The Role of Ownership and Governance in Bank Risk and Performance: An Econometric Study

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Abstract

The banking sector is central to the economy, but has recurrent dysfunctions. Following the Global Financial Crisis of 2007-2009, regulators have attempted to reform governance in banks. However, previous empirical studies on the effects of governance structures have important gaps. Using an econometric framework with novel simultaneous equations models and new dependent variables, I investigate whether corporate governance and ownership have significant effects on bank risk and performance. I employ a novel data set combining financial data from the Bankscope database with governance and ownership data collected painstakingly by hand from annual reports and Basel Pillar 3 disclosures of UK banks over the period 2003-2012. My findings are supported by interpretation of relevant literature and are summarised as follows (stated along with policy implications in parentheses for which features of banking should be encouraged, based on normative assumptions stated in section 9.3).

My work shows that the effects of a particular ownership or governance structure can be attributed to the ways in which categories of decision-maker within the bank are empowered by that structure, and that factors relating to information processing capability have important effects. Mutual and foreign ownership each have negative effects on risk and return because of managerial incentives and information asymmetries, respectively, without either affecting provision of investment to the wider economy. A foreign parent also increases the probability of bank failure (implying mutuality is socially beneficial while foreign ownership is not). A higher NED ratio reduces the probability of bank failure, as does having a remuneration committee, because of greater accounting for risk in decisions (implying they are desirable). The presence of an independent Chairman increases risk because it weakens CEO accountability and confuses decision-making (implying it is undesirable). An independent CRO (as a full Board member) may have similar effects. A higher proportion of Directors with no previous financial services experience increases both returns and the probability of failure because of weaker use of information (implying it is undesirable). Permission to use IRB models lowers risk and return because it provides information to empower risk-averse agents, again without affecting credit provision to the wider economy (implying it is desirable). I report other novel findings on effects of ownership, governance, remuneration and size. These results can guide bank reform.

Lay Summary

People and companies need the services of banks, but the banking sector has numerous problems. In 2007-2009 many banks globally almost went bust (or did actually fail) and this had negative effects on everyone else because there was less lending. The authorities have since tried to improve how banks are run. However, we don't know everything about how best to do this. In my PhD, I use statistics to help us discover more. For 115 banking firms ("banks") in the UK, I obtained data on important outcomes like profits and bad loans over a ten year period. I also gathered data on key features of these banks, like who owned them and what kinds of people and Committees were in power inside the bank. For example, I noted whether or not each bank (in each year) had a Chairman who was a separate person from the Chief Executive, so that they could monitor him/her.

I used patterns in my data to work out the effects of different ways of running banks. For example, if I see that banks with an independent Chairman have more bad loans, then maybe the former caused the latter. To be sure, I used a type of analysis where a computer program took background factors I wasn't interested in, but which could still have an effect (like how much debt the bank had or what was happening in the rest of the economy) and used these factors to explain-away as much as possible of the ups and downs in the outcome (profit or bad loans). I then analysed the variation in the outcome that was left over and determined if it was still linked to the factors I was interested in (like the presence of an independent Chairman). This approach allowed me be sure effects I found are real. To make the test really tough, I used lots of background factors and varied the set of these I used. I'm also sure effects don't go the other way (e.g. from bad loans to management structures) because management structures don't change much from year to year.

I found that banks which are owned by their customers (i.e. building societies) have lower profit and less bad loans than other banks but, for their size, give just as much investment into the economy. Banks with lots of independent Directors (who are separate from day-to-day management) are less likely to go bust, and the same is true for banks that have a Committee which oversees pay. Having an independent Chairman actually does the opposite of what people think – it causes more bad loans than in other banks, probably because the Chief Executive feels less accountability and decisions are confused. Banks with lots of Directors who haven't previously worked in banking (or other kinds of financial services) have higher profits but are more likely to eventually go bust. Banks that have permission (from government authorities) to use advanced methods to forecast risk have lower profit and less bad loans than other banks but give just as much investment into the economy. My results give us more information on how best to run a bank, for the good of people and society.

Declaration of Originality

This thesis was composed by Sean Harkin. The work it describes was carried out by Sean Harkin, except where explicitly stated otherwise (in references to past studies). The work has not been submitted for any other degree or professional qualification.

Signed: ________________________________

Date ________________________________

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Abbreviations

2SLS	Two-Stage Least Squares.
FRC	Financial Reporting Council. A public body in the UK and Ireland that produces standards designed to ensure high-quality corporate governance and reporting.
FS	Financial Services.
FSA	Financial Services Authority. The UK public body that was responsible for regulation and supervision of banks and other financial institutions in the time period considered in this thesis. It was responsible for both financial stability (prudential regulation) and fair treatment of consumers and investors (conduct regulation). These responsibilities were split between the Financial Conduct Authority (FCA) and Prudential Regulation Authority (PRA) from April 2013, after the period considered in my analysis.
FSCS	Financial Services Compensation Scheme. The UK scheme which provides deposit insurance and other forms of insurance designed to protect consumers of financial services.
GMM	Generalised Method of Moments.
GOB	Government-Owned Bank.
GTA	Growth in Total Assets. The year-on-year percentage growth rate of balance sheet assets.
IRB	Internal Ratings Based. An approach to credit risk modelling that banks may use under Basel II and III regulation, subject to national regulators deeming that they have met certain standards.
LI	Loan Impairments. The ratio of impairments on loans over total loan assets.
LII	Loan Interest Income. The income earned on loan assets normalised to total loan assets.
MOB	Mutually Owned Bank. Any bank that is owned by its depositors or employees, on a basis where owners are equal or near-equal with each other.
NED	Non-Executive Director. A Board Director who does not have executive responsibilities.
OLS	Ordinary Least Squares.
ROA	Return on Assets. The ratio of Net Income for a year over assets. It gives a measure of how efficient the asset base, which tends to be relatively stable, is in terms of generating profit.
ROE	Return on Equity. The ratio of Net Income for a year over equity. It gives a measure of how efficient the equity base is in terms of generating profit.
RRP	Recovery and Resolution Plan. A scheme organised by regulators for forestalling incipient bank failure and / or dismembering a failed bank in a manner whereby its remaining assets are used to support high-priority liabilities (such as retail deposits) and payment systems.

RWA	Risk-Weighted Assets. A measure of the total riskiness of bank assets. It is a financial quantity that is usually much smaller than total assets. The proportion of the two is determined by the output of IRB models or other regulator-prescribed quantification methods.
SOB	Shareholder-Owned Bank.
VIF	Variance Inflation Factor

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Chapter 1: Introduction and Summary

1.1 Introduction

Banking plays a central role in the global economic system that exists today (Mishkin, 2012). Indeed, in all but the most rudimentary economies, a banking system of some kind is likely to be essential for economic function and growth. But banking systems can take very different forms, involving different kinds of ownership, control, reserve requirements and regulation. The kinds of banking system that have been prevalent in practice have been subject to a number of problems that are particular to the sector, including difficulties in controlling risk-taking, systemic instability and financial crime. These problems have recurred over a period of centuries (Kindleberger and Aliber, 2011).

Various means have been proposed to address these issues, and bank regulation has evolved in response to the experience of bank stress. There were notable changes in regulation in the UK (which is the focus of my study) immediately after the crisis of 2007-2009 (see Section 2.3 for details). The division of responsibilities amongst UK regulatory bodies has changed. New standards for liquid asset resources have been introduced, designed to cover stressed outflow periods. Methods for quantifying regulatory capital requirements have been made more stringent; minimum capital ratios have been increased sharply; a range of capital buffers that apply in certain circumstances have been introduced; standards for the quality of regulatory capital required have been improved; and maximum leverage limits have been imposed. Regulators have gained authority to engage in "macro-prudential" supervision, by adjusting capital buffers and other tools in response to systemic conditions. New rules have come into force for dealing with bank failure, including retail ring-fencing, Recovery and Resolution Plans (RRPs) and more extensive deposit insurance. Finally, governance has been updated, including revised standards for the suitability of Directors, the operation of risk oversight structures and the management of remuneration.

