data in that regard is that it covers the full banking system, including both large and small banks as well as UK subsidiaries of foreign banks.[7] As a result, it enables us and other researchers to highlight important sources of heterogeneity in the banking sector.

A key goal of the construction of the database has been to make it useful for future research and policy work. To that end, we provide extensive documentation in an accompanying manual. In building the database, we have focused on variables that can be defined consistently throughout the period rather than aiming for the largest possible number of variables. We also provide two versions of the data set – one "raw" dataset that advanced users will likely prefer, and one "managed" that has been subjected to more extensive cleaning and may lend itself better to quick analyses.

The rest of the paper proceeds as follows. Section 2 summarises developments in UK regulatory reporting during our sample period. Section 3 discusses the evolution of prudential regulations in the UK with a focus on capital requirements. Section 4 reviews the market structure of the UK banking sector using a variety of measures based on HBRD data Showcasing the scope and content of the HBRD in more detail, Section 5 gives an historical overview of the conditions and activities of UK banks based on the CAMEL framework. Section 6 suggests avenues for future research using the new database. Section 7 concludes.

2 UK Bank Reporting Requirements

This section gives an overview of the regulatory report requirements that applied to UK banks during the twenty-five years spanning 1989 to 2013. Section 2.1 describes how regulatory reporting requirements evolved to deal with ongoing amendments to the

[6] The "source of strength doctrine" requires bank holding companies in the US to provide financial assistance to their deposit-taking subsidiaries if needed.

[7] Note however that branches of foreign banks are not included.

supervisory framework. Such background is useful for understanding the behaviour of banks during the period. Section 2.2 summarises the data content, while Section 2.3 compares the new database with existing datasets.

2.1 Regulatory Reporting Requirements

In response to changing regulations and supervisory practices over the 1989-2013 period reporting requirements evolved considerably. The legal basis of reporting requirements is embedded in various versions of the UK Financial Services Act.[8] Under this banks must ensure that their regulatory report information is correct, accurate and in some cases verified by external auditors. In addition, the regulator has discretion to waive data elements for certain banks or time-periods. Such discretion, together with outright changes in reporting requirements, can create inconsistencies in regulatory report data, making it difficult to compare information over time and across firms.

Table 1 outlines the five main reporting regimes that were in place from 1989 to 2013. From 1989 to 2008, regulatory report information for banks was collected using Banking Supervision Division (BSD) report form, which underwent two major changes during this period. In 1996, the BSD report form was supplemented with the CAD1 and RAR1 forms to capture more information on trading book assets and risks, respectively. In 1998, these were all consolidated under BSD3. Building societies reported under a separate set of guidance using the Quarterly Financial Statement (QFS) form from 1994 to 2008. Beginning in 2008, both banks and building societies reported using common guidance and regulatory returns from the Financial Services Authority (FSA). This altered yet again the breakdowns of financial statement information and risks submitted by these firms relative to the BSD and QFS reports.[9]

Table 1: Data sources (1989 to 2013) for UK authorized banks and building societies

	BSD1	QFS1	BSD2, CAD1&RAR1	BSD3	FSAXXX
Name of Report	Capital Adequacy Return	Building Society Quarterly Financial Statement	Capital Adequacy Return (banking book)	Bank Capital Adequacy Return	FSA regulatory reporting (reports 001, 002, 003 015)
Time period covered	Dec 1989 to Feb 1996	Mar 1994 to Jun 2008	Mar 1996 to Sep 1998	Dec 1998 to Mar 2008	Jun 2008 to Dec 2013
Reporting firms	UK authorised banks	UK authorised Building Societies	UK authorised banks	UK authorised banks	UK authorised banks and Building Societies

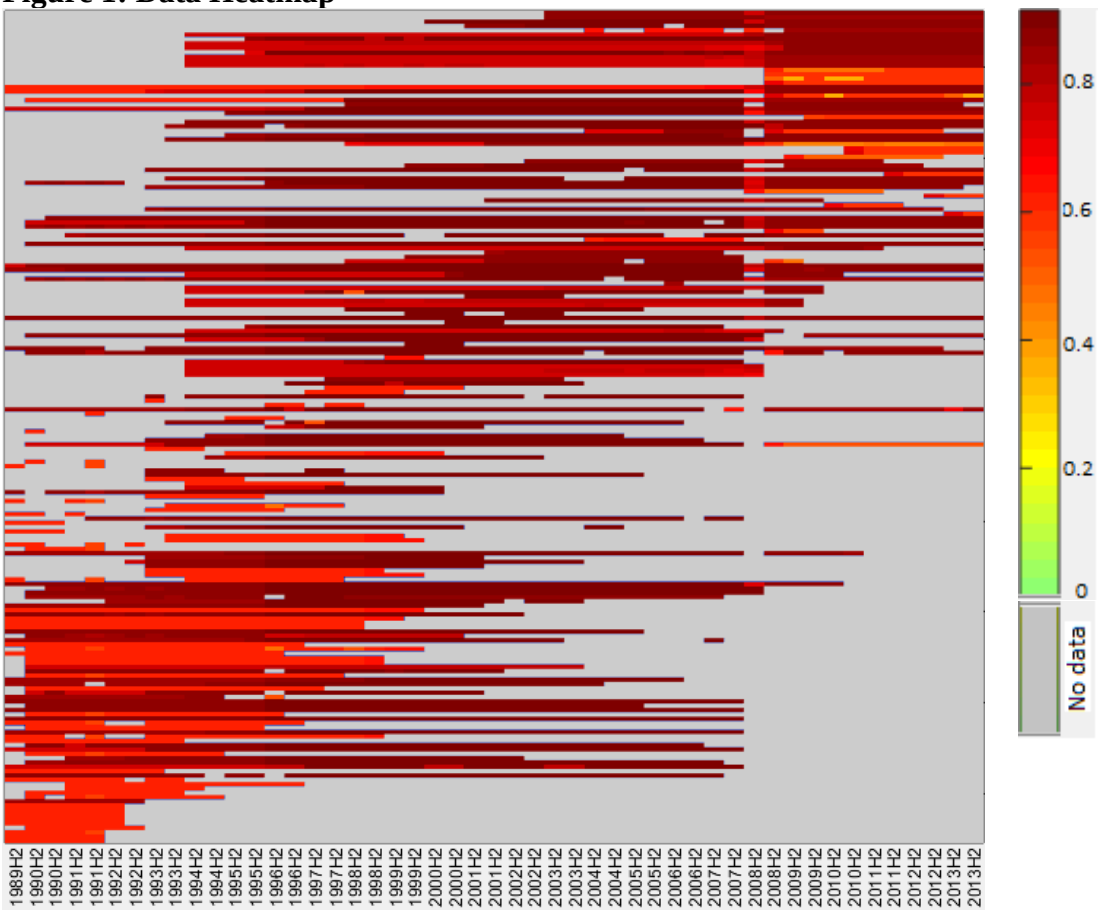
[8] See the Financial Services act of 1986 (section 104) and the Financial Services and Markets act of 2000 (section 166). In summary, the legislation required authorised firms to supply data to fulfil the regulator's obligations. In order to advance to more sophisticated supervisory approaches, a firm needed to demonstrate to the regulator that it had the systems to calculate and report its financial position in accordance with the regulator's guidance.

[9] During the period 1989 to 2008, UK regulators supplemented BSD and QFS data with information from an in–house system called 'Dolly', which stored information on individual capital requirements for all firms. Finally, during the transition to FSA returns and during the crisis in the 2007-2009 period, institutions supplied Early Report (ER1 and ER2) forms, which contained information on balance sheets and capital positions to supplement regular FSA returns. The HBRD contains information from both Dolly and these Early Reports.

2.2 Regulatory Data Content

The new database contains more than 500 regulatory report items submitted by around 170 banking groups and 700 individual banks and building societies.[10] As mentioned earlier, regulatory data were submitted by consolidated groups as well as by subsidiary (solo-level) banks. While the HBRD contains information at both levels, this report relies primarily on group-level data. Figure 1 provides a sense of the scope of data available in the HBRD for banking groups and large building societies by time period (using a set of 125 quantitative measures based on balance sheet, capital and income account information) included in the database. In the figure, darker shades of red indicate more available data for a given bank-year. The figure shows the panel is unbalanced, with only a few firms present through the whole period and some gaps due to missing reports.

Figure 1: Data Heatmap



Note(s): Each row in the figure represents a bank and each column a year. The ordering of rows is determined by the correlation between the year and the share of variables in the given year (hence, the diagonal pattern arises mechanically). The darker red colour represents 100% of data for a bank in that half year period while lighter colour indicates that some variables are missing. The percentage of available data is calculated from 125 basic quantitative measures (balance sheet, capital and income account) included in the database.

[10] Appendix 2 includes a list of the main quantitative measures available in the HBRD. More details are available in a separate user's manual, available upon request.

The regulatory reports include data on several aspects of banking condition and credit provision. Capital adequacy and capital requirements were reported from end-1989 for banks and from early 1997 for building societies. The HBRD's inclusion of such confidential information on individual capital requirements is one of the main benefits of this new dataset. Other reporting data such as profit and loss data are generally available from 1989 for banks and from 1994 for building societies. Regulatory data related to individual liquidity guidance are available only from 2010.[11]

2.3 Dataset Comparisons

In this section we compare and contrast the characteristics of the HBRD with three related datasets. First, we compare the HBRD against another confidential Bank of England dataset based on individual bank returns: the MCG panel (Money and Credit Group Statistics Division). This dataset also includes financial information on UK banks that is not dissimilar to that collected in regulatory returns; however, as noted below, the scope and coverage of the firms and nature of data items included are much narrower. Second, we consider the commercially available datasets CAPITAL IQ and Bankscope. In summary we find that HBRD offers some unique features, but it can also be complemented with other datasets. In particular, the MCG panel offers a great deal of detail on bank exposures to economic sectors. However, researchers need to consider that the level of consolidation of the MCG panel is different from HBRD including only UK bank assets booked through UK offices.[12]

Table 2 below compares and contrasts key features of HBRD relative to these other three databases. While one of the most distinct advantages of HBRD is its inclusion of confidential individual capital requirements, the table also reveals several other important advantages, including:

i. broader cross section of banks and building societies;

ii. larger set of banking groups;

iii. generally longer time series of financial information;

iv. relatively higher frequency of data items;

v. captures non-UK activities (e.g., lending) of UK headquartered institutions;

vi. wider coverage of CAMEL factors;

[11] HBRD includes the Advanced Liquidity Data as a separate and distinct dataset. These data are reported on a weekly basis (with some exceptions on a monthly basis) and include information on (i) decomposition of eligible assets, (ii) modelled in-flows and out-flows, (iii) wholesale refinancing gap, (iv) the individual liquidity guidance (ILG) ratio and (v) glide path transition factors for the implementation of the ILG regime. These data start in 2010 and are available a consolidated and unconsolidated basis. The scope of consolidation for these liquidity data, however, may differ from the scope of consolidation reflected in core variables within the HBRD database, so caution should be used in comparing measures constructed using the Advanced Liquidity Data.

[12] See Gracie and Logan (2002) for more detail and other issues that arise when comparing Bank of England monetary data and regulatory data.

vii. more in-depth user documentation;

viii. inclusion of confidential information on regulatory capital requirements;

ix. consolidated reporting basis similar to that required by UK supervisors; and

x. less cost relative to external vendor sources (no license fees).

Table 2: Dataset comparisons

Database feature	HBRD	MCG panel	Capital IQ	Bankscope[13]
Banks & Building Societies	533 (If authorised 89-13)	118 (86 currently)	371 (mostly banks)	319
Groups	173 (UK groups of authorised firms)	42 (38 currently)	27 (no Building Societies)	155[14]
Periods	1989-2013	1997	1998-	1980 - (but with sparse data in early period and access limited for many users[15])
Frequency	Quarterly, bi-annual	Up to monthly	Annual (quarter interpolated)	Annual
Non-UK activities	Yes	No	Unknown	Yes, to the extent incl. in financial reporting
Non-UK Groups	UK incorporated subs	UK incorporated subs and branches	International groups	International groups
Documentation	In depth	In depth	Minimal (w/support)	Fair (w/support)
Coverage of CAMELS characteristics	44 indicators	Few asset/liabilities; from 2009 sectoral breakdown: loans, approvals, write-offs	Varies by bank	Varies by bank
Regulatory risk and Capital requirements	Yes; reported at same level of application as regulatory requirements	None	None	Limited (only to the extent publicly reported)
Basis of data	Mandatory reporting for prudential regulation	Reporting mandated by regulator	Publicly available financial reporting	Publicly available financial reporting
Availability	Confidential; available to externals subject to individual security clearance	Confidential; available to externals subject to individual security clearance	Publicly available (subject to license fee)	Publicly available (subject to license fee)

Source(s): Bank of England Money and Credit Group Statistics, Bureau van Dijk (undated), Duprey and Lé (2015), authors' analysis of Capital IQ.

[13] The numbers refer to the number of banks / groups with total assets available in 2013; the number with e.g. Core Tier 1 Capital Ratio available will be substantially lower.

[14] Includes sub-groups also of domestic banks (e.g. HSBC has several entities with consolidated accounts in the database, so overstated relative to HBRD).

[15] For many Bankscope users, the time series will be limited to 16 years of data.

3 UK Bank Prudential Regulation

Regulatory and supervisory institutions went through significant changes during the twenty-five years spanning 1989 to 2013. Banks and building societies were supervised by different regulators in 1989. By 2001, however, the FSA supervised them jointly and harmonised the regulatory process that applied to those firms.[16] This change also entailed that the supervision of different entities (e.g., insurance companies, fund managers, securities brokers) within a group was brought together. At the same time there were significant changes in the international and domestic regulatory frameworks for banks. Section 3.1 discusses the evolution of international prudential regulation and the UK implementation of it. Section 3.2 outlines the developments in domestic capital requirements and supervisory practices around capital requirements.

3.1 Bank regulation

This section gives an overview of the international and domestic regulatory frameworks for banks, and the concurrent changes in aggregate capital levels. Figure 2 tracks all the regulatory changes against the aggregate risk based capital ratio requirement over the whole period.[17]

3.1.1 International Basel standards

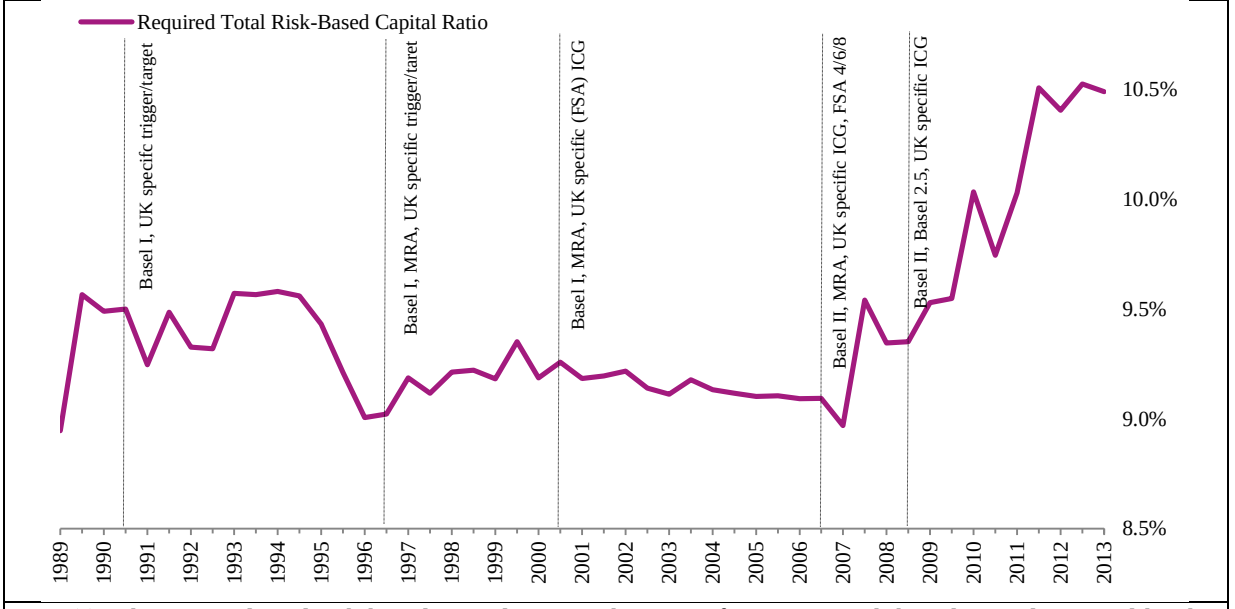
Banking regulations at the international level changed substantially over this timeframe, with the Basel Convergence Agreement of 1988 (BCBS, 1988) and the advent of risk-based capital requirements (under Basel I) in the early 1990s setting a new foundation for overseeing the UK banking sector. Further refinements to the risk-based capital standards followed in the mid-1990s to account for market risk in banks' trading activities and, notably, to allow the use of banks' own estimates (i.e. from internal value-at-risk models) to set capital charges for such risks (BCBS, 1996). In 2007 additional revisions occurred under Basel II, which sought to make capital requirements for credit risk much more risk-sensitive, through a more risk-sensitive standardised approach and permitting wider use of internal models to determine capital requirements for credit risk. Yet more amendments followed in 2011 with introduction of "Basel II.5", increasing capital requirements on securitisation positions,[18] off-balance sheet vehicles and trading book exposures.