Better governance within banks is widely seen as a means of improving banking. Amongst bank Directors and their regulators it appears to be assumed that corporate governance has substantial effects and, if designed appropriately, can ensure desirable functioning of the banking system. For instance, the UK Corporate Governance Code – which represents the combined work of various government-appointed commissions and the Financial Reporting Council (FRC) and is used in regulation and stock-market listing – states in its introduction that:

> "The purpose of corporate governance is to facilitate effective, entrepreneurial and prudent management that can deliver the long-term success of the company."
>
> (UK Corporate Governance Code, 2014.)

This statement entails a clear assumption that corporate governance *can* achieve the aims stated for it. It also indicates an assumption that shareholder oversight and financial-market dynamics are insufficient to achieve the desired outcomes, without the assistance of codified corporate governance.

Given the reliance placed upon it, it is necessary to ask: does corporate governance actually achieve the objectives set for it? Can it be relied upon to temper potential undesirable consequences of commercial incentives that are central to how banks operate in a market economy, such as those identified by Mittnik and Semmler (2013)? Since governance itself is practiced by individuals with strong commercial incentives, we must question its effectiveness.

In this thesis I take an empirical approach to answering such key questions, applying econometric models under conditions that allow me to make causal statements based on the results obtained. Specifically, I identify governance variables that have the characteristics of exogenous variables determined outside the model and use a range of regression and simultaneous-equation models to determine if these have causal effects on financial performance, loss and bank stress. This analysis used audited data published in financial databases and bank annual reports.

I also consider the role of explanatory variables relating to ownership type and bank size, both because these have been the basis of various proposals for reforming the banking system and the economy more generally (such as increased worker ownership of firms – e.g. Gupta, 2014) and because they provide a comparator for the effects of governance variables. Again, these explanatory variables are shown to have characteristics of exogeneity.

1.2 Objectives

This section provides a very concise statement of the aims of this thesis. My primary objective in this study is to better understand the effects of different ownership and governance structures on bank risk and performance, and thus to evaluate proposals for bank reform that would consist of changing ownership and/or governance structures. In my work, governance is defined as consisting of any internal structures for overseeing the firm, including structures for remuneration-setting and information-processing arrangements used for making decisions. My secondary objective is to understand the effect of bank size on bank risk and performance, because this is another bank-level determinant that is discussed extensively in the literature and which may have significant implications for policy. Pursing these objectives has entailed addressing gaps in the relevant empirical literature.

1.3 Relevant Literature – A Summary

The existing literature in this field suggests a number of conclusions relating to the effects of governance and ownership on bank risk and performance. This literature is summarised here, with all the specific papers upon which the summary is based being described in Chapter 2.

The starting point for the relevant literature is agency theory (Jensen and Meckling, 1976 and Schleifer and Vishny, 1997). Agency theory is concerned with situations in which one economic actor, the agent, takes actions on behalf of another, the principal, in the presence of incentives that may or may not tend to align the interests of the two.

Agency theory suggests that bank shareholders have a higher risk appetite than depositors and other external stakeholders and potentially have a higher risk appetite than managers (Jensen and Meckling, 1976 and Sullivan and Spong, 2007). However, the latter may not be true if managers are incentivised on the basis of performance, are disciplined by equity markets or can transfer to other banks in the event of bank under-performance.

The specific argument in Jensen and Meckling (1976) is that the separation of ownership and control inherent in typical corporate structures may result in managerial decisions that deviate from shareholder value maximisation. Meanwhile, Sullivan and Spong (2007) argue that shareholders who are diversified can be expected to have a higher risk appetite than managers who hold part of their wealth as firm-specific human capital. Taken together, these papers yield an argument that managers will reduce the risk tolerance of the firm below that which would be preferred by owners, unless prevented by other incentive structures.

Agency theory and supporting empirical work also suggest that government-owned banks may have higher risk and lower return than shareholder-owned banks, while mutually-owned banks may have lower risk and return than shareholder-owned banks (Schleifer and Vishny, 1997 and Iannotta *et al*, 2007). This is because state-owned banks have social and / or political objectives alongside financial ones, while the managers of mutuals have limited incentive to take risk or pursue profit.

Agency theory further suggests that different agents within banks, such as senior executives, non-executive directors, traders, deal-makers, risk managers, compliance officers and internal auditors will behave differently because they have different incentives in respect of risk and return.

A number of findings in the relevant empirical literature align with the predictions of agency theory. The empirical literature tells us that state majority ownership increases risk and reduces return, while mutual ownership reduces risk and return (Iannotta *et al*, 2007). Foreign ownership and managerial ownership each have effects that are very much context-dependent. Concentration of owners' personal wealth in banks' equity reduces risk (Sullivan and Spong, 2006) while the presence of shareholders that own large blocks of the bank increases risk (Auvray and Brossard, 2012). The presence of more independent directors and a larger Board both lead to less risk, as does the presence of a joint CEO-Chairman (Aebi *et al*, 2012 and Brandão-Marques *et al* 2014). The latter can be explained on the basis of literature suggesting that having separate oversight by the Chairman weakens the personal accountability of the CEO to limit risk and confuses decision-making (Yang and Zhao, 2014 and Rus *et al*, 2011).

The presence of a CRO on the Board is found in a limited number of studies to cause reduced risk (Aebi *et al*, 2012 and Dong *et al*, 2014). However, given that independent monitoring by a Chairman has the opposite effects reported in the literature from independent monitoring by the CRO, it is not clear that these results are reliable. It may be more plausible that an independent

Chairman and an independent CRO each have adverse effects because they weaken the personal accountability for limiting risk perceived by the CEO.

In conclusion, the literature provides a number of insights into how ownership and governance affect bank risk and performance, but it has a number of significant gaps, as discussed in the next section. Please refer to Chapter 2 for more details of the literature mentioned here.

1.4 Literature Gaps and Hypotheses

My study is necessary because past empirical studies give an incomplete picture of how bank ownership and governance affect risk and return. This is evident in a number of important issues that have not been evaluated in the pre-existing empirical literature.

Firstly, it is important for studies in this field to include a range of dependent variables that reflect the outcomes of greatest interest to banks and policy-makers, specifically returns, loan impairments, bank failure, loan interest income and asset growth. Measures of returns (especially return on assets and return on equity) are important because they are direct indicators of how effectively the bank uses its financial resources in generating profit. Loan interest income is important because interest earned on loans is the principal source of bank income. Loan impairments are important because they are a measure of realised risk in banks' main activity (credit intermediation). Bank failure is important because it is the most socially-harmful risk event that occurs in the banking system (Kindleberger and Aliber, 2011). Bank asset growth is important because including it allows a researcher to test whether factors that affect bank performance also affect provision of investment to the wider economy. However, existing empirical studies on ownership and governance omit dependent variables relating to loan interest income, bank failure, and bank asset growth. This represents a significant gap in the literature. I address the gap by including these outcomes as dependent variables in my models. (Please refer to section 3.4 for details of variables used.)

Secondly, it is important to account for simultaneity of risk and return. This is important since finance theory treats these quantities as simultaneous (Jones, 2008) implying that omission of such simultaneity could cause results to be biased. No empirical studies have assessed the effects of ownership and governance on bank risk and return using a framework in which bank risk and return are treated as simultaneous. This is potentially a serious gap in the literature in that reported findings could be affected by bias in which correlation of a regressor with one outcome (risk or return) is mistaken for a causal effect on the other outcome. I therefore seek to test the hypothesis that bank risk and bank return are simultaneous with one another. When I confirm such simultaneity, I use it to create a modelling framework for testing other hypotheses. (Please refer to section 4.3 for the specific hypothesis evaluated in respect of simultaneity.)

Thirdly, it is important that models include as full as possible an accounting for effects of a) the incentives of different agents within banks and b) the information and capabilities of these agents. This should include indicators of the presence or absence of different agents who have different levels of incentive or ability to seek profit and tolerate risk. It should also include indicators of how well-equipped bank leaders and bank systems are to process information relating to risk and performance. Specific empirical studies have omitted certain important indicators of banks containing agents with different incentives, such as the presence or absence of a Chief Risk Officer and / or a Commercial Director as full Board members. Empirical studies have also omitted indicators of information-processing capability, such as the experience of Directors and the presence or absence of permission from regulators to use Internal Ratings Based (IRB) models for credit risk. No studies have been explicitly designed to ensure that a balanced range of such characteristics is used. I therefore test the effects of the following explanatory variables: the proportion of Directors with previous financial services experience, permission from regulators to use IRB models for credit risk analysis, Board size, the ratio of Non-Executive Directors compared to executives, the presence of a Joint CEO-Chairman, the presence of a CRO who is a full Board member, the presence of a Commercial Director who is a full Board member and the proportion of the Board who are female. (Please refer to section 6.4 for the specific hypotheses evaluated.)

Fourthly, it is important to assess the impacts of remuneration structures at all levels of seniority in a bank, including the effects of pay that is not clearly linked to systematic factors[1]. Considering all levels is important since the aggregation of actions at all levels could be as important as decisions at the

[1] In this context "systematic" means factors that are shown to be significant at the level of my sample of banks. Components of pay not determined by such factors clearly must have determinants of some kind, but these determinants are not systematically important across banks.

most senior levels. If pay is more generous throughout the organisation, compared to other banks, then staff may be subject to efficiency-wage effects (Akerlof and Yellen, 1987) that improve all outcomes for the bank. Likewise, considering excess average pay (that component of average pay which is not explained by systematic factors) is important because it reveals the effects of unjustified pay that is indicative of unresolved agency problems (Carter, 2016). However, there are no studies in the literature which consider the effects of remuneration structures at all levels in a bank (as opposed to studies that focus on pay at the CEO- and executive- levels) such that the effects of pay-based incentives throughout banking organisations are not well-understood. It is also important to understand the role of governance structures designed to control pay and, through pay, to affect incentives to take risk. I therefore test the effects on bank risk and performance of having a remuneration committee (a structure that oversees pay at multiple levels), of disclosing executive pay (which is likely to affect remuneration-setting behaviour and which covers at least one level below the CEO), of average pay at all levels, and of excess average pay beyond that which can be explained by systematic factors. (Please refer to section 7.3 for the specific hypotheses evaluated.)

Fifth and finally, it is important to understand whether competitive advantages in the form of implied subsides arising from comparative systemic importance have distinct effects from competitive advantages in the form of economies of scale, arising from sheer size. Both of these are important in economic theory, but the empirical literature on banking has not clearly distinguished them. In order to do so, I evaluate the effects of relative size compared to those of absolute size. (Please refer to section 8.3 for the specific hypotheses evaluated.)

1.5 Methods and Data

To test hypotheses on the effects of variables mentioned above, I use econometric models with measures of bank risk and performance as dependent variables and indicators of ownership, governance, information processing capacity, remuneration structure and relative and absolute size amongst the explanatory variables. In order to cover all the relevant outcomes, measures of risk and return include the loan impairments ratio, bank failure events, return on assets, return on equity, loan interest income and growth in total assets. To minimise bias, I employ models that take account of simultaneity (especially between certain measures of risk and return) and which include appropriate controls. To verify the robustness of results, I vary model specifications and estimation procedures.

To estimate models, I employ a novel data set created by combining financial data from the Bankscope database with governance and ownership data collected painstakingly by hand from the annual reports and Basel Pillar 3 disclosures of UK banks over the period 2003-2012. This yields unique data not available to other studies.

Please refer to Chapter 3 for a full description of methods and data.

1.6 Results and Contributions to the Literature

My research yields a number of important results that constitute new contributions to the literature. I summarise my findings here (along with policy implications in parentheses). It is important to state policy implications because they are a fundamental motivation for any study of this kind. I draw policy implications by interpreting my results in the context of the relevant financial-policy literature and making assumptions a) that loan impairments and bank failure are clearly undesirable (with bank failure being worse because of the strong potential for systemic effects, e.g. Bernanke 1983), b) that provision of investment to the economy is clearly desirable (Romer, 2006), and c) that the desirability of bank profit is ambiguous (*a priori* one does not know whether it is based on efficiency or rent-seeking, Stiglitz 2013). Please refer to section 9.3 for further detail on policy implications.

I find that simultaneity, with a negative sign, is present between risk and return, as represented by loan impairments and return on assets, respectively. This occurs because of a direct accounting relationship between these quantities. There is also a positive lagged relationship between these quantities, due to a classical risk-return correlation as predicted by finance theory (Jones, 2008). This is the first time a simultaneous relationship of this kind has been identified and used in a study of bank ownership and governance. Inclusion of the simultaneous effect in models is vital to prevent bias, which could emerge if correlation of a regressor with either risk or return is confounded with causal effects of risk and return on one another.

In respect of specific ownership and governance variables, my work shows that the effects of a particular ownership or governance structure can be attributed to the way in which specific types of individuals within banks are empowered by that structure. Frequently, this means that banks have lower return and lower risk when there is either a) an ownership structure that entails less pressure on management to pursue profit and take risk, or b) governance structures that involve clear accountability for limiting risk and which generate information that empowers risk-averse decision makers.

For instance, I find that mutual and foreign ownership each have negative effects on risk and return without affecting provision of investment to the wider economy, and that a foreign parent also increases the probability of bank failure. These effects occur because mutual ownership does not entail strong incentives for managers to take risk and pursue profit, because mutual owners do not set such incentives, while foreign ownership entails an information asymmetry between management and owners, such that there is less incentive to pursue profit and a greater vulnerability to failure because the negative effect on profits is large. The results for mutual ownership confirm theoretical predictions (Schleifer and Vishny, 1997) and earlier empirical work (Iannotta *et al* 2007), but this is the first time these effects of mutual ownership have been identified in a model with simultaneity, and the combination of results for foreign ownership is novel. These results are of substantial interest in the context of ongoing debates on the merits of mutual and foreign ownership of banks (e.g. Gupta, 2014) and have implications for policy (specifically they imply mutuality is socially beneficial but foreign ownership is not).

I find that state majority ownership of banks lowers loan interest income, because it involves incentives to make soft loans for social and political reasons (implying that it is inefficient outside special cases). This is in accordance with theoretical predictions (Schleifer and Vishny, 1997) and earlier empirical work (Iannotta *et al,* 2007) but it is the first time it has been verified in a simultaneous equations framework with this particular dependent variable – which is important given that soft lending has been central to arguments that state ownership of banks is inefficient (Gonzalez-Garcia and Grigoli, 2013). My finding therefore provides additional support for the conclusion that the state should only own banks in special circumstances.

These findings on ownership are important because they confirm the effects of mutual ownership in a new framework against a background where only a few empirical papers have addressed the matter; they confirm the effects of state ownership with a new dependent variable that relates directly to soft lending; and they show for the first time that foreign ownership has a similar combination of effects to mutuality and increases the probability of bank failure.

In respect of bank governance, I find that permission to use IRB models lowers risk and return because it provides information to empower risk-averse decision-makers, again without affecting credit provision to the wider economy (implying that it is desirable). This is the first time this result has been obtained in any study and it is especially credible because it is found in a modelling framework that takes account of simultaneity (both between risk and return and of IRB permission with leverage). This novel finding is of particular interest in the context of ongoing debates on the effectiveness of the IRB framework (Haldane, 2013 and Aikman, 2014).