[16] In particular, the Bank of England was responsible for oversight of commercial banks, while the Building Societies Commission supervised building societies since 1986; see The Financial Services and Markets Act 2000 (Mutual Societies) Order 2001 PART II Transferred functions, section 4 Transfer of functions.

[17] Tables A2 and A3 of Appendix 1 provides more details on the underlying regulatory regimes.

[18] The changes for securitisation positions in Basel 2.5 addressed immediate concerns primarily around re-securitisations; Basel III changes the securitisation capital framework more fundamentally (e.g. BCBS, 2013c).

Figure 2: Weighted average risk-based capital requirement 1989-2013



Note(s): The required total risk-based capital ratio is the ratio of aggregate risk-based capital required by the UK regulator divided by aggregate risk-weighted assets. It includes banking book and trading book requirements. Basel I, II and the MRA (Market Risk Amendment) are the international capital standards. Trigger, Target FSA ICG (Individual Capital Guidance) reflect the UK specific capital requirements that include add-ons for risks not captured by the international standards. The FSA enhanced supervisory framework introduced in 2008 (or FSA 4/6/8) reflected expectations aimed at the major UK banks. This framework did not attempt to capture risks not covered in the international framework, but rather it set out minimum expected core tier 1 and tier 1 capital ratios, based on a more stringent definition of core tier 1 capital than the Basel II definition. While the framework was not an explicit requirement, we conjecture that it acted as a de facto set of requirements potentially affecting bank behaviour

Towards the end of our sample period, regulators worked on the Basel III framework. While the entire package was not finalised during our sample period, the first publication was released in 2010, so it may not be unreasonable to expect that at least some of the patterns in the CAMEL factors discussed below reflect UK banks' responses to the proposals under Basel III. Basel III is a comprehensive set of reforms aimed at improving the banking sector's ability to absorb shocks, enhancing the quality of risk management and governance practices and transparency and disclosures. It has also placed much more emphasis on strengthening the loss absorbent nature of regulatory capital resources and required that banks hold significantly more regulatory capital in the form of Common Equity Tier 1. In particular, the Basel III common equity minimum is 4.5% of risk weighted assets, with a capital conservation buffer of 2.5% and a countercyclical buffer in the range 0-2.5%.[19] In addition, Basel III strengthens capital requirements for securitisations, counterparty credit risk and exposures to central counterparties.[20] It also introduces a non-risk-based leverage ratio requirement to address potential model risk errors and serve as a backstop to the risk-based

[19] We note that 2.5% is not a hard limit, but refers to the amount by which reciprocity is mandatory and for which there is a buffer guide.

[20] In addition, changes to the treatment of trading book activities were made in the so-called Basel II.5 package in 2009. Subsequent changes were agreed recently in the so-called Fundamental Review of the Trading Book (FRTB; see BCBS, 2016c).

regime. In addition to strengthening capital standards, Basel III introduces liquidity standards (i.e., the liquidity coverage ratio and net stable funding ratio) to address shortcomings in banks' liquidity practices and sources of market-based funding risk that also contributed to financial difficulties during the crisis. Previous Basel accords only covered capital adequacy, however there were domestic standards for liquidity buffers in the UK and some other countries before the introduction of Basel III.

3.1.2 UK implementation and additional domestic requirements

On the domestic front and through the whole period, discretionary regulatory policy played a greater role in the setting of minimum bank capital ratios. On top of the hard floor of 8% set by Basel and European Directives, the UK regulators set bank-specific minimum capital requirements, which took into consideration bank-specific factors including, for example, the outlook in a bank's main operating markets; the quality of its risk management; the quality of its internal control and accounting systems; and its future business plans.

Before the establishment of the FSA, the Bank of England set "trigger ratios" – bank-specific minimum total capital requirements, as well as "target ratios" – typically 50-100 basis points (bps) above the trigger ratios to avoid an accidental breach. The target ratio was to act as a warning light for supervisory follow-up if breached.

Following the Financial Services and Markets Act of 2000 bank supervision was transferred to the FSA, a process that was completed in 2001. As part of this transition, all banks were given individual capital guidance (ICG)[21] by the FSA. A key input into the FSA's ICG setting process is each bank's internal capital adequacy assessment. Subsequently, ICGs became set as part of the Pillar 2 process under Basel II.

After the 2008-09 financial crisis, following the government-supported recapitalisations in 2008, the FSA applied an enhanced regime for bank capital for those supported institutions.[22] Under this new supervisory framework, banks were expected to meet the following risk-based capital standards:

(i) in the outcome of a stress test based on FSA-generated parameters, a bank's core tier 1 capital ratio should not drop below 4 percent;

(ii) a 4 percent post-stress core tier 1 ratio that is judged to be consistent with a post-stress tier 1 ratio of 6 to 7 percent; and

(iii) a bank's Tier 1 capital, including common equity but also other accepted instruments, such as certain forms of hybrid capital, should be at or above 8 percent in normal times.

[21] We will use indistinctly capital requirements and individual capital guidance (ICG). Although the latter was the name given to the regime that applied from 2007 onwards, the process of setting prudential requirements was led by bank supervisors and applied at an individual firm basis throughout the period under study.

[22] The institutions were: Abbey (now Santander UK), Barclays, HBOS (now LBG), HSBC Bank plc, Lloyds TSB, Nationwide Building Society, Royal Bank of Scotland and Standard Chartered. See FSA (2009b).

In 2013, the responsibility for supervising banks was moved back to the Bank of England.[23] The Bank of England announced that it would no longer monitor the capital position of major UK banks and building societies using the previous supervisory framework, and would instead expect the major banks to meet a minimum 7 percent common equity tier 1 capital ratio under Basel III. Additionally, the Bank announced that it would expect banks to meet a (non-risk-based) 3% Tier 1 leverage ratio, following the recommendation of its Financial Policy Committee.[24]

3.2 The UK individual capital requirement regimes

Individual capital requirements (i.e., Triggers, ICRs and ICGs) for individual banks were the result of supervisory assessments and were delivered to banks as confidential statements. HBRD includes individual capital requirements collected from regulatory reports and additional supervisory datasets. Figure 1 above shows that at least on a weighted average basis across banking book, trading book credit risk and market risk, the requirements remained relatively stable, ranging from 9% to 10% prior to 2007. These aggregate statistics, however, provide a somewhat misleading picture, suggesting that only a few changes in capital requirements occurred during this period. In this section we show that for individual banks changes occurred much more frequently and there were significant differences in these changes across banks and over time. We do this by looking at simple averages and distributions across periods and firm types.

3.2.1 Implementation of individual requirements under Basel I regulation

During the early part of the period (between 1989 and 1995), individual capital requirements were set as a ratio, expressed as a percentage of an institution's on-balance sheet risk weighted assets. Banks had to satisfy up to four different ratios depending on whether they engaged in trading book activities. The first two named "trigger" ratios set a minimum capital requirement for the trading book[25] and one for the banking book. The final two ratios, known as "target" ratios established mandatory buffers above the trigger minimums. Such buffers could be used to meet unexpected losses, however, if they were used, firms were required to submit capital restoration plans demonstrating how they proposed to meet the higher targets. For cases involving groups of banks, supervisors typically set requirements at the group level and then applied these requirements to constituent banking subsidiaries. It was uncommon for supervisors to do additional analysis of capital adequacy at the solo or subgroup level.[26] Consequently UK banking groups faced

[23] The change entered into force in April 2013 (see Financial Services Act 2012). Specifically, supervisory powers were moved to the Prudential Regulation Authority (PRA) within the Bank of England. We use the term Bank of England for simplicity.

[24] See Bank of England (2013). The implementation would be made through the transposition of the EU Capital Requirements Directive (CRD) and later through the EU Capital Requirement Regulation (CRR).

[25] These were set only for a small number of bank subsidiaries up to 1995.

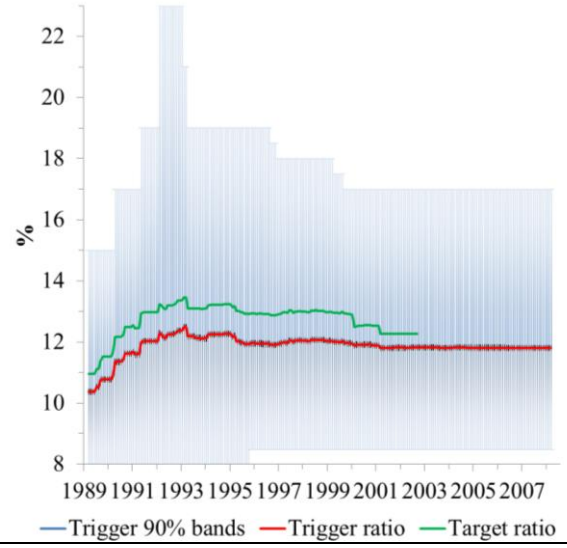
[26] However, there were exceptions to this rule when there were concerns about capital being 'locked' in a foreign subsidiary and not being readily transferrable to UK entities in the event that it was needed. More complex banks (e.g. banking, investment and insurance entities in the same group) had different requirements for solo entities and the group. The FSA (2002) highlights the complexity of fitting together regulation for

capital constraints at the consolidated group level and at the individual bank subsidiary (or subgroup) level.[27] Banks reported these trigger and target ratios for their banking books in their regulatory filings, which provided the main source of confidential information on capital requirements in the HBRD.

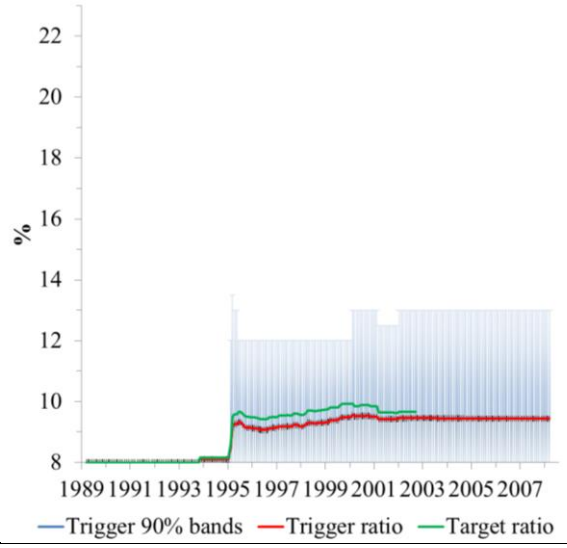
During this early period, however, banks did not include information on trading book activities or the required capital requirements on such activities in their regulatory reports. This information became available through the formal regulatory reporting process only beginning in 1996, following the introduction of the Basel Market Risk Amendment (MRA). To fill in the gaps on capital requirements for trading activities before then, we relied on other internal data sources.[28]

Figure 3: Average and range of capital requirements for banking groups 1989-2008

Panel A: Banking book



Panel B: Trading book



Note(s): Trigger ratio is the minimum requirement, Target ratio is the buffer above the minimum.

After the MRA formalised the international standards on trading book capital, UK supervisors extended the individual trigger ratio requirement to all banking groups with trading books.[29] Figure 3 compares the unweighted average trigger and target ratios for the banking book (left-hand side) with those for the trading book (right-hand side). The key difference is that before 1996, average banking book capital requirements generally trended upward (from around 10% at that start of Basel I to around 12% by 1996), whereas requirements for trading activities remained unchanged at 8% of risk-weighted assets. We

different firm types and the need to take into account consolidation, deduction and aggregation within a group. Source: internal discussions.

[27] Subgroups were supervisory constructs that attempted to combine subsidiary banks and related business entities. As a result, subgroups could differ from a standalone bank subsidiary to the extent it included operations of other entities within the wider group (or excluded certain business operations within the subsidiary bank).

[28] The HBRD contains such information for solo-level banks with trading books prior to 1996.

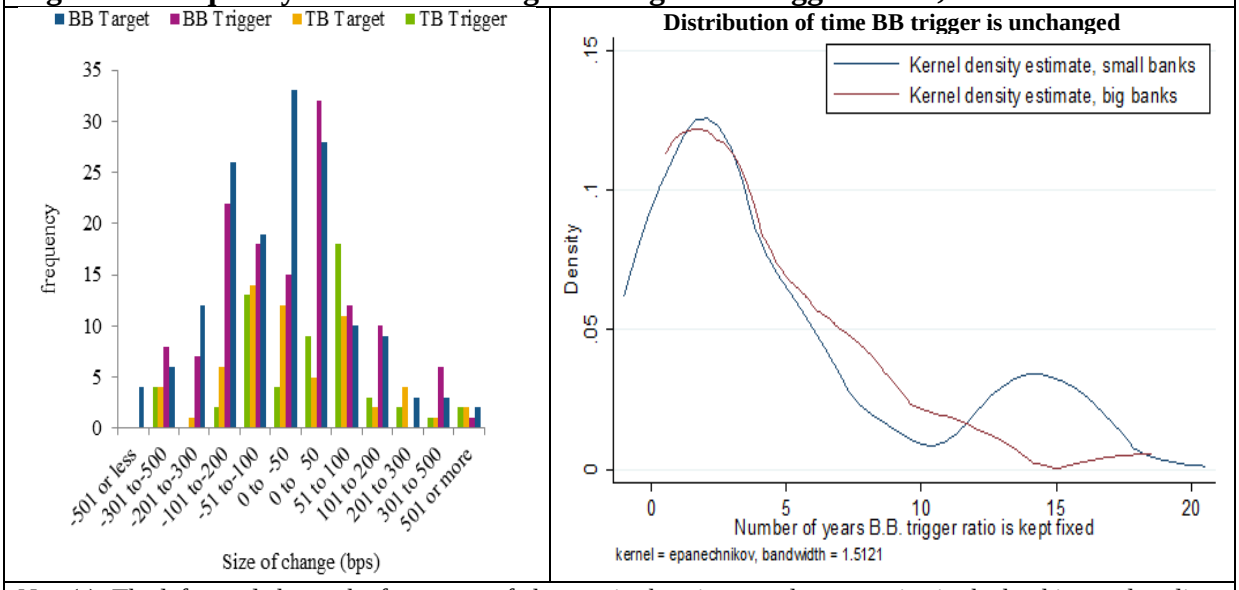
[29] Prior to that supervisors set a simplified solo-level trading book trigger ratio for only a few select banks.

discuss how banks' asset allocation and capital ratios changed following the MRA in Section 5.2.1.

The final sub period (from the second half of 1998 to 2007) saw the establishment of the FSA as the banking supervisory authority independent from the Bank of England. During this time, the FSA revised the supervisory process for setting individual capital requirements. In July 2003 it introduced the revised regime and abandoned the use of target ratios (see FSA, 2003), explaining why the green line disappears in Figure 3.

A review of these simple averages, however, can mask changes that occurred across banks and over time. Figure 4 provides additional insight showing the distribution of the changes over this period. It shows that there were more reductions than increases during the sample period, with the majority of reductions reflecting small changes (in the 50 to 200 bps range). These changes reflect a move towards lower requirements within the small bank class (as supported in Figure 14 below). Figure 4 also shows that there were several large increases of over 200 bps. The right-hand panel shows the distribution of time between changes in capital requirements. The median time between changes was roughly 2.5 years, but they were often kept fixed for significantly longer.

Figure 4: Frequency and size of changes to target and trigger ratios, 1989-2008



Note(s): The left panel shows the frequency of changes in the trigger and target ratios in the banking and trading book. The trigger ratio is the minimum requirement and the target ratio is the buffer above the minimum requirement. Out of a total of 2,010 observations there are around 400 changes for each ratio. The right hand side panel shows the distribution of years when the banking book trigger ratio was kept fixed, using a kernel density estimation with the default settings in *Stata*.

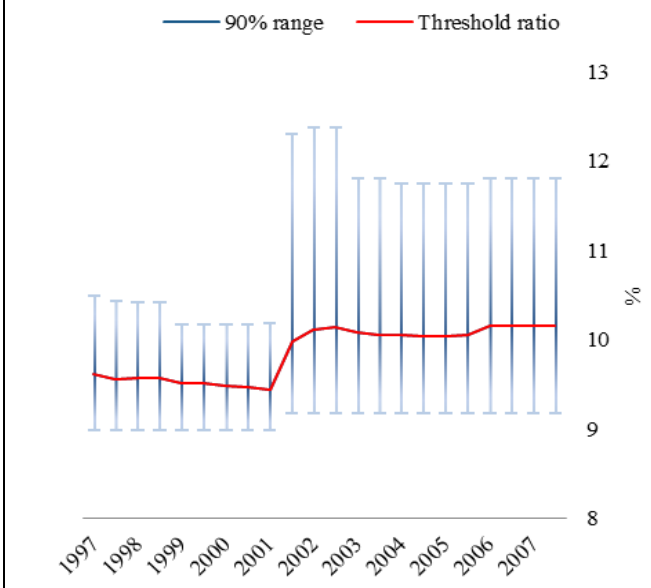
3.2.2 Building societies during the early period

Building societies received individual capital requirements in the form of a 'threshold ratio' with respect to risk weighted assets.[30] This framework was simpler than the one for

[30] Similar to a trigger ratio for banks, the product of the threshold ratio and risk weighted assets determines the amount of regulatory capital with which a building society was required to finance its operations.

banks, in that the mandatory ratio covered credit risks only, and the 'threshold' regime did not involve buffers or 'targets' as in the UK capital regime for banks. Figure 5 reports the distribution (average and 90% bounds) of capital requirements for building societies and suggests a possible regime shift in the way requirements were set for these firms after the formation of the FSA in 2001.[31] Between 1997 and 2001 capital requirements ratios for building society groups fell slightly. Between 2001 and 2002 the ratio increased by around 100bps. After 2003 the range narrows slightly, but the regime is more or less stable in average.