I obtain several other findings relating to effects of specific governance structures, remuneration and bank size that are novel and which have important policy implications. A higher proportion of Directors with no previous financial services experience increases both returns and the probability of bank failure, because it entails pursuit of profit without understanding of risk (implying that it is undesirable). Board size positively affects returns because it improves information processing (making larger Boards desirable). A higher NED ratio reduces the probability of failure, as does a remuneration committee, because both empower individuals with incentives to minimise risk (implying that they are desirable). Higher average pay leads to faster growth and lower risk, while higher excess pay, beyond that explained by systemic factors, leads to slower growth and higher risk, due to effects related to efficiency wages and agency theory respectively (implying that high average pay is desirable while excess pay is undesirable, leaving aside important macro-level income-distribution concerns). Greater relative size boosts bank growth whereas absolute size does not, probably because greater systemic importance leads to a belief that the bank would be bailed out in a severe stress, leading in turn to lower funding costs and an inventive for growth-oriented strategies (suggesting that policymakers should seek to mitigate moral hazard by counteracting the effects of implied subsidies).

Consistent with the limited literature on the subject, I find that presence of a Joint CEO-Chairman is associated with lower loan impairments. In agreement with this, but contrary to the specific literature on the role of the CRO, I find the presence of an independent Chair or CRO is associated with higher impairments. Both results occur because the presence of other senior-level monitors (a Chairman or CRO) dilutes the personal accountability of the CEO and confuses decision-making.

Each of these results is novel, in that some of them have not been found before, while others confirm earlier results in a more robust framework. My results provide guidance to regulators in terms of which features of governance have desirable effects and which do not.

1.7 Outline of the Thesis

The remainder of this thesis is structured as follows.

Chapter 2 provides a detailed review of the relevant literature. Chapter 3 provides a summary of my hypotheses and details of the econometric approach and data I have used. In Chapter 4, I show that simultaneity is present between return on assets and loan impairments and use this to create a new framework for evaluating the effects of bank ownership and governance.

In Chapter 5, I utilise this simultaneous equations framework to show that mutual ownership and a foreign parent each have a negative effect on both risk and return. This is the first time a multi-equation framework has been used in this way. I corroborate these results by showing in single-equation models that mutual ownership and a foreign parent have negative effects on return on equity. Another novel finding is that the presence of a foreign parent is associated with a greater likelihood of bank failure.

A further novel finding in Chapter 5 is that state majority ownership has a negative effect on loan interest income (which was not previously used as a measure of performance in studies of this kind and is important given that critiques of state banks relate to soft lending). I also find that state majority ownership increases the likelihood of failure events, probably because state ownership arises in this sample mainly due to stress and on-going stress raises the probability of further failure events, implying that the correlation is of limited interest. More importantly, I find that state ownership, mutual ownership and a foreign parent have no effects on rates of growth in bank assets. This suggests that, although these can lead to lower performance for banks, they do not affect the provision of credit and other forms of investment to the wider economy.

In Chapter 6, I use another novel framework in which risk, return and leverage are endogenous to confirm that regulatory permission to use Internal Ratings Based (IRB) models leads to lower impairments and lower ROA. This occurs because IRB models entail better detection of risk and thus empower risk-averse decision makers with information, leading to lower risk-taking and lower return. In my analysis, IRB permission is allowed to affect the equity ratio because regulators may permit IRB banks to hold less equity capital.

Using single-equation models, I obtain a further novel result in Chapter 6 relating to information-processing capability: I find that the proportion of Directors without previous financial services experience positively affects ROE. I also find that banks in which fewer of the Directors have previous financial services experience are more likely to fail. These effects occur because of more aggressive pursuit of returns, without sufficient understanding of the eventual risk.

Using the same novel multi-equation framework as for results on ownership, I find in Chapter 6 that Board Size positively affects returns, due to better information-processing compared to other banks. Supporting work using a single-equation model with ROE as the dependent variable reaches the same conclusion. An independent Chairman and an independent CRO are both found to increase risk, because they weaken the personal accountability for managing risk perceived by the CEO and confuse decision-making. As a final novel result in Chapter 6, I find that a higher ratio of NEDs and the presence of a remuneration committee both lower the probability of bank failure – suggesting that these structures work as intended in respect of risk management: ensuring better oversight of risk-taking and remuneration that is better aligned with risk, respectively.

In Chapter 7, I show that higher average pay at all levels in banks leads to faster growth and lower risk, because of efficiency-wage effects. A measure of excess pay (the component of average pay that is not determined by systematic factors) has the opposite effects, because it is indicative of unresolved agency problems (Carter, 2016).

My analysis also shows that the presence of a remuneration committee leads to higher average pay, and that disclosure of executive remuneration leads to lower average pay. These are again novel findings and they occur because a remuneration committee is used to justify higher pay, while the effect of pay disclosure is to discourage high pay, for reputational reasons.

In Chapter 8, I show that bank relative size has a positive effect on the rate of growth in bank assets, while absolute size does not. This is a novel result that occurs because larger banks can grow faster due to competitive advantages arising from implied subsidies, while economies of scale are not important in my sample.

Chapter 9 summarises conclusions, discusses policy implications and considers future research.

1.8 Conclusions

This work is the first empirical study to a) evaluate the effects of bank ownership and governance in a framework where risk and return are simultaneous, b) include a full treatment of indicators of ownership and governance structures, c) examine the effects of structures designed to improve information processing in bank management, d) consider the effects of remuneration structures and pay at all levels in a bank and e) compare the effects of absolute and relative bank size. It therefore has important implications for banking policy. Specifically, it suggests that certain features of banks are desirable or undesirable, given the normative assumptions stated in sections 1.6 and 9.3. Specific desirable features include mutuality, IRB permission, a high NED ratio, a remuneration committee and high average pay at all levels. Undesirable features include foreign ownership, an independent Chairman, an independent CRO, Directors with no prior FS experience and systemic importance.

Chapter 2: Literature and Literature Gaps

2.1 Introduction

The study of bank risk and performance, and of variables which affect these, such as ownership and governance, is motivated in part by the episodes of banking instability which have marked financial history. It is desirable to understand which variables can be altered in ways that make the system less prone to crisis, and more efficient in non-crisis periods, so that we can make use of this knowledge in economic and financial policy.

Bank failures and banking crises have been a recurring pattern in market economies throughout history (Gorton, 2012) and can intensify economic downturns (Bernanke, 1983 and Fernandez *et al*, 2013). It is therefore important to understand their causes and seek means to reduce their frequency and impact. Banking instability is driven by effects at the systemic level, including expectations, macroeconomic imbalances, exogenous shocks and contagion effects (Gorton, 2012). Policy responses must be designed to take account of such factors. However, the characteristics of individual banks are likely to affect the extent to which they are vulnerable to stress, and are more tractable to study and manage because they entail fewer confounding influences than macro-level aggregates.

Different institutional arrangements in banks may affect the probability of bank failures, and ownership structures and governance are likely to be important in this regard. The actions of banks, whether they lead to success or failure, are the result of decisions by individuals within banks, particularly senior individuals. Basic microeconomic theory tells us that individuals respond to incentives in the form of personal payoffs (Varian, 2009). Bank ownership structures and governance determine the incentives of owners, Directors and managers and the possibilities they have for acting on these incentives. So, if we wish to understand banking instability, it is necessary that we understand bank ownership structures and governance and their implications for risk and performance. Any structures which affect outcomes for many individual banks will likely also affect outcomes for the system overall.

In exploring the implications of ownership and governance structures, it is important that we consider both risk and performance. Finance theory suggests that risk and performance are fundamentally linked, because providers of debt and equity investment seek greater return as compensation for greater risk (Jones, 2008). By comparing the effects of explanatory variables on risk and return it may be possible to elucidate the mechanism by which each variable has its effects. For instance, if a variable lowers risk without lowering returns it may be that it reflects a characteristic which entails a better ability to process information compared to other banks, such that the theoretically-predicted risk-return correlation is not apparent.