Figure 5: Mean and range of capital requirements for building societies 1997-2007



Note(s): Data for large builindg society groups only.

3.2.3 Implementation of individual requirements under Basel II regulation

Basel II came into force in the UK in 2008 and explicitly established requirements for credit, market and operational risks.[32] However, comparing individual requirements set under Basel II with those set under the previous Basel I regime is difficult due to new aspects of the post-2007 regime that feature in determining overall requirements. In particular, the use of stress tests for setting stressed capital requirements (including capital planning buffers), which were not formally part of the previous UK domestic regime.[33] It is mainly for this reason that we focus on discussing patterns in capital requirements after 2007 only in this subsection.

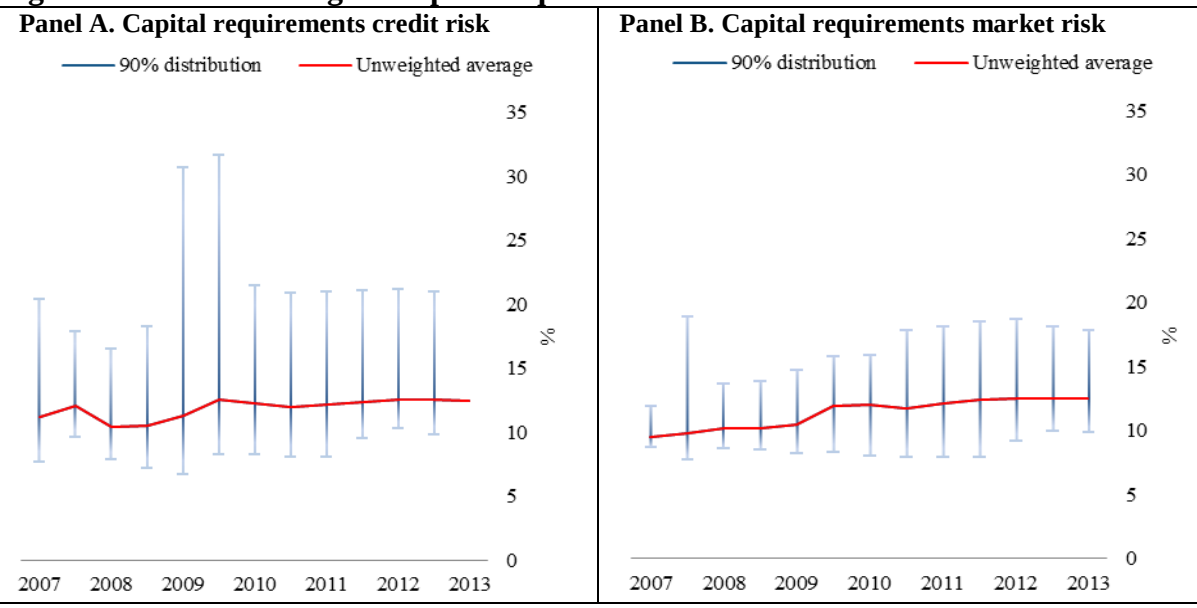
[31] See the discussion of the N2 review in FSA (2002).

[32] After 2007, UK banks reported a breakdown of these requirements according to these three risks in their regulatory filings.

[33] The information collected in the FSA regulatory report forms (see Appendix 1) include the requirements that come from stress tests and capital planning buffer.

Figure 6 shows the distribution of capital requirements for credit risk and market risk separately. The figure reports the simple average across all banks and building societies and the 90 percent bound of the distribution. It shows that variability in these ratios increases quite considerably in the period immediately after the height of the crisis.

Figure 6: Mean and range of capital requirements all firms 2008-2013



Note(s): Data for bank groups and large building societies.

We discuss how actual capital ratios changed in relation to the requirement further in Section 5.1.2.

4 Market Structure

This section gives a brief overview of the market structure of the UK banking sector as seen through the different firm types present in the database. This background helps in motivating our sample selection for assessing market conditions in the next section.

4.1 Concentration, size distribution and competition

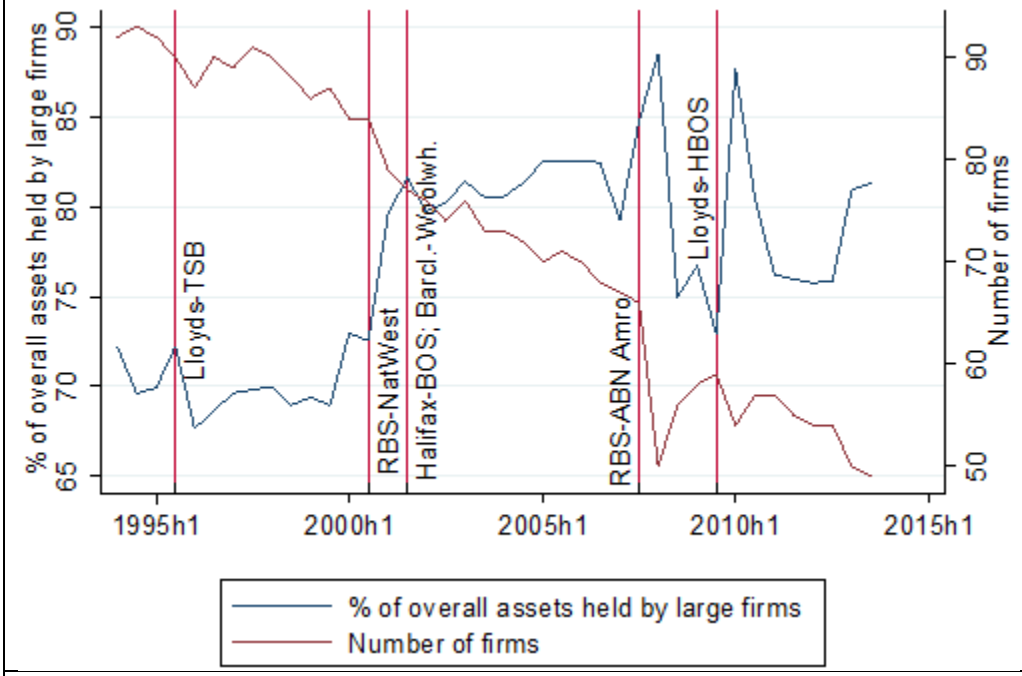
A key development over our sample period has been that large banks have grown ever larger and more concentrated due to mergers. To illustrate this development – and to introduce a key dimension of heterogeneity into the remainder of the paper, we classify banks as "large" if they are among the largest 8 in terms of assets during the first year of our sample period, and keep the classification constant throughout.[34] In this way, the large banks

[34] The big banks under our definition are Bank of Scotland (later acquired by Lloyds), Barclays, HSBC (Midlands Bank prior to 1993), Lloyds Bank, NatWest (acquired by Royal Bank of Scotland in 2001), Royal Bank of Scotland, and Standard Chartered, and Treasury Select Bank (TSB) (later acquired by Lloyds). Of those, Standard Chartered is not traditionally counted as one of the "big four English banks" since it is focuses on emerging markets.

correspond to what is traditionally thought of as the big six banks in England and the two large Scottish banks, as well as their successors.

Figure 7 shows that this group of large banks accounts for 75%-95% of the total assets of all banks covered by the study, a share that has generally increased over time. When interpreting these shares, readers need to keep in mind that the global assets of UK banks are included; hence, these are not market shares on e.g., the UK retail banking market. The figure also shows the dates for mergers among those big banks and acquisitions of overseas banks e.g., RBS purchase of ABN Amro. Note that we start the series in 1994 to make the numbers comparable.[35] In addition, the figure shows that the number of banks has generally decreased over time, nearly halving during the sample period.[36]

Figure 7: Concentration and number of banks over time



Note(s): Data for banks groups. Excluding foreign and non-traditional banks.

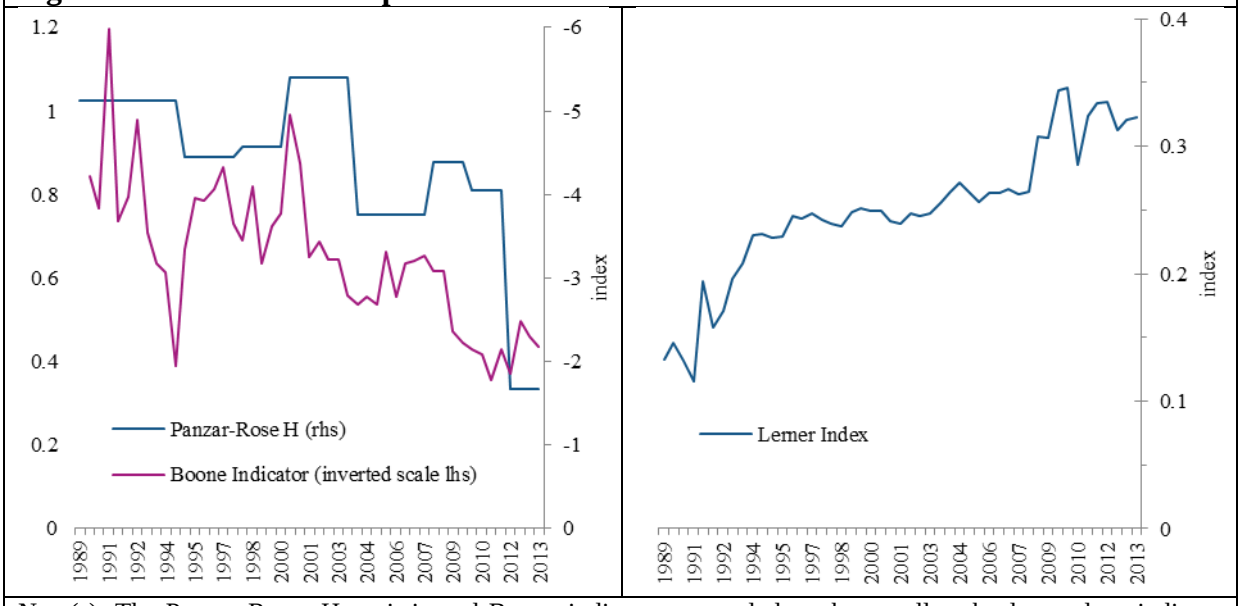
The HBRD provides a rich set of metrics on input and output prices that permit a fuller exploration of the evolution of competition in the UK banking sector. These metrics include flow variables such as funding and employment costs and cost of fixed assets over time and revenue and profits per period. Indeed, de-Ramon and Straughan (2016) use the HBRD to estimate several measures of competition from the literature on industrial organization and find evidence that since 2000 competition became less intense. Figure 8 reproduces their charts showing estimates of the Panzar-Rosse H-statistic, the Boone

[35] Since building societies generally enter the sample in 1994 due to data limitations, it is difficult to compare e.g. the number of firms in the database before and after that date.

[36] Increasing concentration and evidence of decreasing competition in the UK banking markets has also been uncovered by Davies et al. (2010), Logan (2004); Matthews, Murinde, and Zhao (2007); and Schaeck and Cihák (2010).

indicator and Lerner index.[37] Smaller absolute values in the first two measures indicate lower competition, while higher values of the last suggest lower competition. Figure 8 clearly shows a relative drop in competition intensity according to all three measures from 2000 onwards.

Figure 8: Measures of competition



Note(s): The Panzar Rosse H statistic and Boone indicator are scaled so that smaller absolute values indicate less competiton; both show a fall in competition. The Panzar Rosse H statistic is averaged over periods of stable competiton according to the data. Lerner index is an overall mark-up estimate which is higher under less competiton; it shows fluctuating and falling competition over the whole period with an increase just before the 2007/08 crisis. See de-Ramon and Straughan (2016) for more dicussion on these trends.

4.2 Heterogeneity in terms of activities and origin

The broad coverage of the data is a key strength of the new dataset, but it also implies that we must take care to ensure that the institutions included are comparable. To this end, we describe two filters imposed in the analysis that exclude non-traditional banks, i.e., those banks that do not engage very much on traditional banking activities and foreign banks.

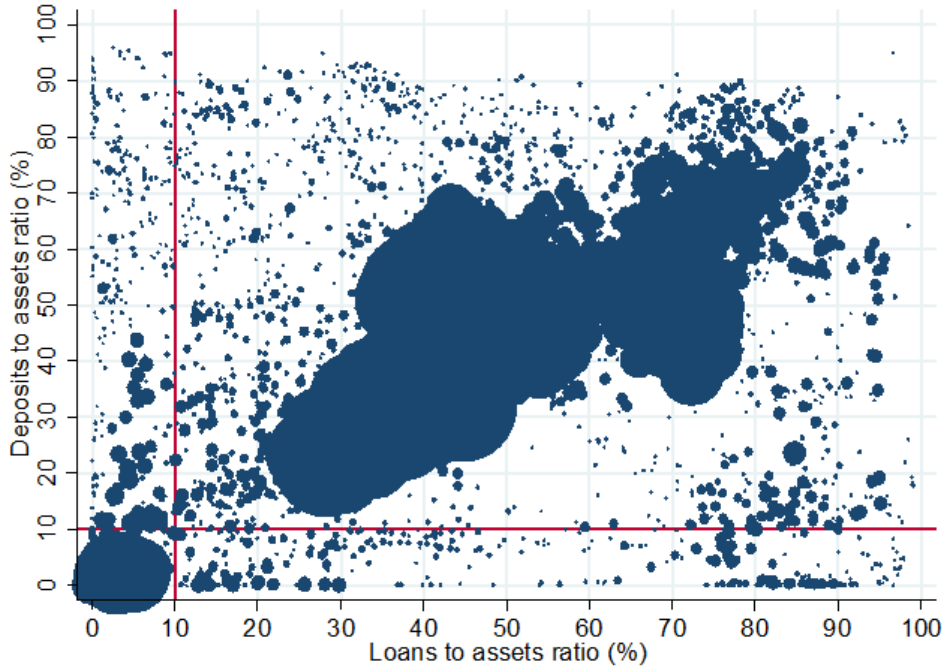
4.2.1 Non-traditional banks

Figure 9 shows the industry composition in terms of the extent to which banks take deposits and grant loans. It shows a cluster of banks that do nearly none of both. For the analysis in this paper, we include only those institutions that report loans and deposits of at least 10% of their assets.[38] This restriction corresponds qualitatively to the definition of banks in Freixas and Rochet (2008).

[37] The Panzar-Rosse H-statistic (Panzar and Rosse, 1987) is a cost of production pass-through proxy that denotes market-power when the pass-through falls below one. The Boone indicator (Boone, 2008) measures competition through the ability of efficient firms to gain market share. The Lerner index (Lerner,1934) is a price-cost margin proxy that denotes market power when it diverges from zero.

[38] To keep the sample relatively stable, we keep banks even if they fall below these thresholds in later years after they have met them at least once before.

Figure 9: Ratios of deposits and loans to assets



Note(s): Each bubble represents a bank-year observation; the size of the bubbles is proportional to total assets. The horizontal position of the centre of the bubbles corresponds to the loans to asset ratio and the vertical position to the deposit to asset ratio.

4.2.2 Foreign banks

The large presence of foreign banks is a key characteristic of the UK banking market, making it one of the largest and most interconnected nodes in the global banking network (Fender and McGuire, 2010).

The dataset includes many observations of UK subsidiaries of foreign banking groups. These foreign owned banks provide a rich additional set of data as they operate in some of the same markets as UK banks, e.g., intra-financial business, or banking services for specific customer types (UK foreign nationals).

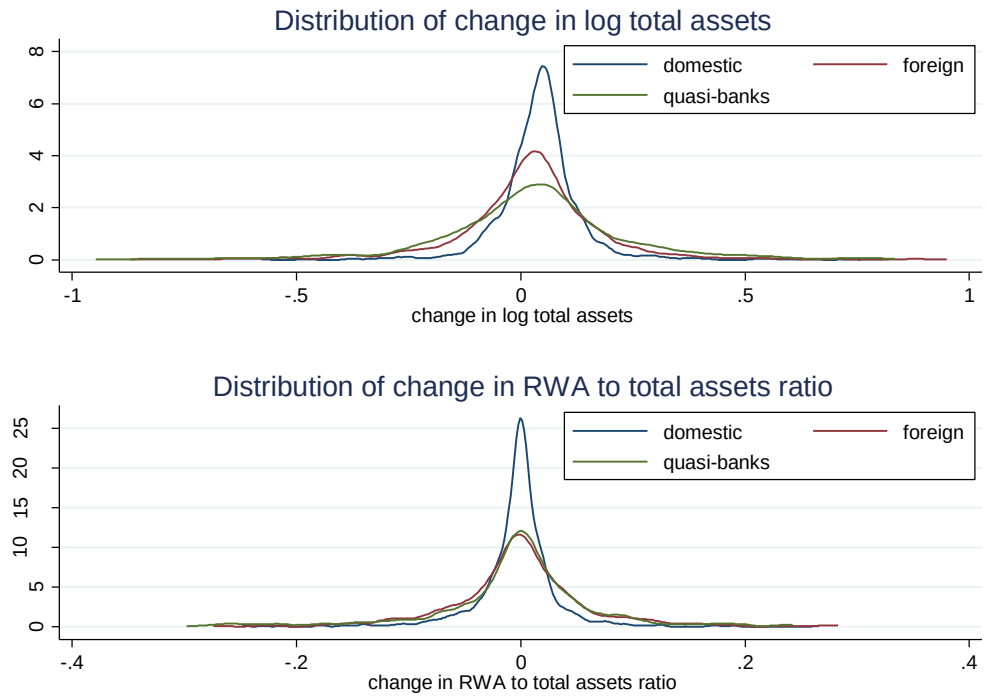
For the rest of the analysis in this paper we drop most foreign banks for conceptual reasons. The group reporting data is consolidated to the highest level where there is a UK entity but this makes UK and foreign holding companies not comparable in scope. For a UK-headquartered holding company the group consolidation includes all banking subsidiaries worldwide, while for a foreign group it is only be UK sub-group of the foreign group.