I address in this Chapter the general body of literature relevant to my research. This starts with critical evaluation of literature relating to which observational units should most appropriately be included in my study (section 2.2). I then consider literature that addresses bank instability and places studies of bank governance in the context of a range of proposed reforms intended to affect bank risk and performance and thus the stability of the wider banking system (section 2.3). In the central part of the chapter, I move on to the implications for banks of agency theory, along with empirical literature which tests these implications (sections 2.4 to 2.6). Towards the end of the Chapter, I consider other theories with implications for bank risk and return and their empirical confirmation (sections 2.7 and 2.8), before finishing with an assessment of gaps in the literature and consequent new directions for research (section 2.9), which I seek to address through the results I present in subsequent chapters.

This is an extensive and complex set of literature. Within it there are contradictory findings. In order to provide an unbiased review, I discuss the details and limitations of papers that reach opposite conclusions. However, in the interests of clarity, I end each section, and the Chapter overall, with a summary of what can be concluded from the various papers I have discussed.

While this chapter provides an overall introduction to the literature and key questions that have yet to be conclusively answered, each of the empirical chapters in my work – Chapters 4 to 8 – picks up specific elements of this body of literature and discusses them in more detail in order to develop hypotheses that are then tested.

2.2 The Nature of Banking

Before considering literature on banks' institutional structures and their effects, it is important to critically evaluate different definitions of the entities referred to as “banks” since they are observational units to which my literature review and my empirical research relate. This is of fundamental importance, and the definition to be used is not immediately obvious, for the reason that there are differing economic and legal definitions of what constitutes a bank, with the range of ownership and governance structures evident perhaps differing substantially depending on which definition is used. The legal definition is effectively a sub-set of the economic definition, so it is necessary that I discuss here the literature on what kind of entities each of these sets contains, what sub-set my literature review and research should relate to, and why this is a useful definition in the context of key questions and previous research.

In economic terms, the financial sector is fundamentally about contracts that facilitate the exchange of utility today for utility at some point in the future, in the face of risk and uncertainty (Jones, 2008 and Chisholm, 2009). Financial intermediaries are organisations that intermediate such relationships between different parties, for various economic purposes (Mishkin, 2012).

Economically, banks are a particular form of financial intermediary that act to intermediate credit (Mishkin 2012). Frexias and Rochet (2008) provide a thorough overview of the basic microeconomic theory of banking. They note that banks link savers and borrowers by borrowing from the former (in the form of deposits or similar) and lending to the latter. In so doing, they argue, banks provide economies of scale and scope in monitoring depositors and borrowers that would be unachievable for smaller agents who have not specialised in this way. The role of intermediating credit intrinsically involves a substantial degree of leverage, because it entails substantial debt financing.

Banks borrow funds with one set of loan sizes and maturities and lend on different scales and maturities. (Such as borrowing callable funds from small depositors and then lending with a maturity of several years to a small, medium or large enterprise). Typically banks' liabilities are much shorter maturity than their assets, and are frequently callable without notice (as is the case with retail deposits). Banks operate in this way because agents who lend to banks, including depositors, demand assets they can treat as a store of cash (used as the basis of payment systems) while agents who borrow from banks seek larger, longer-maturity, more predictable commitments. A relatively informal economic definition of banking has been suggested as "borrowing short and lending long" (Edwards and Mishkin, 1995).

Allen and Gale (2007) present a model of the basic rationale for banking in which the presence of banks allows individual depositors, who may be subject to unforeseen private demands for liquidity, to gain some of the returns from long-maturity investments while holding short-maturity claims, even if they must exercise these claims early. This is not possible in some other forms of financial intermediation where early liquidation of holdings entails forgoing returns. So the economic definition of banking directly implies provision of a risk-management service.

Different types of banks conform to the definition that banking consists of "borrowing short and lending long", but differ in other respects (Casu *et al*, 2006). Retail banks borrow deposits and lend residential mortgages and other retail loans. Commercial banks borrow from retail and commercial depositors and lend to businesses. Investment banks borrow in the short-term money markets and use the funds to make large loans and to participate as principal, market-maker, agent or advisor in markets for new-issue or pre-existing investments. These categories often overlap and universal banks have extensive operations in all these areas.

The legal/regulatory definition of a bank is narrower than the economic definition. It consists of having regulatory permission to accept deposits (a legally-defined form of liability) from customers and being subject to specific rules, governance structures and regulatory supervision arrangements that come with this permission. In the United Kingdom, the Financial Conduct Authority (FCA) defines a bank as:

> "A firm with Part 4A permission which includes accepting deposits, and which is either a credit institution or whose Part 4A permission includes a requirement that it comply with the rules in GENPRU and BIPRU relating to banks."
>
> (FCA Glossary.)

In this definition, the deposits accepted may be from individuals or businesses, the "Part 4A permission" simply refers to being authorised to undertake some regulated financial service under the UK Financial Services and Markets Act 2000, and GENPRU and BIPRU are specific rule-books employed by UK regulators. In UK law, building societies are defined separately from banks, but their definition also includes deposit-taking as a central element.

The economic and regulatory definitions of banking are not equivalent in the sense that the borrowing entailed in "borrowing short" in the economic definition could take a form other than accepting deposits as they are legally defined. The "shadow banking system" consists of increasingly-prevalent organisations that are economically banks, but not legally banks because they are not regulated as banks (Claessens *et al* 2012). Shadow banks include investment banks that are financed through forms of short-term borrowing that are not legally deposits. They also include Special Purpose Vehicles (SPVs) that issue Asset-Backed Commercial Paper (ABCP) and use the proceeds to finance loans, along with various forms of investment funds that have a similar balance sheet structure to a regulated bank.

The economic definition of banking is clearly more interesting than the legal one for the purposes of modelling bank risk and performance and considering their systemic implications. This is because it would be arbitrary to exclude bank liabilities that are equivalent in economic effect to deposit financing but differ in legal details which mean they are not regulated as deposits. Therefore I seek to stay as close as possible to the economic definition of a bank.

However, a study of bank ownership and governance cannot encompass all kinds of entities which are economically banks. This is because some of the kinds of entities included in the definition of shadow banks do not have wellelaborated governance structures or do not disclose key information. Thus, the relevant population consists of those entities which are economically banks *and* have a clearly-defined governance structure that they disclose – specifically retail banks, private banks, commercial banks, building societies, investment banks and universal banks. This is the population where it is possible to examine effects of governance (and ownership in the same model) on bank risk and performance. Findings in the literature and my research cannot necessarily be extrapolated beyond this population.

2.3 Bank Governance in the Context of Bank Reform

The fundamental motivation for my study relates to the need to evaluate different proposed changes to banks that would supposedly improve outcomes at the bank level and thus make the banking system overall less crisis-prone, taking account of the fact that reforms to bank ownership and governance have been one such proposed change. Thus I briefly summarise the literature relating to bank instability, proposed reforms and the place of ownership and governance amongst such reforms.

Banking is nearly as old as civilisation itself and developed its modern structure from the late Middle-Ages onwards (Davies and Davies, 1996). However, since its historical origins, modern banking has suffered serious crises that have adversely affected the wider economy (Reinhart and Rogoff, 2009). In historically recent periods, banking crises of varying severity have affected the United States in 1907, the US and Central Europe in 1929-33, the

United Kingdom in 1973-1975, emerging markets and the US in 1982-1991, Japan and Scandinavia in 1990-1995, emerging markets in 1997-2002 and developed countries from 2007 (Kindleberger and Aliber, 2011). Such crises can have very serious impacts: the worst banking crises and associated macroeconomic downturns have involved GDP contractions in the vicinity of 30%, with attendant social and political dislocations.