We also drop groups with a foreign owner, since as noted before we want to focus on the decisions taken at the highest level of consolidation, which is likely to be the focus of top management's decisions.[39,40] As described above, we also restrict our analysis to traditional

[39] Note that the foreign banks include some that are seemingly managed fairly autonomously from their foreign parents and could therefore potentially be considered domestic, in particular Santander UK and National Australia Bank UK.

banks based on deposits and loans. UK subsidiaries of foreign groups are to a larger extent engage in intra-financial business (e.g., trading and interbank lending and borrowing) compared to loans and deposits to households and non-financial companies.[41] These differences also mean that the growth profile of foreign-owned banks is not necessarily comparable to that of domestic institutions. This is borne out in Figure 10, which shows that foreign banks have more variable growth rates in (log) total assets and the ratio of risk-weighted to total assets, likely due to intragroup transactions. The figure also shows that non-traditional banks as defined in the previous section also have more variable rates of change along these two dimensions.

Figure 10: Changes in assets and RWA, foreign, domestic and quasi-banks



Notes: the figures show kernel density estimates for the distribution of changes in log total assets and risk-weighted to total assets, estimated using the default settings in *Stata*.

Finally, prudential requirements on foreign firms throughout the sample were set somewhat higher than those of UK-headquartered firms with average requirements in excess of 10% of risk weighted assets. As a result risk based capital ratios of foreign banks were on average higher than those of UK-headquartered banks as shown in Panel B of Figure 11 below.

[40] The main intragroup decisions that motivate our exclusion of foreign banks relate to the allocation of capital and funding within the broader consolidated group, which can influence reported financial measures, sometimes considerably.

[41] In particular, as seen in Table 1, roughly 27% of the bank-years for foreign banks do not meet the threshold condition for assets and deposits described above (i.e. that both constitute at least 10% of assets). In contrast, only 9% of domestic bank-years fail the criterion.

Table 3 shows that after applying the criteria to exclude foreign banks and banks with insufficient loans or deposits, our sample consists of 1636 bank-years in the sample.

Table 3: Number of bank-years meeting sample conditions

Sample criteria	Domestic Banks	Foreign-owned Banks	Total Banks
Deposits & loans ≥ 10% assets	1636 (87.5%)	1323 (4.5%)	2959 (92%)
Deposits & loans < 10% assets	152 (0.1%)	359 (8%)	511 (8.1%)
Total	1788 (87.6%)	1682 (12.5%)	3470 (100.1%)

Note(s): The share of total assets (in parenthesis) is the average share over all years in the sample.

5 Industry Conditions and Activities (CAMEL characteristics)

This section describes industry conditions over our sample period by setting out and discussing stylized facts on the CAMEL factors (i.e., Capital Adequacy, Asset Quality, Management, Earnings Performance and Liquidity) typically used in characterizing banking conditions. We describe separate developments for small and large banks, where large banks are defined as above (i.e. largest 8 in terms of total assets in 1989, and the successors of these banks). Further, we show separate developments for a sub-sample consisting of a common set of of small banks available from 1994 to 2013, so as to enable readers to distinguish between changes that are due to changes in sample composition and within-bank changes. We chose the year 1994 rather than the starting year of the database since data on many small banks are not available prior to 1994. Moreover, the building societies only enter the sample in 1994.[42] Hence, the main difference between this subsample and the full sample of small banks is the higher weight of building societies in the former. Therefore, differences between this sample and the full sample of small banks will largely reflect differences between building societies and banks. For these reasons, readers should proceed with caution when interpreting the pre-1994 aggregates for small banks. In contrast, all large banks are present in some form throughout the sample (although they often merge with each other); hence, no separate subsample is necessary for those.

The figures in this section therefore show averages (weighted by total assets) separately for these three groups. Unless otherwise noted, the aggregate developments were similar to those for large banks; this effect arises mechanically in value-weighted averages due to the concentration of assets in large banks (as described above).

5.1 Capital Adequacy

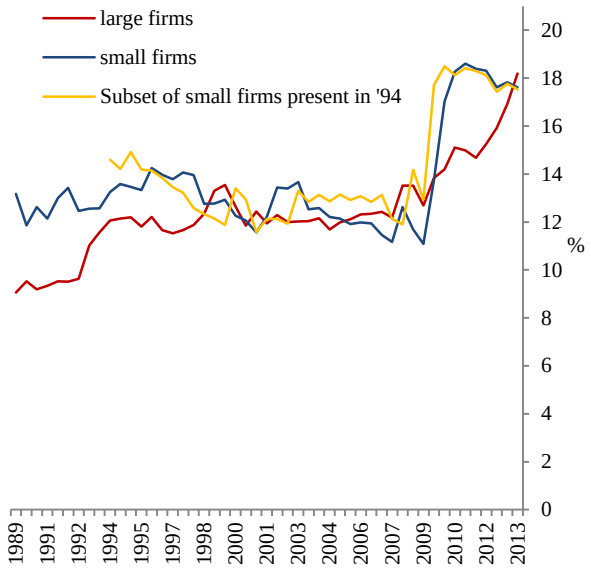
Aggregate measures of capital paint different pictures of overall capital adequacy for the UK banking sector over time and between large and small banking firms. In this subsection, we compare total risk-based and non-risk based capital ratios, as well as trends in

[42] Recall that building society data is available from 1994 but their individual capital requirements generally only become available in 1997.

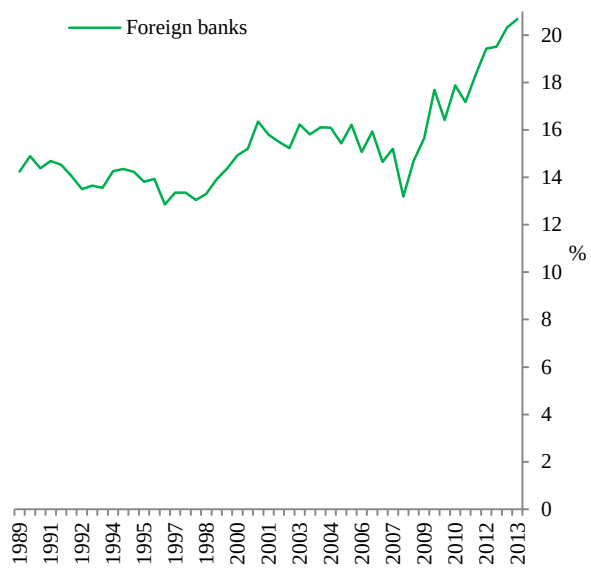
average risk-weights over time and across size classes to get a better sense of how capital adequacy evolved in the UK. We also look at developments in aggregate capital requirements and voluntary buffers over time for both large and small banks as a step towards providing insight into capital management practices in the UK.

Figure 11: Total Regulatory Capital Ratio (risk weighted)

Panel A: Domestic institutions



Panel B: UK subs of international banks



Note(s): The figures show RWA-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

Panel A Figure 11 above reports the total risk-based capital ratio for large and small banks and shows that there was a relatively broad-based increase in total capital ratios during the early- and mid-1990s after the introduction of Basel I. During this time, large banks reported materially lower overall capital ratios compared with smaller banks. Some potential explanations for this difference include that large banks were able to hold lower capital since market participants expected them to be "too large to fail", as well as the lower individual capital requirements on these banks that we document in section 5.1.2 below. This increasing trend reversed in the mid- to late 1990s, after the introduction of the Market Risk Amendment which required capital for market risk in the trading book and allowed banks to use internal models for determining such capital charges for market risk in trading books. From the late 1990s until start of the global financial crisis at the end of 2007, a subtle downward movement in total risk-based capital ratios continued. Beginning in 2008, however, total risk-based capital ratios jumped in response to mounting regulatory and market pressures as well as a number of government actions to shore up banks' capital positions during this period.[43]

[43] These patterns also held for UK subsidiaries of international banks (shown in the right panel), which generally had higher capital than domestic banks over this timeframe.

The absence of clear falls in capital ratios during the crisis is likely due to the swift measures undertaken by banks and authorities. In addition, they may reflect that banks were slow to realise losses, an issue we return to in Section 5.4 below.

Behind this broad aggregate change there are several dimensions that we discuss below, in particular the decomposition into risk weights and leverage ratios and the composition in terms of required and voluntary capital, and the composition in terms of capital instruments of different quality.

5.1.1 Risk-weighted capital ratios and leverage ratios

To understand the development of risk-based capital ratios, a useful decomposition is

$$\frac{Capital}{Risk\ Weighted\ Assets} = \frac{Capital}{Total\ Assets} \times \left(\frac{Risk\ Weighted\ Assets}{Total\ Assets}\right)^{-1}$$

The first term on the right hand side of the of the expression above is the so-called leverage ratio and is similar in spirit to the leverage ratio proposed under the Basel III framework.[44,45] It reflects a much broader measure of leverage, however, in that the numerator includes all (eligible) regulatory capital and not just common equity tier 1capital, and the denominator equals total assets and not a measure of 'leverage exposures' as set out in Basel III. The term within brackets is sometimes referred to as the risk weight density, and can be interpreted as a regulatory measure of the riskiness of assets. Both ratios are interesting objects to study.

Figures 12 and 13 show the evolution of these two ratios. As figure 12 shows, leverage ratios generally trended downward in the run-up to the global financial crisis of 2008-09, after which they increased at both large and small banks. The increase at small banks, however, was short-lived: as by mid-2013 small bank ratios had dropped back to pre-crisis levels.

In contrast, figure 13 shows that there was a marked decrease in the average risk weight densities, particularly for large banks, over the full time frame. This decline was relatively broad based across both large and small banks, and especially pronounced after the introduction of Basel II in 2007, which generally lowered risk-weights and allowed banks to use internal models determine capital requirements (i.e., risk weights) for credit risk in the banking book; such internal models became widespread among large banks (while small ones generally did not adopt them). An additional explanation for the decline after the crisis may have been that banks shed high risk-weight assets to conserve capital. The drop in average risk weights over this period explains much of the upward movement in risk-based capital ratios highlighted earlier.

[44] Note that in corporate finance, researchers often use the "leverage ratio" to mean the inverse of this measure.

[45] The Bank of England's use of the leverage ratio is motivated by concerns about relying too heavily on the modelling behind risk-weighted assets; see e.g. Bank of England (2016a, p. 34-35). For details on the Bank of England's implementation of the leverage ratio, see Bank of England (2015).

Figure 12: Leverage ratio (capital as a % of total assets)

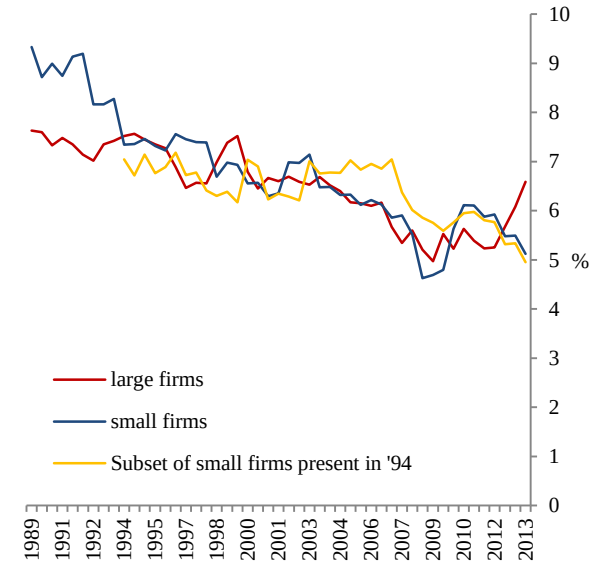
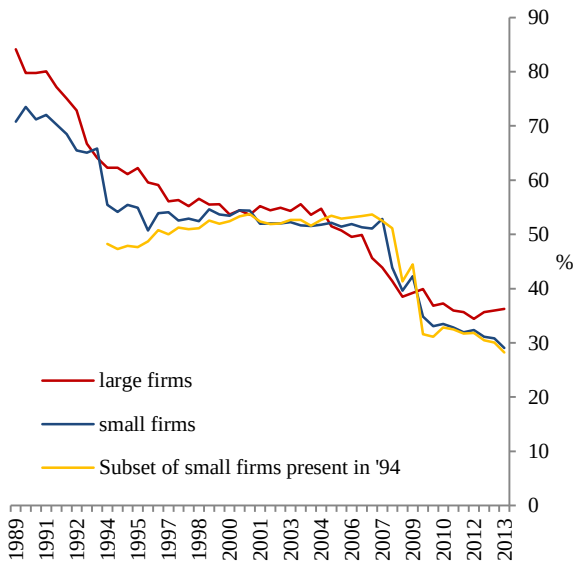


Figure 13: Risk-weighted assets (RWA) (% of total assets)



Note(s): The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

The conflicting movements in these measures make it challenging to assess capital adequacy overall. The downturn in average risk weights could suggest, for instance, a reduction in industry-wide asset risk. The general reduction in the leverage ratios across the sector, implying a build-up in financial leverage more broadly, raises questions about overall capital adequacy.

Policymakers and researchers need to understand to what extent the decrease in average risk weights reflects a change in actual risk and to what extent they reflect a combination of pro-cyclicality of risk weights and relatively benign times, or even banks' managing to arbitrage capital requirements by engaging in activities at lower risk weights without reducing risks (e.g., by shifting assets to the trading book as we discuss in section 5.2.1 below). We suggest some avenues for further exploration of this topic in section 6.

5.1.2 Voluntary and required capital

Capital requirements are an important driver of capital choices,[46] but banks also hold buffers above those requirements which we can think of as voluntary.[47] Figures 14 and 15 show the evolution of the average total capital requirements and the buffers above those.

Figure 14 shows that individual capital requirements were lower on average for large banks compared to smaller bank, especially in the period after the 2008-09 crisis. In addition,

[46] See for example Alfon et al (2004), Francis and Osborne (2009, 2010).

[47] Of course, parts of these "voluntary" buffers are probably kept to avoid hitting the regulatory limit; e.g., Francis and Osborne (2012). In section 6.1 we suggest research avenues for disentangling these motivations.

while they increase over time, until the time of the crisis, they were never far from the Basel minimum ratios (of 8%) for large banks.

Figure 14: Total required capital by firm size (% of RWA)

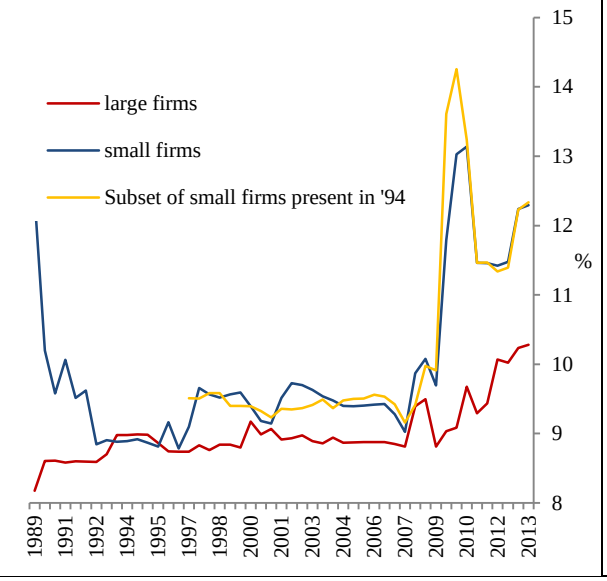
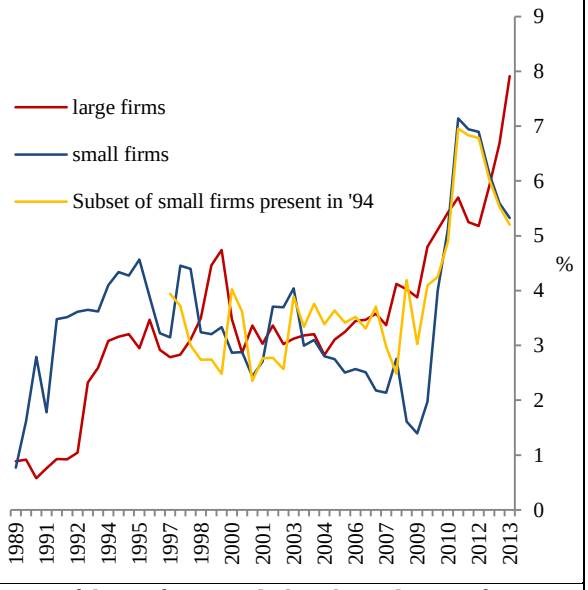


Figure 15: Regulatory capital in excess of requirement by firm size (% of RWA)



Note(s): The figures show RWA-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

The higher individual capital requirements for small banks is likely to reflect the fact that the methodology for setting those requirements were based on an assessment of firms' processes and systems[48] rather than, for example, the complexity of the risks they took or the risk they posed to the broader economy. From this perspective, the philosophy behind the requirements differed markedly from the philosophy for imposing additional buffers on the largest firms, as Basel standards will require going forward.[49]

Figure 15 shows that, on average, aggregate voluntary buffers ranged from 1% to 4% in the period from 1989 to the start of the crisis in 2007. Small firms, however, saw a significant drop in voluntary buffers around the time of the 2008-09 financial crisis, when capital requirements and losses heightened. Since 2009, banks have generally increased voluntary buffers in response to increased market and regulatory pressures (including stress tests) as well as in anticipation of higher requirements under Basel III.[50]

[48] See section 6.1.2 for details.