Bank stress is the subject of an extensive literature, demonstrating the importance and complexity of the problem. It is important to summarise this literature and understand the nature of the issue if we are to discuss whether reforms to ownership and governance represent a plausible solution. Kindleberger and Aliber (2011) argue that bank stress occurs due to concerns over bank solvency, whether justified or not, and can rapidly increase in scale as some short-term creditors (such as depositors) observe others withdrawing and conclude that they too should withdraw, from the same banks or from other banks that may have correlated exposures. Asset sales to meet withdrawals may affect valuations in a way that makes concerns over solvency self-fulfilling. Bryant (1980) and Diamond and Dybvig (1983) build theoretical models in which the sole driver of bank runs is expectations about the behaviour of other depositors. By contrast, Allen and Gale (1998) build a model in which real shocks to the value of bank assets are the sole driver.

Other theoretical models add additional elements, and more realism, to these two basic approaches. Kiss (2010) modifies the Diamond-Dybvig expectations-based approach by allowing investors to signal non-withdrawal and showing that, if this signal is of low-enough cost, it prevents runs.

Jacklin and Bhattacharya (1988) and Postlewaite and Vives (1987) both show that a combination of low returns on bank assets and high stochastic needs for liquidity at the level of individual depositors may trigger bank runs. Chari and Jagannathan (1988) and Gu (2010) each develop models in which observation of aggregate withdrawal decisions or of the specific actions of other depositors, plus noisy private signals relating to the future performance of bank assets received by some or all depositors, drive withdrawal behaviour.

Allen and Gale (2000 and 2004) develop models in which sale of assets by banks experiencing liquidity stress causes asset prices to fall and thus propagates and amplifies the crisis. Rochet and Vives (2004) and Calvo (2009) consider, respectively, the potential for wholesale depositors to refuse liquidity to solvent banks because of uncertainty relating to their connections to other aspects of the system, and the potential for crises to emerge from collapsing acceptance as liquidity of instruments based on illiquid assets.

Bank regulation seeks to address the issue of bank instability and other problems specific to the sector (Schooner and Tylor, 2009 and Financial Conduct Authority Handbook, Prudential Standards). Regulation is divided into conduct regulation, which aims to prevent mistreatment of consumers and market abuse, and prudential regulation, which aims to ensure the stability of individual banks and the banking system overall. It is prudential regulation which is relevant to this thesis.

Given the experience of the crisis years of 2007-2009, bank regulation in the UK (which is the focus of my study) underwent significant change in the years after 2008 (Prudential Regulation Authority Annual Report and Accounts, 2014). The bodies which oversee regulation were reformed. Prior to 2013, prudential and conduct regulation were overseen by the Financial Services Authority (FSA) while the Bank of England undertook monetary policy. Since 2013, prudential regulation of the largest financial services firms has been undertaken by the Prudential Regulation Authority (PRA) while prudential regulation of smaller financial services firms and conduct regulation of all firms in the sector has been undertaken by the Financial Conduct Authority (FCA). However, this change at the top has been less significant than change in the content of regulation.

One of the most basic ways in which banks may be regulated is through rules controlling the activities they may undertake and the interest rates they may pay or receive. Such regulations existed from the 1940s up to the 1980s in the UK (and until the 1990s in the US). They included rules that prohibited deposit-taking institutions from undertaking activities in market-making and corporate finance, and restrictions on cross-border capital flows, with the aim of preventing contagion of stress between different sub-sectors of financial services, while also preventing the financial sector from behaving in ways inconsistent with the goals of macro-economic policy. However, these controls were removed as part of a broader ideological drive towards deregulation and free markets (Kindleberger and Aliber, 2011).

Other regulations involve standards for the levels of liquid asset reserves (on the asset side of the balance sheet) and regulatory capital (on the liability side of the balance sheet) that banks must hold.

Minimum levels of liquid asset reserves are intended to reduce the likelihood of panic-induced bank runs and ensure smooth function of the payment system (Schooner and Tylor, 2009). Various countries impose minimum levels of central bank reserves that banks must hold, with such minima being adjustable as a tool of monetary policy, but the UK has never set minimum reserve requirements. Instead, banks have set voluntary levels of reserves, governed *via* interpersonal relationships with the Bank of England up until 1981 and, from 1981 to 2009, *via* bilateral contracts with the Bank of England. In 2009, the UK authorities introduced a requirement that banks conduct an Individual Liquidity Adequacy Assessment (ILAA) in which stress testing is employed to assess potential outflows over one- and three-month periods, with qualifying liquid assets to be held sufficient to cover these outflows (Financial Conduct Authority Sourcebook, Prudential Standards). On the international level, similar requirements were codified in the Basel III accord, somewhat later than they were introduced in the UK.

As an additional means to prevent liquidity stress, the Bank of England and other central banks have long operated Lender of Last Resort (LLR) facilities. These involve lending at a penalty rate against qualifying collateral, with a "haircut" taken in the valuation of such collateral, and are intended to prevent concerns over liquidity becoming self-fulfilling in circumstances where bank assets are actually of good quality (Schooner and Tylor, 2009).

Bank regulatory capital requirements in the UK were governed by the Basel I international capital accord (as implemented in EU and UK regulation) prior to 2004, with capital requirements established *via* regulator-prescribed formulae (Bank for International Settlements, 1988). Between 2004 and 2007, this was progressively replaced by the Basel II standards (Bank for International Settlements, 2006). Pillar 1 of Basel II involves either regulator-prescribed formulae or internal models (depending on the regulatory permissions of the bank) for determining capital required for credit, market and operational risk. Pillar 2 involves a Supervisory Review and Evaluation Process (SREP) and an Internal Capital Adequacy Assessment Process (ICAAP) in which capital requirements are quantified *via* scenario analysis for risk types excluded from Pillar 1, and macroeconomic stress tests over future horizons of 3-5 years are used to adjust the assessment of capital requirements for all risk types under the assumption of severe but plausible economic scenarios. Pillar 3 involves public disclosure of capital requirements and resources and of associated calculations, on the assumption that this aids financial-market efficiency and makes uninformed panic less likely.

One feature of Basel II regulation was that it permitted very low levels of regulatory capital and very high leverage, supposedly justified by the belief that banks understood their own risks and had sufficient incentive to mitigate them. Since 2009, under changes in UK regulation and the Basel III accord (Bank for International Settlements, 2009) regulatory capital standards have become much more stringent. This has involved augmenting the Basel II framework, rather than replacing it. Stress testing assumptions have become more severe and there has been more stringent regulatory supervision of stress testing and models. Minimum levels of Core Tier 1 (CT1) capital have been introduced, along with CT1 buffers for capital conservation, systemic importance and counter-cyclical adjustment, and maximum leverage ratios have been introduced to reduce the impact of banks manipulating internal calculations of regulatory capital requirements.

Under Basel I and II, capital could be held as Tier 1 capital (common and preferred stock plus retained earnings), Tier 2 capital (revaluation reserves, hybrid debt-equity financing and subordinated debt) or, unusually, Tier 3 capital (short-term subordinated debt), with minimum levels for Tier 1. However, the crisis revealed that only common equity as a ratio of total assets provided protection against solvency risk and negative perceptions: the market essentially discounted other forms and measures of capital. In consequence, the standards of Basel III are defined almost entirely in terms of Core Tier 1 (CT1) capital (common equity). In addition, Basel III allows for contingent-convertible capital: debt that converts to common equity when regulators deem that certain measures of stress have occurred at the level of an individual bank, with the aim being to protect solvency and bolster market discipline by imposing a cost on creditors.

The PRA and similar regulators in other countries have the legal authority to pursue macro-prudential policy. This involves adjusting regulatory capital, liquidity requirements and other tools in a counter-cyclical manner to counteract speculative booms and stress periods. The power to intervene in this way was granted to the PRA in 2013 but it has yet to be used extensively.