[49] Indeed, the additional buffers imposed on the largest and systemically important firms after the end of our sample period address this regulatory failure (see BCBS, 2013a for a discussion of capital surcharges for global systemically important banks, and Bank of England, 2016b for a discussion of the UK implementation).

[50] Some of this increase may also be attributable to the FSA enhanced supervisory framework in 2008 which increased expectations around the capital ratios that banks needed to satisfy.

Both figures allow us to see the reactions to the 2008-09 crisis more clearly. The required capital levels increased steadily. For small banks there was a peak that partly reflects the introduction of requirements based on stress tests, as described in Section 3.2.3, while for large banks the requirements continued to increase until the end of the sample period. The voluntary buffers above requirements increased in a similar fashion, partly reflecting how the government-led recapitalisations of large banks undertaken during the crisis.

5.1.3 Capital "tiers" of different quality.

Researchers and policymakers have increasingly focused not just on the quantity but also on the quality of capital.[51] Researchers have demonstrated that "alternative" or "hybrid" forms of capital were less able to absorb losses and thereby prevent failure in the 2008-09 crisis (e.g., Detragiache et al., 2013; Haldane and Madouros, 2012; Turner, 2009). After the banking crisis, policy-makers have put requirements in place on the highest-quality form of capital known as "Common Equity Tier 1", i.e. essentially common equity.

Figure 16: Core Tier 1 ratio (% of risk-weighted assets)

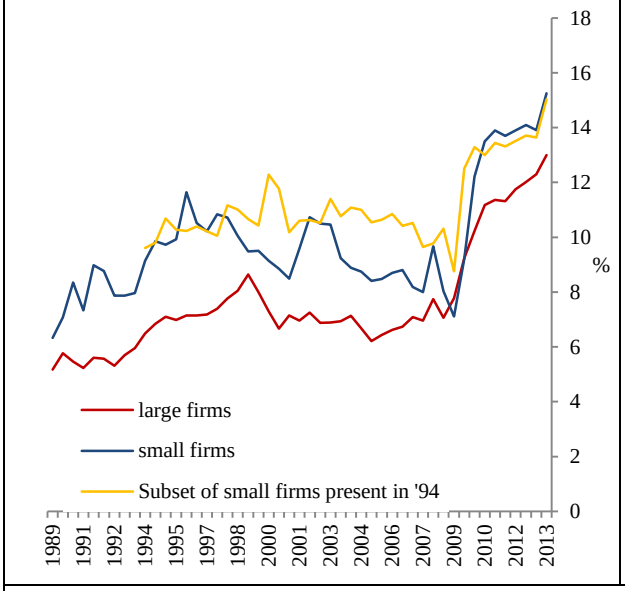
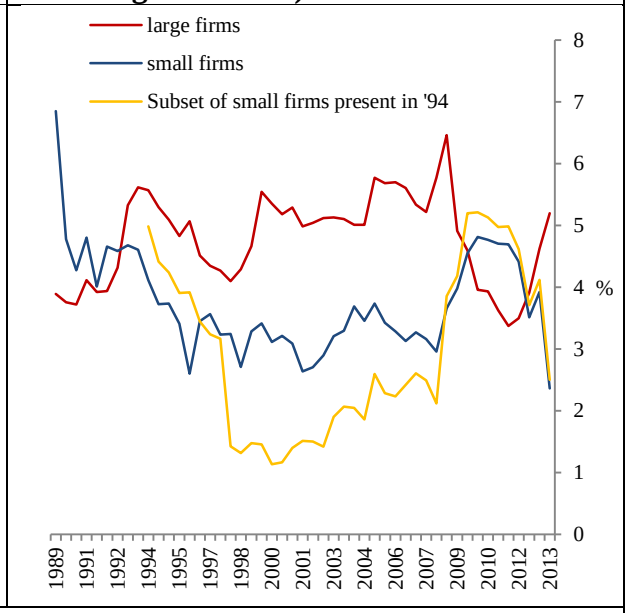


Figure 17: Regulatory Capital after deductions in excess of Core Tier 1 (% of risk-weighted assets)



Note(s): The figures show RWA-weighted averages.The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

Figure 16 above shows the development of the highest-quality form of capital (i.e., the Core Tier 1 capital ratios) over time.[52] Figure 17 reports the difference between the total

[51] When we speak of the quality of capital, we are referring to the ability of the underlying capital instrument to absorb losses in the time of stress.

[52] We have attempted to keep our definition of 'core tier 1' capital consistent over time. Prior to April 2008, we computed this measure for banks as the sum of ordinary shares / common stock (issued and paid up), perpetual non-cumulative preferred shares/stock (issued and paid up), current year's profits/losses, less goodwill and other

regulatory capital ratio (after deductions) and the Core Tier 1 ratio. This figure shows the extent to which banks relied on lower-quality forms of capital. Before the crisis, large banks generally relied on relatively less Core Tier 1 capital and higher levels of other forms of regulatory capital than small banks. After the crisis, there is some convergence as large banks placed more emphasis on raising common equity levels (alongside a move to decrease risk-weighted assets as highlighted above).

5.2 Asset Quality

Asset risk — and credit losses in particular — multiply in times of distressed economic conditions. And the correlation between the likelihood of default and losses given default also tends to increase during such periods, thus exacerbating procyclical swings of credit losses (e.g., Saunders and Allen, 2010). These effects were most acute during the Great Financial Crisis, with UK banks recording loss rates on their asset portfolios not seen since the early 1990s, another period characterized by a downturn in economic conditions and banking crisis, although arguably more benign.

Figure 18: Net loan losses (% of total loans)

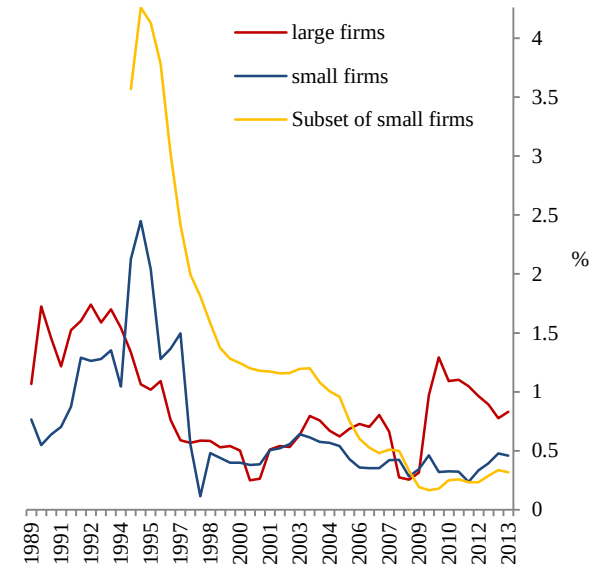
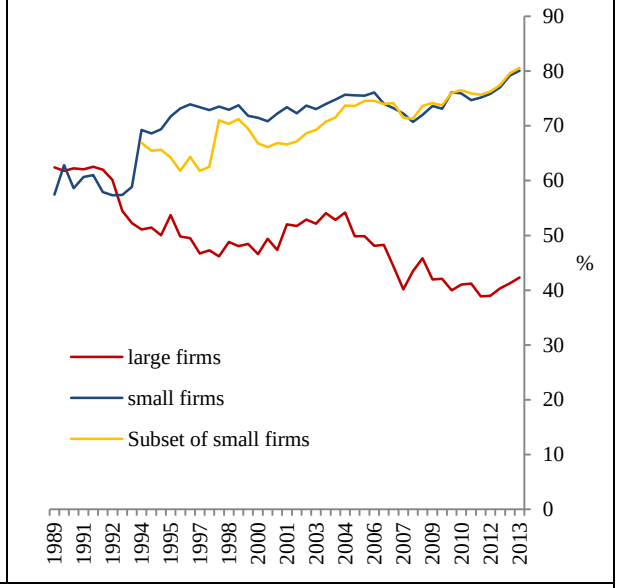


Figure 19: Loan to asset ratio (%)



Note(s): The figures show loan-weighted (lhs) and asset-weighted (rhs) averages.The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

Figure 18 reports net loan losses (i.e., write-offs less recoveries) as a percentage of total loans for large and small banks. We can see that loan losses were relatively high for both small and large banks during the distressed period of the early 1990s, while the opposite was

intangible assets. For building societies (from 1994 to March 2008) we computed this as the total tier 1 capital (as reported on the QFS returns) less minority interests. After March 2008, we computed core tier 1 capital as core tier 1 capital before regulatory deductions (as reported on the line 17A of the FSA003 return) less investments in own shares and intangible assets.

true in the 2008-09 crisis. Net loan loss rates for the small firms overall and the subset of small firms in particular peaked in 1995 and then trended downward until just before the height of the 2008-09 crisis. Of particular note here is that loan loss rates during the 2008-09 crisis, while high by historical standards, were below those recorded during the early 1990s, supporting the notion that credit risk played a more limited role in contributing to the more recent crisis. Net loss rates at the smallest banks have continued to climb in the aftermath of the crisis, but remain well below levels reported during the small banks crisis in the early 1990s.[53]

Balance sheet composition may provide some further clues about the nature of the risks underlying banks' asset portfolios. Figure 19 reports the share of lending within banks asset portfolios and shows a relatively pronounced movement away from traditional lending activities since 1989 for the largest institutions. At these institutions lending declined from just over 60 percent of balance sheet activities in the early 1990s to around 40 percent at the end of 2013, reflecting in part the increased emphasis on non-traditional intermediation services (e.g., securitisation[54] and investment banking activities) that occurred over this period within the large bank subsector.

Whether and how this alteration in balance sheet makeup has affected overall asset risk remains an open question for further research. The riskiness of banks' portfolios as measured by the ratio of the regulatory risk-weighted assets to total assets declined considerably over the period, as we described earlier. This decline in average risk weight density was especially evident during the run-up to the 2008-09 financial crisis, after which sector loan losses jumped and profitability continued to be challenged. Pre-crisis aggregate measures confirm that regulatory risk weights were in fact a relatively poor reflection of asset quality overall. We discuss additional research indicating this issue in section 6.1.2.

5.2.1 Assets and risk-weights in the trading and banking books

One contributing factor to the decrease in average risk weights may have been the shift of assets into the trading book, which, under the MRA, garnered lower capital charges for similar assets held in the banking book. The distinction of assets in the banking and trading book arose through the MRA in 1996. Figure 20 shows that after that time, the share of assets classified as trading book assets generally increased over time for the largest institutions, consistent with the idea of these firms minimizing capital requirements by shifting assets into the trading book.[55]

Figure 21 provides a better sense of the extent of the beneficial treatment of trading book assets. In particular, the average risk-weight of trading book assets was roughly half of

[53] The incurred loss model under the accounting standards that were in place during this latter period could also have a role in this lower measured loan loss ratio (see, for example, Bushman, 2016 and Camfferman, 2015).
[54] The dataset currently lacks information on securitisation; it could be complemented with such information for parts of the sample period.
[55] For expositional ease, in this section we only show figures starting in 1996, and only for big banks and small banks present in 1994, since the trading book classification only starts in 1996.

that in the banking book (note that we show this figure only for large banks due to the limited number of small banks with a trading book). The figure also shows that average risk weights in both the trading and banking books have generally decreased during the sample period. We discuss the possibility that this reflected "regulatory arbitrage" in section 6.1.1.

Figure 20: Trading book assets (% ot total assets)

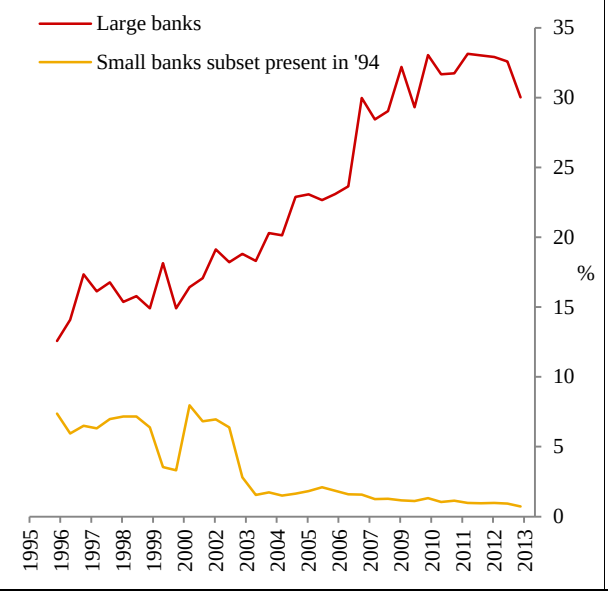
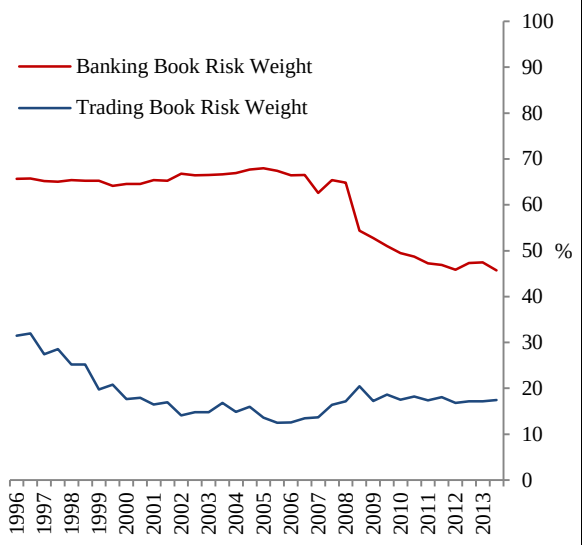


Figure 21: Risk-weights in the banking and trading books (large banks)

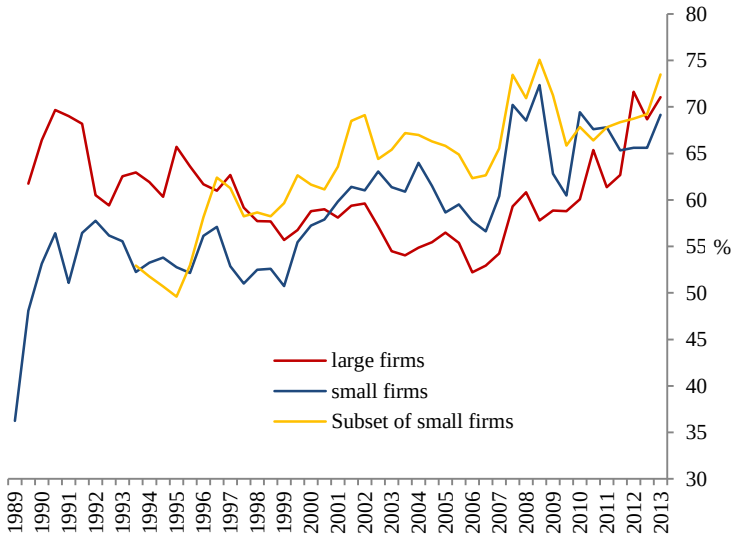


Note(s): The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK. The banking book and trading book risk weights are calculated as the weighted average across all firms of the corresponding ratio between risk-weighted assets to total assets.

5.3 Management Skills

The research on the influence of bank management and cost efficiency on the sustainability of bank profitability and asset risk provides another basis on which to understand patterns in the performance of the UK banking sector. Previous research on cost efficiency focused on how such measures may contribute to the likelihood of failure and financial crises more broadly (e.g., see Berger and DeYoung, 1997, Berger et al., 2014). This section reviews the cost efficiency of the UK banking sector over time and across size classes. In particular, Figure 22 reports the ratio of non-interest expense to the sum of net interest income and non-interest income, also known as the efficiency ratio. This ratio reflects the cost of generating a pound of earnings, with higher ratios depicting less efficient management. Sector efficiency remained relatively stable at between 50 to 65 percent prior to the crisis. The ratio increased considerably since the crisis moving to over 70 percent during the height of the crisis in 2008-2009 for small banks. It also increased dramatically for the largest banks, rising from around 55 percent just prior to the crisis to over 70 percent at the end of 2013. This increase was relatively broad based across both large- and small-sized institution.

Figure 22: Efficiency ratios



Note(s): The figure shows income-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

A literal interpretation of these ratios would suggest that banks have generally become less efficient, particularly in the aftermath of the crisis. A more adequate interpretation of the trends in efficiency may be that overhead and provision expenses grew, particularly during the onset of the crisis, as banks had to deal with growing loan problems. Also weighing heavily on efficiency measures since the crisis have been the mounting charges for Payment Protection Insurance (PPI) mis-selling. We suggest directions for alternative ways of measuring management efficiency in section 6.5.1.

5.4 Earnings Performance

The performance literature on banking examines the persistence of earnings and the underlying driving factors of such persistence (e.g., DeYoung and Roland, 2001; Hirtle and Stiroh, 2007). Studies typically use measures of earnings performance, such as return on equity or return on assets, in evaluating the volatility of and influences on such performance measures (e.g., Goddard, Molyneux and Wilson, 2009). This section reviews the performance of the UK sector.