Finally, since 2010, UK regulators have enhanced their tools for dealing with bank failure. Retail banking operations are to be ring-fenced in separate legal groups with independent governance, and financial and operational resources sufficient to ensure they could survive separately from other divisions in a crisis. Recovery and Resolution Plans (RRPs) have been introduced, including pre-prepared actions for ensuring the survival of banks under stress and, where survival is impossible, for winding-up banks in an orderly manner where remaining assets are used to service priority liabilities, such as retail deposits. Deposit insurance has long existed in the UK to protect retail depositors, but the maximum amount covered by the Financial Services Compensation Scheme (FSCS) was increased sharply in 2007 to mitigate the risk of depositor panic.

Corporate governance in the UK has a distinct history from banking regulation. In the late 1980s and early 1990s a series of corporate scandals involving accounting fraud and embezzlement led government-appointed commissions to recommend codified corporate governance. In 1995, the recommendations of these commissions were amalgamated in the Combined Code, which was later re-named the Corporate Governance Code (UK Corporate Governance Code, 2014).

Meeting the standards of the Code is a requirement for listed companies in the UK and is considered good practice for other corporate entities. The provisions of the code are not rigidly prescriptive, but rather are enforced by auditors on a "comply or explain basis".

The contents of the Code are driven by an assumption that preserving and increasing shareholder value is the objective of a company. This is distinct from other countries such as Germany where governance is designed to safeguard the interests of a wider set of stakeholders, through such structures as worker representatives on Boards and cross-shareholdings between supply-chain counterparties. It is also in contrast with the objectives of UK financial services regulation which, as I have discussed, is aimed at preventing mistreatment of consumers and detrimental effects on the stability of the financial system and economy.

Specific requirements of the UK Corporate Governance Code include separating the roles of the CEO and Chairman, having a sufficient number of suitable Non-Executive Directors, and having Board-level Committees to oversee Audit and Remuneration. The effectiveness of the Board and its Committees must be subject to internal evaluation. The Board is also responsible for establishing clear individual accountabilities for managers, formal structures for monitoring risk, and structures to safeguard the independence of control functions within organisations.

Following the banking crisis of 2007-2009, standards for bank Governance, and supervisory enforcement of such standards have been updated. This has created additional requirements to be met within a wider context defined by the UK Corporate Governance Code. The additional requirements applicable to banks have been codified in the handbooks of the FSA, FCA and PRA (Financial Conduct Authority Handbook, Systems and Controls Sourcebook) moreso than the Corporate Governance Code itself.

Specifically, there has been greater scrutiny on the selection and skills of Non-Executive Directors (NEDs) and a greater time commitment is expected from NEDs. The powers of Risk Committees and Chief Risk Officers to block transactions have been enhanced, and there are requirements that the independence of such oversight functions is safeguarded. There are more stringent standards for control over remuneration, linkage of remuneration to risk and disclosure of remuneration. Finally, there is an expectation that governance structures, including role descriptions, be documented more clearly. In the area of bank governance, there has been more change in the level of energy in regulatory supervision of standards than in the standards themselves.

Because UK regulation and governance standards have changed over the period of my empirical study (2003-2012), with likely effects on bank behaviour, I include dummy variables to control for external conditions (see Section 3.4 for details).

For the future, a range of proposals to reform banks and bank regulation have been advanced that would, it is claimed, reduce the propensity of banks and the banking system to undergo crisis. It is important to understand the range of these proposals and the part of this range to which my research relates. Some proposals for reform would involve fundamentally changing the nature of money and banking, such as by requiring retail banks to operate on a full-reserve basis: holding all assets as cash, central bank reserve accounts or government bonds and offering deposit-taking and payment systems as their only services, while transformation of savings into investment was handled by separate asset management businesses (Kobayakawa and Nakamura, 2000). This reform would sharply reduce liquidity risk as fractional-reserve banking would no longer exist and would likewise reduce insolvency risk in the financial system as investment funds make no promise to remain above the originally invested value. However, the transition to such a system would presumably be challenging.

Other proposals would involve extensive reform of the current system while preserving the essential features of fractional reserve banking. Such proposals include more widespread mutual ownership, changing structures for governance and incentive-setting, sharp reductions in leverage (on the basis that this reduces solvency risk while the costs of equity capital are lowered by falling risk), closer supervision by regulators, and arrangements to wind-up failing banks in an orderly fashion so that their remaining assets can provide uninterrupted support to high-priority liabilities, such as retail deposits.

Some measures along these lines have been implemented since the global banking crisis of 2007-2009 (Schooner and Tylor, 2009). Since 2010 the UK, for instance, has changed regulations relating to bank governance (and supervisory practices in enforcing these regulations) so that there are now more suitable Non-Executive Directors, greater individual accountability, remuneration that is more closely linked to risk, and greater rigour in several areas of risk analysis.

It is certainly plausible that reforms to governance could affect outcomes at the bank level and, consequently, affect systemic stability. If the incentives of bank managers are changed so that they are less profit-seeking and less risk-tolerant, then risk at the bank level will likely fall. The propensity for systemic panics will also reduce if banks are less exposed to solvency shocks and depositors know this is the case.

However, I argue that reforms to bank governance could fail to have the intended effects for a number of reasons. In a complex and opaque system, bankers might find new means to pursue their own interests even under a reformed governance structure, outside the observation of regulators and with the consequence that bank-specific and systemic risk stayed the same. Or asset allocations that would change risk in the ways that managers with different incentives would intend might not be available. Or depositors might not be aware-enough of changes to affect the propensity for bank runs to occur.

The problem with many current proposals for reform is that they are based on theory or anecdotal experience, and there has generally not yet been sufficient empirical assessment of how they perform in practice. Empirical research is clearly needed to assess the likely consequences of different options. The research reported in this literature review and my research is relevant to options that would alter ownership and governance structures whilst preserving the basic fractional reserve system. Since this is the path reform efforts have taken to date after the global bank crisis of 2007-2009, it is vital to evaluate its effectiveness as soon as possible.

2.4 Agency Theory and its Implications

Arguments that different ownership and governance structures lead to different outcomes at the corporate level, and that changing such structures could reform banking so as to make it less crisis-prone, arise from agency theory. It is therefore important that I evaluate the relevant parts of agency theory and assess the extent to which they generate relevant, testable hypotheses.

As explained in Fama (1980), agency theory is concerned with situations in which one economic actor, the agent, takes actions on behalf of another, the principal, in the presence of incentives that may or may not be designed to align the interests of the two. It involves models based on assumptions of individual self-interest, maximising behaviour and information constraints. Jensen and Meckling (1976) argue that the separation of ownership and control inherent in typical corporate structures may result in managerial decisions that deviate from shareholder value maximisation. This 'agency cost' may increase as the proportion of equity held by managers falls and as external ownership increases.

How exactly might the interests of shareholders and managers differ? Sullivan and Spong (2007) hypothesise that shareholders who are diversified and earn equity returns are expected to have a higher risk appetite and a stronger profit motive than managers who hold part of their wealth as firm-specific human capital, unless managers have strongly performance-related pay.

How might principal-agent conflicts be mitigated? It is argued in Fama (1980) and Fama and Jensen (1983a) that performance-based wage-setting in markets for managerial labour and value signals generated as a result of trading of firms' equity on public markets may substitute for managerial share ownership by disciplining managers to take actions aligned with shareholder interests. In this setting, managers who do not please shareholders will either earn less or be replaced following a decline in the share price and acquisition by new shareholders.

However, one can propose other hypotheses for manager behaviour, omitted in the relevant literature. For instance, if we have a situation in which bank managers have human capital that is largely transferrable to other banks and there are liquid markets for managerial labour, then managers may have a risk tolerance comparable to that of shareholders. This could occur if managing risk carries a personal or cognitive cost and managers expect they will have some control over the information available to a new employer, such that bad performance can be left behind. This is particularly likely to influence behaviour if managers are incentivised on the basis of bank performance (especially short-term performance). In some cases managers might even have a higher risk appetite than shareholders who intend to hold the bank's equity long-term. Such managers may make decisions almost exclusively on the basis of maximising returns, in the expectation that they can change employer if serious risk materialises.