Figure 23 reviews the return on assets (after-tax net operating income as a percentage of total assets) for the UK banking sector and clearly shows that sector performance was relatively volatile, with a notable decline during the height of the 2008-09 crisis. The figure also highlights how the problems in the early 1990s translated into weak earnings overall and mainly within the small-bank class.

Figure 23: Return on assets (%)

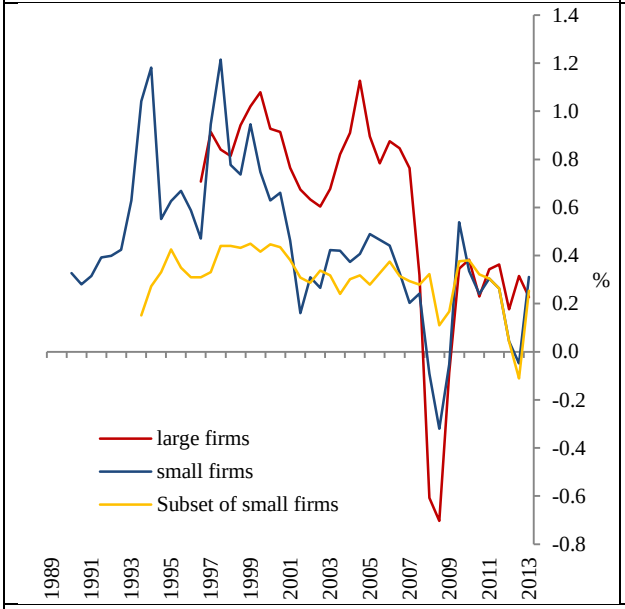
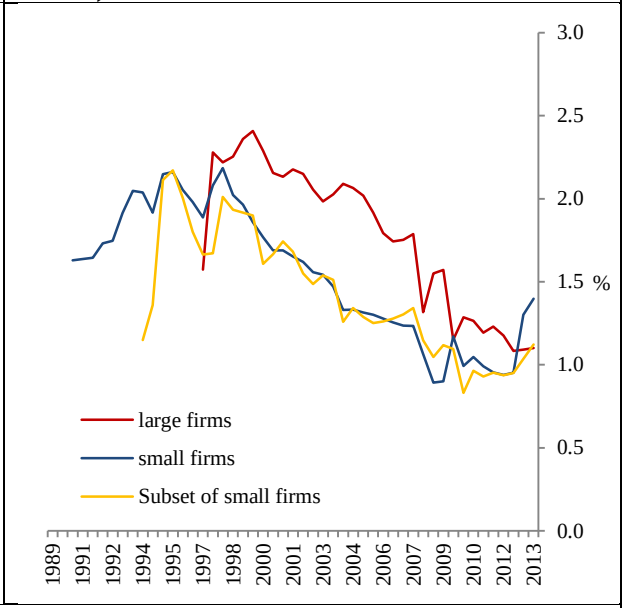


Figure 24: Net interest income (% of assets)



Notes: The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

Figure 24 offers some insights into the components of such performance. This figure reports net interest margins (as a percentage of total assets) and shows an apparent improvement from the early to late-1990s and then a sustained downturn from 2000 to the crisis period in 2007. The drop in margins was relatively broad based across size classes, though the decline at small banks appears to have been more rapid than at the largest banks. The higher interest income of large firms is perhaps surprising considering their lower levels of loans as a fraction of assets seen in section 5.2 above. A potential explanation is that their higher market power enables more beneficial input and output prices for them.

Figure 25 suggests that at least part of the downturn in margins was due to the shift in banks' balance sheet makeup towards lower earning asset proportions. This drop in earning assets, i.e. those assets that yield a return through interest, is most pronounced within the smallest class of banks beginning in 2004.

The volatility in earnings performance can also be attributed to the relative volatility in loan loss provision expense exhibited over this period. The expense reflects the amount of actual incurred losses that banks experiences on specific loans combined with a general loss estimate that banks expect on a pool of relatively homogeneous loans. Figure 26 shows the ratio of UK banks' provision expense to total assets and shows two distinct spikes: one during the economic difficulties of the early 1990s and another during the 2008-09 crisis. The spike during the early 1990s distress period was common to small and large firms, while the jump the 2008-09 crisis was more pronounced within the largest banks. Since the end of the

crisis, however, this divergence narrowed as small banks continued to deal with problem legacy assets.

Figure 25: Earning assets (% of assets)

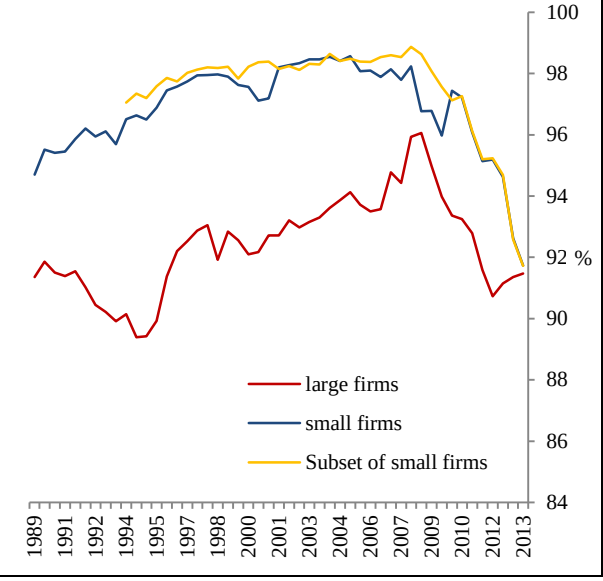
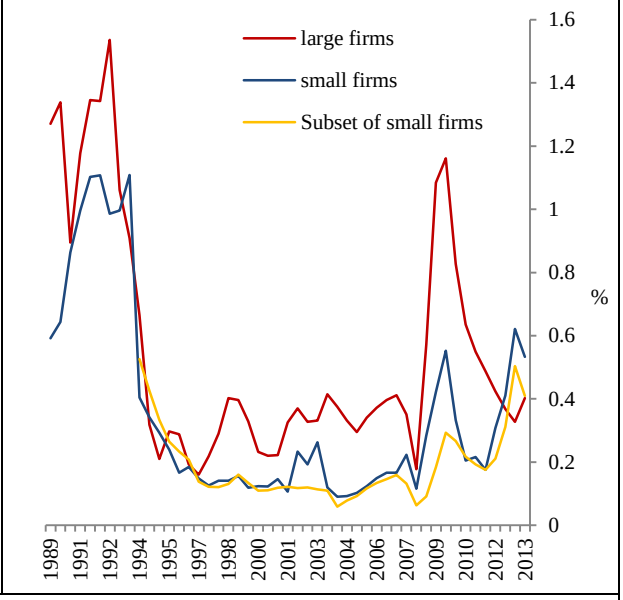


Figure 26: Provision expense (% of assets)



Note(s): The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

5.5 Liquidity

"Maturity transformation", i.e. using short-maturity liabilities to fund long-maturity assets, is at the core of the archetypical bank business model (e.g., Diamond and Dybvig, 1983; Diamond and Rajan, 2001). But as vividly illustrated by the failed British bank Northern Rock, maturity transformation can become excessive and threaten bank survival in times of funding stress (e.g., Goldsmith-Pinkham and Yorulmazer, 2010; Shin, 2009). This section seeks to highlight how the UK banking sector has evolved first with regard to liquid asset buffers and then with regard to funding stability. We limit the sample period in this section to start in the year 1994, since changes before that period are hard to interpret due to a change in sample composition. In particular, most building societies enter the sample in that year, and typically have a different liability structure (more retail deposit funding).

5.5.1 Liquid asset buffers and quality

As a first line of defence against liquidity stress, banks can hold a buffer of liquid assets. Figure 27 shows that banks have generally increased their share of such assets in relation to total assets during the sample period. This figure reports the share of banks' balance sheets that consist of a broad measure of liquid assets,[56,57] defined as highly-liquid

[56] The measure includes high quality liquid assets (cash and balances at central banks, gilts, treasury bills and other highly liquid bills) as wells as credit to other financial institutions, debt securities and equity shares.

cash equivalents, inter-bank loans and readily-marketable debt and equity securities. This broad liquid asset ratio shows a notable jump in 2007, especially for large banks. This seeming jump needs to be interpreted with caution since it is partly due to a reporting issue.[58] However we note that it may partly reflect the onset of the crisis and moves by banks into safer, more liquid assets overall, as well as a shift by some of the large banks in business model from lending into market-making in liquid assets.

Figure 27: Broad liquid assets (% of total assets)

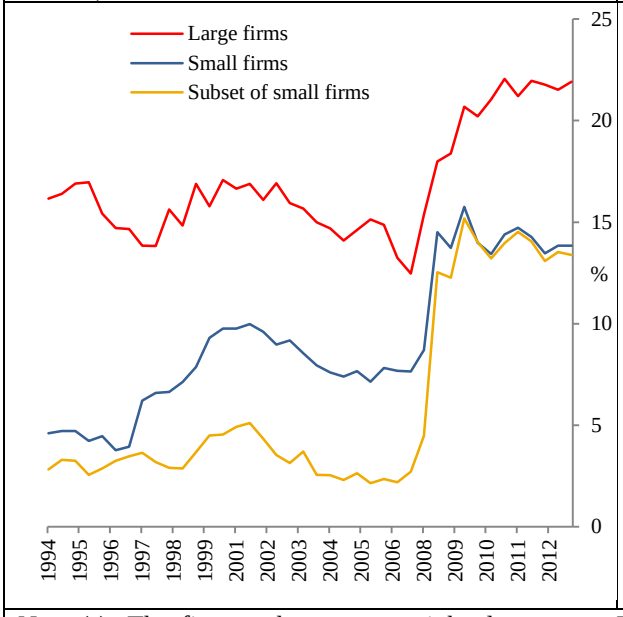
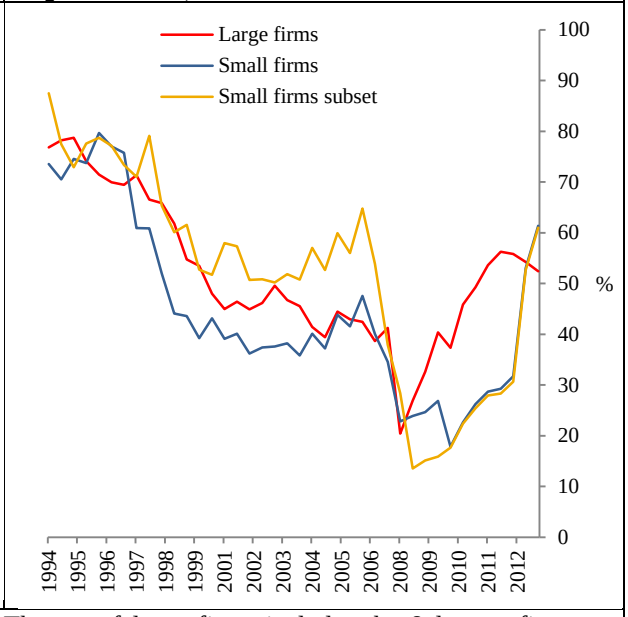


Figure 28: Narrow liquid assets (% of total liquid assets)



Notes(s): The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

Figure 28 reports the ratio of narrow liquid assets (which we define as highly-rated bonds traded in active markets and which have readily available market prices) to total liquid assets, which proxies for the quality of liquid assets overall. The figure indicates that the average quality of UK banks' liquid assets decreased consistently in the run-up to the crisis.[59]

[57] Note that our measures of liquid asset buffers reflect assets held outright. The measure used in the regulatory Liquidity Coverage Ratio (LCR) will be different, because some of the bonds held outright will be lent out, and some assets in the buffer will be borrowed and not held outright.

[58] In particular, the liquid asset measure is narrower before 2008 for some firms. The lower level before 2008 is due to using a holding company level consolidation technique called "aggregation plus" which is a reporting feature. Under that reporting option firms were allowed not to breakdown certain liquid assets held in the trading book (mostly low quality liquid assets but not HQLA). Firms were allowed to present a bottom reporting line adding up the whole trading book positions across the group. Therefore total assets include all assets but the broad measure misses some low quality assets before 2008. This feature does not affect solo reporting which is therefore potentially a more accurate data source for this purpose.

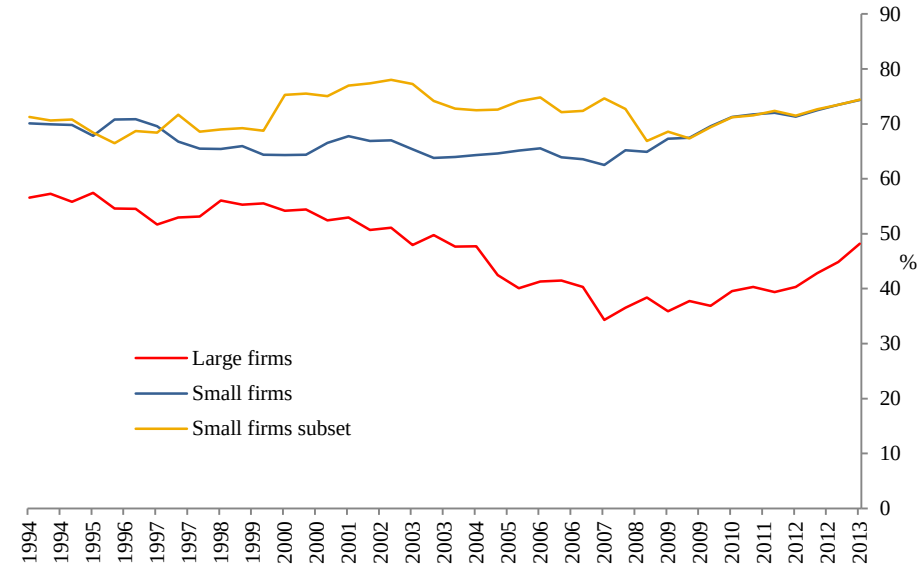
[59] The narrowest category includes only high quality liquid assets (cash and balances at central banks, gilts, treasury bills and other highly liquid bills), while the broader category also includes credit to other financial institutions, debt securities and equity shares.

The fall during the early stages of the crisis is substantial, suggesting that banks consumed these buffers. Liquidity levels improved already in the later stages or the crisis in 2008. Partly, this improvement is likely to reflect the liquidity assistance provided by the Bank of England.[60] Additionally, it likely reflects that banks could no longer meet their problems by selling assets, particularly considering the potential fall in asset prices that could have caused, and instead re-capitalised. After the crisis the rebound continued, partly reflecting the introduction of more comprehensive bank-specific liquidity requirements in 2010.[61]

5.5.2 Funding stability

Banks can also use more stable sources of funding to avoid liquidity stress. As a coarse measure of this, Figure 29 shows the share of non-financial deposits[62] to assets. This ratio shows a marked decrease for large banks up until the crisis, with a sharp rebound afterwards. For small banks, the patterns are less striking.

Figure 29: Non-financial deposits (% of total assets)



Note(s): The figure shows asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK

By proxying the Net Stable Funding Ratio (NSFR) recently introduced in the Basel framework, we can study a more comprehensive measure of funding stability and put it in

[60] The Bank of England's Special Liquidity Scheme was introduced in April 2008 and allowed banks to swap their high quality mortgage-backed and other securities for UK Treasury Bills. See e.g., John et al. (2012) for details.

[61] These requirements were known as Individual Liquidity Guidance (ILG); for details on this framework and earlier domestic liquidity requirements, see Banerjee and Mio (2015).

[62] The category 'Non-financial deposits' includes all deposits except those taken from other financial institutions.

relation to the funding needs on the asset side. The NSFR limits maturity transformation by requiring that the available stable funding is at least as large as the required stable funding. Our measures of the NSFR and its components are admittedly coarse proxies due to data limitations, but are similar to other approximations used in the literature (e.g., Distinguin, Roulet and Tarazi, 2013; Hong, Huang, and Wu, 2014; King, 2013)[63]:

$$NSFR_{proxy} = \frac{Available\ Stable\ Funding_{proxy}}{Required\ Stable\ Funding_{proxy}}$$

$$Available\ Stable\ Funding_{Proxy} = 0.7 \times NonFinancialDeposits + TotalCapital$$

$$Required\ Stable\ Funding_{proxy} = 0.85 \times Loans + OtherNonLiquidBankingBookAssets + 0.5 \times NonLiquidTradingAssets + 0 \times LiquidAssets$$

Figure 30: Net Stable Funding Ratio proxy

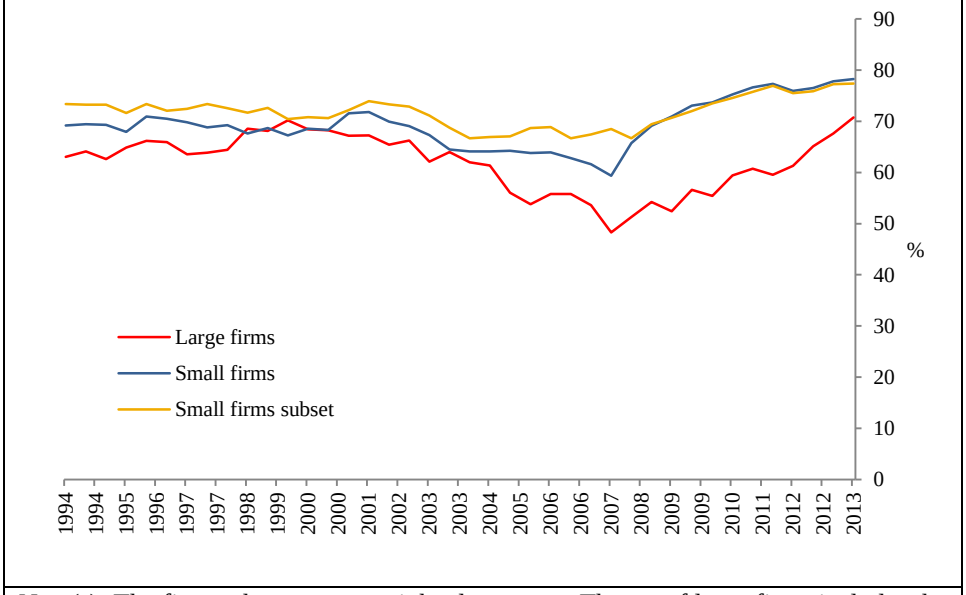


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Figure 30 shows that this measure of funding strength deteriorated particularly for large banks up until the crisis, with a sharp rebound afterwards. It is also instructive to study the numerator (liabilities side) and denominator (asset side) of this measure separately. These measures are then scaled by total assets and shown in figures 31 and 32 below. It can be seen that the liabilities side ratio – i.e. the available stable funding scaled by total assets – has shown broadly the same development as the NSFR ratio, suggesting a broad movement away from more volatile funding sources and increased reliance on more stable funding by banks

[63] Lallour and Mio (2016) form more granular proxies than what is available with our dataset.

overall Figure 32 shows a somewhat subtle downward trend in required stable funding within the smallest class of banks, ahead of the crisis. This pattern was different, however, at the largest banks, where the required average stable funding ratio reached an historical high (at around 85%) just ahead of the crisis. This increase along with the general decline in available stable funding sources helps explain the overall dramatic decline in our proxied NSFR ahead of the crisis for the largest banks. The favourable movement in the NSFR after the crisis can be explained by increases in available stable funding sources combined with a decrease in required stable funding, which is evident across both small and large banks.

Figure 31: NSFR available stable funding proxy (% of total assets)

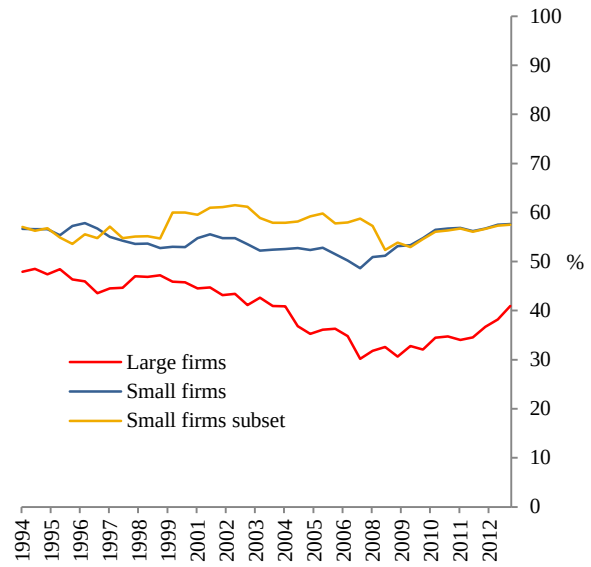
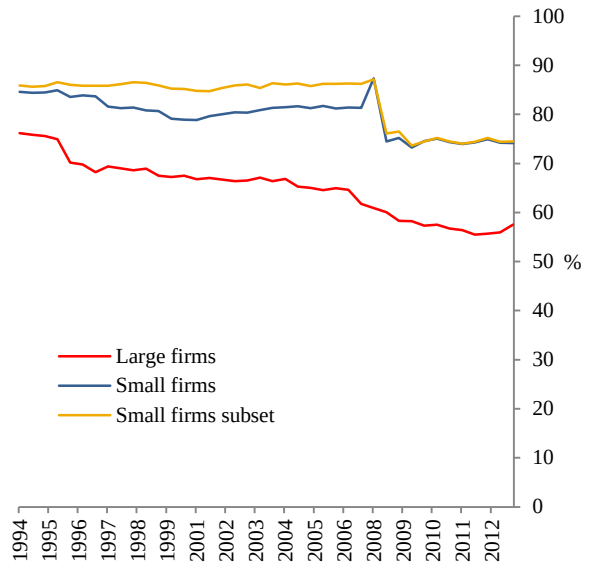


Figure 32: NSFR required stable funding proxy (% of total assets)



Note(s): The figures show asset-weighted averages. The set of large firms includes the 8 largest firms as determined at the beginning of the sample period. The set of small firms includes all other institutions as determined each semester and is not consistent over time. The subset of small firms includes a consistent set of small banks and building societies that supplied regulatory data from 1994 to 2013. Data are from firms headquartered in the UK.

6 Potential uses of the HBRD in policy and research

This section suggests a number of outstanding research and policy questions that we believe HBRD could help address. It is beyond the scope of this paper to suggest identification strategies for answering these questions in a causal way, although we recognise the importance of such identification. However, in that direction we highlight areas where detailed institutional knowledge could help establish credible exogenous variation.

6.1 Capital regulation, supervision and bank behaviour

Understanding how banks choose their capital levels and activities in response to various shocks, including those coming from changes in regulation is vital for policymakers tasked with assessing the effects of regulation. Our database allows researchers to investigate these behaviours.

6.1.1 What evidence of unintended consequences of capital regulations can be gleaned from regulatory data?

Policymakers and researchers have suggested ways in which banks engaged in "regulatory arbitrage" to improve their risk-based capital ratios in ways that did not reflect true changes in asset risk or capital strength (e.g., BCBS, 2013b; Jones, 2000; Acharya et al. 2013). During parts of the sample period banks were able to reduce risk weights by reclassifying assets from the "banking book" to the "trading book". The arbitrage opportunities are currently being addressed by policy-makers.[64] As discussed in section 5.1.4, the share of assets classified as trading book generally increased over our sample period, and these trading assets generally had substantially lower risk weights than those in the banking book. Disaggregated data on these measures could help in understanding bank capital management behaviour better and, importantly, establishing evidence on regulatory arbitrage to address questions relating to the design of capital regulation (e.g., on unintended consequences).

In addition, the introduction of internal ratings-based ("IRB") models for credit risk has also been a key factor in the decrease of average risk weights since 2007. Key issues with IRB models discussed in academic research are excessive variability of risk weights, excessively low risk weights for some asset classes, and pro-cyclicality.[65] Policy initiatives are currently seeking to address such shortcomings.[66] Since our data can be linked to confidential data on switching dates to IRB, it is potentially useful for understanding the consequences of these switches. Of particular relevance is understanding whether the risk-profiles of firms using internal (IRB) models differ from those that do not.

The crisis demonstrated weaknesses in the risk-based capital regime to signal incipient problems at individual firms. Researchers have argued that the relatively more simple non-risk-based leverage ratio does a better job at predicting bank distress than the complex risk-based ratios (e.g., Aikman et al., 2014 and IMF, 2009 for international banks; Estrella et al., 2000 for US banks; and Francis, 2014 for UK building societies).[67] The current dataset can be useful for evaluating whether this conjecture holds for UK banks (across regulatory regimes and market conditions) and, in particular, whether risk-based measures are useful for signalling bank distress.

Perhaps most worrying, researchers have questioned to what extent internal models have actually achieved the aim of making capital regulation more risk sensitive (e.g., Behn, et al., 2014). Additionally, policymakers have criticized them as being overly opaque and difficult to monitor for both market participants and supervisors (e.g., Tarullo, 2014).

[64] The Basel Committee's Fundamental Review of the Trading Book (FRTB) aims to reduce the discretion to reclassify assets to the trading book and reduce discrepancies between the trading and banking books. See BCBS (2016c) for details.

[65] See e.g. Behn, Hasselmann and Wachtel (2016) on pro-cyclicality; and Plosser and Santos (2014) on strategic "gaming" of internal risk weights.

[66] See e.g. BCBS (2016b) for policy initiatives targeting excessive variability in risk weights.

[67] For a critical perspective on this claim, see however Jackson (2016).

Consistent with this idea, we have shown that the decrease in average risk weights over time in our database was not matched by decreased average loan losses. Future research could for instance use the HBRD data on average risk weights and loss rates on a more granular basis to try to get at the extent to which risk weights are indeed representative measures of banks' asset risk. This could be a step towards understanding whether there may be a need for greater disclosure around risk-based capital measures and bank losses to help in fostering market discipline.

6.1.2 How do banks respond to capital requirements?

The UK regulatory regime of setting individual capital requirements provides a rare laboratory for understanding how banks respond to requirements. Several earlier studies have looked at such reactions as changes on both the asset and liability side of the balance sheet.[68]

Our database offers the ability to extend the research in this area to help inform policy judgments about how banks might behave in response to new requirements. For instance, how might banks react to changes in capital requirements under the Basel III framework which focuses on the highest-quality forms of capital, considering that earlier studies found that UK banks tended to raise lower-quality capital (e.g., Francis and Osborne, 2012) to deal with higher requirements? Relatedly, how will firms set their voluntary buffers and respond to requirements in the presence of the regulatory buffers contained in Basel III? Regulators require banks to build up these buffers but allow them to consume them in times of stress. The individual "recommendations" or "target" ratios used in the UK and that are included in the HBRD can be instructive in this regard.

Understanding why banks hold surplus capital (over and above regulatory minimums) can help shed light on banks' incentives to use regulatory buffers under the new provisions set out under Basel III. The new provisions require that banks' capital include formal management buffers above regulatory minimums that can be used in times of stress. Using such buffers, however, comes at a cost in that firms will also face restrictions on the amount they can distribute in the form of dividends and bonuses. This restriction naturally raises the question of whether banks will elect not to use management buffers to avoid such restrictions (and potentially send negative signals to the market by, for example, not paying a dividend). While it is not possible to know exactly how banks will behave under this new buffer regime, past behaviour may offer some insights. The rich variation in capital measures (including surpluses) in HBRD, together with the precise information about the level of application of such requirements, could help and contribute to the earlier literature on the determinants of bank capital.[69] In addition, since the HBRD covers a period which also included a formal buffer regime, in the form of the 'target' regime in the 1990s, data from that period could also help.

[68] See, for example, Francis and Osborne (2012) and Aiyar, et al. (2014a, 2014b).

[69] While this literature is too comprehensive to review here, important contributions include the studies using UK data in Alfon et al. (2004); Jokipii and Milne (2008, 2011); and Francis and Osborne (2010); those using German data in Gropp and Heider (2010); Memmel and Raupach (2010) and Stolz and Wedow (2011); and the contribution using Spanish data by Ayuso et al. (2004).

6.1.3 How do regulation and supervision interact to affect behaviour?

Banks are subject to both regulation (i.e. quantitative requirements) and supervision (i.e. monitoring and oversight). While the concepts differ, the terms are sometimes used interchangeably, and our understanding of their interaction is limited. The individual capital requirements described above are an example of regulation. The fact that they were generally lower for large banks is surprising at first sight considering the more complex risks they are likely to take. However, this difference may also reflect that individual capital requirements depended also on a review of firms' risk management processes, systems and controls that were considered not to be adequately captured by the Basel capital framework (e.g., Aiyar, et al., 2014a,b; De Marco and Wieladek, 2016; Turner, 2009). To an extent, this approach mirrored the broader philosophy that advanced regulatory approaches would give banks the proper incentives for managing risks (cf. Tarullo, 2008, p. 102). Still, it remains an open question as to the extent to which closer supervision may have been used as a substitute for lower capital requirements, especially during the earlier periods prior to advanced approaches.

Seeking to understand how supervision and regulation can act as substitutes and complements more broadly could be a promising avenue for further research. While a detailed investigation of the supervisory institutional framework is beyond the scope of this paper, such information could be collected to further our understanding of these interactions.[70]

6.2 Liquidity and funding, and its interaction with capital regulation

Theoretical and empirical research on the interaction of liquidity and capital is still in its infancy. Relatively little is known, for example, about the interaction between bank's liquidity and capital choices, as well as between capital regulation and the relatively recent liquidity regulation.[71] Future research could benefit from the HBRD database when studying this interaction.

The UK-specific liquidity regime, which has been in place since 2010 and included requirements similar to the LCR under the Basel III provisions, can be particularly instructive for understanding the likely impact of the recently introduced CRD liquidity requirements. In that vein, Banerjee and Mio (2015) use the heterogeneous introduction of the UK Individual Liquidity Guidance (ILG) to study the impact of liquidity requirements. They do not, however, consider the interaction with capital requirements. Because our dataset includes liquidity metrics used in this previous study as well as data on capital requirements and

[70] See e.g., Eisenbach et al. (2016) for a theoretical treatment and use of institutional information about the supervisory process in the US context.

[71] See e.g., Berger and Bouwman (2009), Diamond and Rajan (2000, 2001), and Distinguin, et al. (2013); for a comprehensive literature review see BCBS (2016a).

capital ratios, researchers could use our dataset and similar identification strategies to understand the effects of liquidity and capital regulations together.[72]

Research could also be expanded by exploiting the combination of our main dataset with the advanced and high-frequency data that had been reported since the introduction of the ILG regime in 2010. To that end, Ferrara et al. (2016) study optimal liquidity regulation using data on UK banks' daily cash flows, short-term interbank funding and liquid asset buffers.

Researchers could also use and potentially improve our proxies for the Net Stable Funding Ratio (NSFR) included in the Basel III framework. With these proxies, they could assess how firms might respond to these requirements to help inform cost-benefit analyses.[73] A study along these lines, however, would come with some considerable caveats, since the liquidity and funding requirements were only introduced after the end of our sample period.[74]

HBRD's long time series and broad cross sections allow researchers to address several questions that have so far only been studied using US banks. For instance, how do banks change their underwriting policies and behaviour when the liquidity of the underlying assets changes, e.g., due to changes in the possibility of securitising mortgages (cf. Loutskina, 2011, Loutskina and Strahan, 2009)? Is the persistence of liquidity and funding policies, as documented by DeYoung and Jang (2016), present in other samples, and if so, why does such persistence arise?

6.3 Competition and market structure

Measuring the intensity of competition is important for regulators tasked with ensuring that competition remains effective.[75] Effective competition has also important implications for economic welfare overall. Undertaking this type of analysis is not straightforward, especially without adequate data. The new database provides a starting point for doing such work, as discussed in de-Ramon and Straughan (2016) who study group level bank and building society data. They use the current database to construct several well-known competition metrics from the literature to evaluate how the intensity of competition has evolved in the UK banking sector since 1989.

Another important issue that could benefit from further research relates to the relationship between competition and financial stability. The relationship is not obvious either empirically or theoretically (e.g., Vives, 2011). The new database offers researchers a

[72] In particular, the advanced liquidity data reported following the introduction of the individual liquidity guidance regime is available as a separate database within HBRD.

[73] For cost-benefit analyses, see e.g., Macroeconomic Assessment Group (2010); Schmaltz et al. (2014) and Yan et al. (2012). King (2013) predicts the reaction to the NSFR using international data.

[74] The LCR took effect in the EU on in 2015 (with transitional arrangements); NSFR is expected to enter into force in 2018.

[75] For instance, in 2014 the Prudential Regulation Authority (PRA) at the Bank of England was given a secondary competition objective (see Dickinson et al. (2015)).

rich set of information with which to construct several measures of competition that could then be combined with measures of financial stability to study the links in more detail.

An additional line of inquiry facilitated with our database is assessing the net benefit of proposed mergers, comparing competitive effects against possible efficiency improvements (cf. Focarelli and Panetta, 2003). The dominance of the largest banks can also be concerning in terms of financial stability, particularly considering their interconnectedness. In this vein, Langfield, Liu and Ota (2014) describe the central role of four UK banks in the network structure of the UK financial system.

6.4 Performance persistence, early-warning systems and distress

A long panel like ours can also be useful for examining the drivers of bank distress. A main benefit of this longer data set is that it allows researchers to consider the persistence in banks' performance across crisis episodes documented by Fahlenbrach, et al. (2012). Investigating the extent of such persistence using the new dataset could further research on this topic, and the results could be useful for supervisors and policymakers in developing models to help predict individual firm failure. Relatedly, the data could be used to understand the heterogeneity in recoveries from distress documented in recent research (e.g., Bonaccorsi di Patti and Kashyap, 2014).

6.5 In-depth reviews of the structure of activities and performance of the UK banking sector over the economic cycle

We have conducted our analysis based on the small versus large bank paradigm as a key source of heterogeneity in the data. However, other dimensions could be equally interesting, e.g., foreign-owned and domestically-owned institutions, traditional commercial banks versus market oriented (investment) banks. In particular, the commonly used distinction between traditional and market-oriented activities is very important to understand risk characteristics, e.g., by decomposing income into different sources of non-interest income, and by investigating when in the economic cycle one model may perform better or worse.[76] Researchers could also use our database to conduct a fuller investigation of how business models have evolved over time and how firms have shifted between these models (cf. e.g., Roengpitya, et al. 2014).

With the variation in organisational structures in our data, users could also seek to understand the implications of those structures in more detail. In this area, Valnek (1999) studies the comparative performance of shareholder-owned banks and depositor-owned building societies in the UK, finding better performance among the latter, which he attributes to lower degree of conflicts between depositors and management as well as between different kinds of clients.

[76] See DeYoung and Torna (2013); DeYoung and Roland (2001); and Stiroh (2004, 2006).

There could also be macroeconomic implications of the heterogeneity among banks, which future research could further explore. In particular previous research has suggested that bigger, more liquid and better capitalised banks may be less affected by monetary policy (the "bank lending channel" of Kashyap and Stein, 1995).[77] The new database provides sufficient granularity for undertaking studies across these characteristics.

6.6 Banking groups and group structures

While this paper focuses on the aggregate behaviour of banking groups, studying the internal behaviour of such groups could also be fruitful. Our data is well suited to such studies since we have data at the group-consolidated and solo-subsidiary levels.

The HBRD contains information on capital requirements at both levels, which could facilitate research on whether the determinants of capital differ between entities that are part of a larger banking group and those that are not. From a policy perspective, results from such studies could be particularly useful for understanding the likely behaviour of banks under the upcoming ring-fencing policy, which requires banks to keep core retail activities structurally separated from investment activities, and allocate capital to ring-fenced banks as if they were standalone institutions.[78] In addition, there is scope to evaluate similar questions related to liquidity and funding.

Understanding group structures and internal capital markets more generally can also be worthwhile research topics. Campello (2002) suggests that for US banking groups, internal capital relax the credit constraints faced by smaller banks thereby affecting their individual response to changes in monetary policy. The HBRD contains sufficient data to undertake similar studies based on UK data.

Some of the banking groups in our sample have subsidiaries with relatively heterogeneous strategies. Our database could be useful for understanding the transmission of shocks to capital and liquidity within such groups, for instance due to shocks in other countries or in isolated markets (cf. e.g., Aiyar, 2011; Cetorelli and Goldberg, 2012a, b, and Schnabl, 2012). Consequently, it might also enable us to judge better how bank behaviour might evolve under the UK's upcoming "ring-fencing" regime, which will require structural separation of "core" UK activities from other activities.[79]

7 Concluding remarks

This paper presents HBRD, a new dataset of UK banking information derived from regulatory reports submitted by all banks and building societies from 1989 to 2013. Because regulatory reports include a wealth of information not available elsewhere, HBRD offers the opportunity to advance policy analyses and empirical research. Several advantages of HBRD

[77] See Butt et al. (2014) and De Marco and Wieladek (2016) on whether a "bank lending channel" is present in the UK.
[78] See Bank of England (2014) for details.
[79] See Bank of England (2016c) for details

make this possible. First, HBRD contains a broader cross section and longer time series of financial data compared with other (internal and external) databases. Second, HBRD contains confidential data, including information on individual capital requirements, not available through private vendors. Third, the dataset contains financial information measured at the same level of consolidation as that used by UK supervisors in establishing quantitative requirements (e.g., on liquidity and capital). This last feature is especially important when evaluating the effects of supervision and regulation on firm-level behaviours.

This paper also provides a sense of the breadth of data contained in the new database by reviewing a series of stylized facts about developments in the UK banking sector. This review has been placed in the context of ongoing changes in regulation and supervision, providing high-level insights into the patterns exhibited during the 25 years through 2013. We recognise, however, that the end date in 2013 is likely to present a limitation for some analysis. Extending the sample is technically not straightforward and is therefore beyond the scope of this project, but future extension of the sample period could make the data even more useful.

Researchers can use this analysis to understand better not only the nature and scope of the data in the HBRD but also the types of policy issues that HBRD can help address. In that direction, we have also suggested possible avenues for future research where we believe HBRD offers potential. While we recognise that the possibilities are likely to outstretch our imagination, we are confident that the database manual and metadata accompanying this paper will enable researchers to use the HBRD with ease and confidence in the future.

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Table A2. Historical Overview of Regulatory Capital and Liquidity Regimes

	1992 to 1997	1997 to 2007	2007 to 2012	2012 to 2013	2013 onwards
International Capital Regime	**Basel I**	**Basel I + MRA**	**Basel II**	**Basel 2.5**	**Basel III**
EU Implementation	**CAD1 (1993)**	**CAD2(1998)**	**CRD (2007), CRD II(2009), CRD III (2010)**	**CRD III**	**CRD IV / CRR**
Key features	Minimum capital requirements • Credit risk only • Assets classified and grouped into one of the 5 risk weight groups(standardised approach)	• Basel I • Incorporate a capital requirement for the market risks (allow the use of internal VaR models)	Three Pillars • Minimal capital requirements 1. Credit risk (Standardised and IRB) 2. Market risk (VaR models) 3. Operational risk • Supervisory review • Disclosure	• Basel II • A package to strength the capital framework with regard to treatment of complex securitisation positions, off-balance sheet vehicles and trading book exposures	• Capital and liquidity • Tighter definition of capital (capital instruments that no longer qualify phase out 2013-2023) • Higher minimum ratios • Capital conservation buffer (2. 5% by 2019) • Countercyclical buffer (0-2. 5%) • Wider risk coverage • Introduction of a non-risk-based leverage ratio.
Common equity Risk-based ratio					4.5%
Tier 1 Risk-Based Ratio	4%	4%	4%	4%	6%
Total Risk-Based Ratio	8%	8%	8%	8%	8%
Capital Conservation buffer					2. 5% (phase in from 2016)
Countercyclical buffer					0-2.5%
Total common equity					7-9.5%
Total capital – no SI					10. 5-13%
SI Buffer					1-2.5%
Total capital - SI					11. 5-15. 5%
Leverage ratio					3% (disclosure from 2015; Pillar 1: 2018)
Liquidity Coverage ratio					Cover net cash flows over 30 days by 2019 (phase-in starting in 2013).
Net stable funding ratio					Stable funding over a one-year period of extended stress by 2018

Table A3. Specific Features of UK Regulatory Capital and Reporting Regimes

	1992 to 1997	1997 to 2007	2007 to 2009	2009 to 2013	2013 onwards
UK Capital Regime	Basel I + UK Pillar 2 (Triggers) + Targets	Basel I + MRA + UK Pillar 2 (Triggers / ICR / ICG)	Basel II + UK Pillar 2	Basel II, Basel 2.5 + Pillar 2 FSA enhanced supervisory framework (+Pillar 2b PRA buffer)	Basel III/ CRD IV
Key features			FSA enhanced supervisory framework (or 4/6/8) applied to recapitalisation (2008)	FSA enhanced supervisory framework (or 4/6/8): • Common equity should not drop below 4% in a stress test • Common equity capital should remain 6% on a continuous basis • Tier 1 capital 8%	Firms no longer monitored on 4/6/8 supervisory framework since Jan 2014
Minimum Requirements	Trigger	Trigger (to 2001) ICG (from 2001)	ICG	ICG	ICG
Required Capital Buffer	Target	Target (to 2001)			
Common equity ratio				6% (continuous) 4% (in a stress)	Firms to meet a 4% Pillar 1 CET1 requirement in 2014, rising to 4. 5% from 1 January 2015.
Tier 1 ratio				8%	Similarly, during the same period the required Pillar 1 Tier 1 capital ratio will be 5. 5%, rising to 6% from 1 January 2015 onwards.
Total capital ratio					Total Pillar 1 capital remains at 8%.
PRA (P2B) Buffer			Yes	Yes	Yes
PRA Stress Tests					Yes
UK Average Requirement	10. 6%	10. 4%3	11. 9%	15. 0%	Not available in our dataset
Regulatory Reporting Regime	BSD1 and BSD2	BSD2 and BSD3	BSD2, BSD3, FSA	FSA	FSA, COREP, FINREP

Appendix 1: HBRD data content

The HBRD distinguishes among three types of data. The first, referred to as Level 1 data, includes the actual reporting line or cell items as recorded in the regulatory returns submitted by banks and building societies. Level 1 data include simple, standalone items like Total Banking Book Assets and Total Trading Book Assets as reported according to conventional accounting standards, and more complicated, derived items like Total Capital after Deductions reported according to a combination of accounting and regulatory rules; these items are specific to each report and not directly consistent over the whole period. The second set of data items, known as Level 2 data, comprises simple combinations of Level 1 data to construct the longest possible consistent measures over the period 1989-2013: e.g., Total Assets, which is the sum of Total Banking Book Assets and Total Trading Book Assets (see Table A1.2). The final set of data items, Level 3 data, includes relatively more complex measures derived from Level 1 and Level 2 data items. These include several analytical measures typically used by bank analysts and researchers and reflect combinations and transformations of underlying Level 1 and Level 2 data items: e.g., Return on Equity, which reflects the ratio of annualized net income to total average equity (see Table A1.1).

Table A1.1: Level 3 Data Items

Variable	Description
Earnings and Profitability Analysis:	
EARNPRO01	Interest Income
EARNPRO02	- Interest Expense
EARNPRO03	= Net Interest Income
EARNPRO04	+ Non-interest income
EARNPRO05	- Provision for Loan losses
EARNPRO06	- Non-interest Expense
EARNPRO07	= Pre-tax Operating Income
EARNPRO08	+ Extraordinary items
EARNPRO09	= Net Operating Income
Margin Analysis:	
MGANAL01	Earning Assets to Total Assets
MGANAL02	Interest Income to Earning Assets
MGANAL03	Interest Expense to Earning Assets
MGANAL04	Net Interest Income to Earning Assets
Loan Analysis (Asset Quality):	
LNANAL01	Net loss to total loans
LNANAL02	Earnings coverage of net loss
LNANAL03	Ratio of Provisions to Net Losses
LNANAL04	Ratio of Provisions to Total Loans
LNANAL05	Arrears rates on loans secured on residential property to individuals
LNANAL06	Arrears rates on loans secured on residential property to others
LNANAL07	Arrears rates on other secured loans to individuals
LNANAL08	Arrears rates on other secured loans to others
LNANAL09	Other impaired loans to total assets ratio
LNANAL10	Average risk weight
LNANAL11	Ratio of Provisions to Total Arrears
Liquidity:	
LQANAL01	Loans to Assets ratio
LQANAL02	Ratio of Loans to retail Deposits
LQANAL03	Ratio of Loans to Total Deposits
LQANAL04	Broad liquid asset ratio
LQANAL05	Narrow liquid asset ratio
Capitalization:	
CAPANAL01	Tier 1 risk based capital Ratio
CAPANAL02	Total risk based capital Ratio
CAPANAL03	Retained Earnings to Total Equity
CAPANAL04	Arrears Level to Provisions and Equity
CAPANAL05	Tier 1 leverage ratio
CAPANAL06	Solvency
Growth Rates: (one-year)	
GROWTH01	Assets
GROWTH02	Tier 1 Capital
GROWTH03	Total Capital
GROWTH04	Loans
GROWTH05	Deposits
Management:	
MANAL01	Efficiency ratio of total overhead to net-interest and non-interest income
MANAL02	Size
MANAL03	Retail residential loans to total assets

Table A1.2: Level 2 Data Items

Variable	Description	Variable	Description
ASSETS	Total Assets	int_rece	Interest received: in total profits
BBA	Banking Book Assets	int_paid	Interest paid: in total profits and variable costs
TBA	Trading Book Assets	inc_feec	Fees and commissions: in total profits
loans	Public and Private sector including recognised clearing houses and exchanges	oth_inco	Other income: in total profits
lunsec	Other loans (unsecured) , advances and bills held	pl_forex	Income from trade: in total profits
mortgg	Loans secured on residential property	pl_inves	Income from investment: in total profits
connlend	connected lending of a capital nature incl.	pl_fxinv	Total Trading income (no separation forex vs other trading investment)
cash	Cash and balances at central banks (excludes client money)	pl_subto	Subtotal: net interest and trading income
debt_sec	Debt securities+ equities shares	nint_inc	Net interest
gilts	Gilts, Treasury bills and other eligible bills	div_subs	Dividends from subs
intrafass	Deposits with, and loans to, credit institutions	pl_fixas	Profit loss on fixed assets
lbroad	Similar to CRD4 level 2A.B and below liquid assets	exp_staf	Op expense: Staff: in total profits and variable costs
lnarrow	similar to CRD4 level1 and ILG HQLA	exp_occu	Op expense: Occupancy: in total profits
IG	Intangible assets and goodwill	exp_othe	Op expense other: Staff expense as reported in profits and variable costs
FxA	Fixed Assets	exp_subt	Expense sub-total
totaldep	Total deposits all sources	nprov_ca	Provisions: Capital
deposits	Deposits other than from credit institutions (no guidance pre-2008)	nprov_si	Provisions: Suspended interest
intrafdep	Deposits from credit institutions	prov_tax	Provisions: Taxation
CT1	Common Tier 1 capital exc. preferred stock	prov_div	Provisions: Dividends
TT1	Liabilities: Total reported Tier 1 capital after deductions	pl_cost	Total variable cost
TT2	Liabilities: Total T2 capital	curry_pl	Current year's profit and loss
TT3	Liabilities: Total T3 capital	extra_it	Extraordinary items
TTO	BoE non-eligible capital	pl_GOP	Gross operating profit
TCE	Tangible common equity	pl_tbinc	Total financial operating income from the Trading Book
PSt	Preferred Stock	net_ptinc	pre-tax net income
SPA	Share premium account	net_profit	post-tax net income-P&L estimate as long as P&L is reported
sub_debt	Subordinated debt total		

Table A1.2: Level 2 Data Items: Basic Measures (Continued)

Variable	Description	Variable	Description
RetPro	Retained profits (sometimes interim)	NPV_SPLUS	"NPV Sensitivity to+ shift (as derived from above data)". (If
Reserv	Reserves	NPV_SPLUSa	"Alternative estimate of NPV sensitivity to+ shift" completed, compare; supervisors may need to consult local experts or SRS to assess firm's own approach.)
provi	Total provisions (specific and general) against bad/doubtful debt	RWA	Risk Weighted Assets
chgoff	write/charge offs	RWA_BB	Banking book Risk Weighted Assets
impair	impairments charge/credit to P&L	RWA_TB	Trading book Risk Weighted Assets
ARREARS	Total Arrears	lrw100	Other loans (unsecured) 100% risk bucket
ARFSRP_I	Total arrears on fully secured loans to individuals	lrwe10	Other loans (unsecured) 10% risk bucket
ARFSRP_O	Total arrears rate on fully secured corporate loans	lrwe20	Other loans (unsecured) 20% risk bucket
AROTHR_I	Total arrears rate on partially and unsecured loans to individuals	lrwei0	Other loans (unsecured) 0% risk bucket
AROTHR_O	Total arrears rate on partially and unsecured corporate loans	ICG	Capital guidance in £
BLFSRP_I	Total balance to fully secured loans to individuals	ICG_BB	Banking book capital requirement
BLFSRP_O	Total balance to fully secured corporate loans	ICG_TB	Trading book capital requirement
BLOTHR_I	Total balance to partially and unsecured loans to individuals	Trigger	Risk based capital ratio requirement
BLOTHR_O	Total balance to partially and unsecured corporate loans	REGCAP	Total eligible capital after deductions
IMPAIR_OTHER	Other impaired loans	ET2	Liabilities: Total eligible T2 capital
NPV_SMINU	"NPV Sensitivity to downward shift (as derived from above data)". (If	ET3	Liabilities: Total eligible T3 capital
NPV_SMINUa	"Alternative estimate of NPV sensitivity to downward shift" completed, compare; consult local experts or SRS to assess firm's own approach.)	Staff	Number of staff (building societies 1994-2008 only)
		Repon	Reporting date

Appendix 2: Previous research using UK regulatory returns (selected)

Authors	Time period	Research objectives	Number Reporting firms	Consolidation level
Logan (2000)	1990-1991 (2 periods)	Bank balance sheet characteristics and bank failure during the 1990s small bank crisis.	67	Solo (capital requirements only)
Alfon et al. (2004)	1997-2002	How risk management, market discipline and regulatory environment affected banks and building societies decisions about equity funding.	187	Solo
Barrell et al. (2009)	1989-2007 (73 quarter)	Used aggregated time-series from regulatory returns to study the macroeconomic implications of Basel III proposals.	4	Groups only
Francis and Osborne (2010)	1990-1995, 1998-2006 (60 quarter)	Bank behaviour with respect to capital ratios	168	Solo
Francis-Osborne (2012)	1996–2007 (45 quarter)	Bank responses to capital requirements	254	Mixed overlapping group[(b)], solo
Aiyar et al. (2012)	1998-2007 (40 quarter)	How changes in banks capital requirements affect credit supply by UK domestic banks and foreign banks.	104	Mixed[(c)]
Mora and Logan (2012)	1990-2004 (30 bi-annual)	Impact of changes in bank capital requirements on lending.	139	Groups only
De-Ramon et al. (2012)	1998-2007 (89 quarter)	Used aggregated time series from regulatory returns to study effects on UK lending and output from changes in aggregated bank equity funding.	5	Groups only
Bridges et al. (2014)	1990-2011 (30 quarter)[(a)]	The impact of changes in bank capital requirements on lending.	53	Groups only
Aiyar et al. (2014)	1998-2007	How capital requirements and monetary policy interact with credit supply.	88	Mixed[(c)]
de-Ramon, Francis and Harris (2016)	1989-2013 (49 bi-annual)	Study capital requirements and bank behaviour since 2007	141	Non-overlapping groups[(b)] and solo firms
De-Ramon and Straughan (2016)	1989-2013 (49 bi-annual)	Constructs measures of competition in the UK banking sector	127	Banks Building Societies mainly groups

Note(s): These studies may have used other data sources, the table summarise only variables taken form the regulatory databanks. (a) Bank groups reported bi-annually only over the period, 30 refers to the average number of quarters spanned by the data; (b) Keeps merged banks as separate series from pre-merged banks; (c) Creates synthetic merged data series for the entire period for banking groups in 2007.