The prospect of reputational damage, where managers are blamed for poor bank performance and consequently command a lower external wage, could impose discipline. But this effect may be weakened if individuals have influence over information available to new employers or accountability is dispersed amongst managers in a firm such that it is unclear who is responsible for losses. The prospect of systemic stress occurring as a result of risk-taking by bank managers across the economy (likely causing personal loss for these managers) may not be effective either in disciplining managers, since they each have an incentive to defect from any consensus to be prudent. So, contrary to Sullivan and Spong (2007), I argue that it is not clear that bank managers will necessarily have a lower risk appetite than shareholders.

What is clear is that bank shareholders have a higher risk appetite than depositors and other external agents with an interest in bank stability (including regulators). Forrsbaeck (2011) argues that this is the case because shareholders have unlimited upside potential from good bank performance (combined with limited downside potential) while other agents have limited upside. He also argues that depositors may not impose a risk premium on banks in the presence of deposit insurance, thus removing one risk-limiting mechanism, although this 'moral hazard' effect may be limited when bank franchise values are high (giving owners an incentive to preserve these values) or when prudential regulation is stringent.

The consequences of agency problems within individual banks may have direct implications at the systemic level. Allen and Gale (1997) show how agency problems affecting bank managers and investors can cause credit-driven asset-price bubbles that, when they burst and adversely affect asset prices, may trigger bank runs. The agency problems in question involve bank managers financing speculative investment because they are incentivised only by short-run returns, not long-term loan performance.

In conclusion, it is clear that this body of literature on agency theory generates relevant, testable hypotheses. Different ownership and governance structures empower different individuals with different incentives within banks, and give them different information, or protect them from monitoring by others. So it seems clear that different structures should affect decisions made and, ultimately, bank risk and performance. For instance, mutual ownership structures that do not entail counterbalances against the incentives of managers to preserve firm-specific human capital may lead to low risk and low performance. Cross-border ownership may create monitoring difficulties that increase principal-agent conflicts. Empowering of comparatively risk-averse agents such as Non-Executive Directors may lead to lower risk and lower performance, and so on.

However, we must recognise that various frictions in real banks may interfere with the realisation of theoretically-predicted behaviours. For instance constraints on the availability of, or information on, a range of different kinds of investable assets could narrow differences in risk-taking across different governance structures. Or NEDs might not, in practice, have the power that the banks' annual reports say they do. It is for such reasons that agency theory must be tested empirically.

On a specific level, agency theory has been employed to consider the implications for risk and return of particular types of ownership and governance structures within banks. I discuss these implications, alongside the relevant empirical literature, in sections 2.5 and 2.6 below.

2.5 The Role of Ownership Types

In assessing the literature on bank ownership I consider studies of ownership by other types of firms, private shareholders, governments and mutual owners who may be depositors or employees. I also consider work on the role of managerial ownership or foreign ownership, in the latter case addressing the question of whether foreign ownership affects the risk-return trade-off due to international diversification or greater information asymmetries between owners and managers that are in different countries. Ownership concentration is also discussed, considering such questions as whether the presence of owners that control large percentages of a bank's equity facilitates monitoring and control by owners.

Work by Schleifer and Vishny (1997) suggests that Shareholder-Owned Banks (SOBs), Mutually-Owned Banks (MOBs) and Government-Owned Banks (GOBs) may have different risk-return profiles. They point out that government-owned entities are overseen by public officials who have concentrated control rights but no significant cash flow rights. They are therefore not incentivised on the basis of financial returns and may instead, if they are not motivated by social goals, be motivated by political goals, such as granting concessions to political supporters. In mutuals, meanwhile, managers may have a very limited equity stake, ownership is not concentrated (potentially implying reduced monitoring by owners) and there is no equity market listing to discipline managers, so theory suggests that risk and return may be low. Rasmussen (1988) argues that, if the depositors of MOBs are more risk-averse or less well-informed than those of other banks, or if depositors in general are badly informed, these entities may not be punished if their deposit services are more costly (but less risky) than competitors. So GOBs may have higher risk and lower return than SOBs, while MOBs may have lower risk and return than SOBs.

Empirical studies have sought to test such predictions by means of regression models with various metrics of performance and risk as dependent variables and indicators of ownership type and various controls as regressors. In an extensive study of European banks, Amadou-Barry *et al* (2010) examine the hypothesis that different ownership structures imply different risk-return profiles. They find a significant negative association of several indicators of risk with ownership by families/individuals and ownership by other banks. While the latter is difficult to interpret, the former is consistent with the hypothesis that concentrated owners who own a large block of the firm are more able to monitor managers and have a stronger incentive to limit risk when their personal wealth is concentrated in the firm.

It could be argued that another interpretation of this result is simply that individual or family investors choose to invest in banks with different levels of risk compared to institutional investors: the opposite direction of causation to that hypothesised. However, since family ownership is likely to be long-standing and to have shaped the culture of a firm over several generations, this is not plausible.

Marco and Fernandez (2007) employ panel methods to analyse the relationship between ownership structure and risk in the Spanish banking sector. Following Merton (1977) they argue that deposit insurance has an option value to the owners of banks that increases with risk and that such insurance therefore induces risk-taking. They propose that owner-manager agency conflict, in which managers are more risk averse, can counteract this incentive and that there will be differing levels of risk between institutions with differing degrees of owner control. This conflict may be least effective as a risk mitigant in commercial banks where managers can have an equity stake, and more effective under mutual ownership where there are fewer incentive structures to increase the risk tolerance of managers.

They consider a sample of 127 Spanish banks over the period 1993-2000 using data from banking industry associations and regulators in Spain. The sample included 50 non-commercial savings banks, which were owned by combinations of local governments, depositors and founding entities. They find a significant negative association of savings bank status with risk-taking. However, this study does not reveal which aspects of savings bank status are important for risk aversion – is it the incentive arrangements of managers, depositor ownership or something else correlated with one of these? Good use of control variables could differentiate these possibilities, but the range of controls included is limited. Specifically, changes in the governing body were the only governance variable included, and the study omitted each of foreign ownership, sophistication in risk management, liquidity and asset portfolio composition. Nevertheless, the result is consistent with theory and other empirical studies, so it is convincing.

Angkinand and Whilborg (2010) explicitly examine the interaction of ownership types and deposit insurance in determining risk. They find evidence that government ownership of banks increases the risk-taking incentives associated with the option value embedded in deposit insurance. However, this study is not convincing as it relies on country-level data. It is therefore vulnerable to omitted variables at the bank level and aggregation effects. In any case, it is not clear that the option value of deposit insurance should affect the decisions of public sector managers (who have negligible cash flow rights) more than those of private owners.

In an important study, Iannotta *et al* (2007) compare the performance and risk of SOBs, GOBs and MOBs in a sample of 181 large banks from 15 European countries over the years 1999-2004. They reveal that SOBs are more profitable than either GOBs or MOBs, which is as theory predicts. They also show that GOBs have higher risk than SOBs, which in turn have higher risk than MOBs. This is again as theory predicts. The results are convincing because of their empirical rigour and alignment with theory.

This study omitted controls for other ownership types, governance, sophistication in risk management, balance sheet composition and liquidity resources. However, a large set of other controls was included and a panel model specification was used so, while there are specific reasons to consider vulnerability to omitted variables bias, the extent of the problem is limited. For these reasons, and because of agreement with theory, the results are convincing. It would also be interesting to confirm if the results obtained are applicable to smaller banks and other territories, such as the US or Asia, given that parameter values may not be the same in these settings.

Overall, empirical studies of the roles of government and mutual ownership in banking show that government ownership increases risk and lowers return, while mutuality lowers risk and return. The conclusions for mutual ownership are based on just two studies (Iannotta *et al*, 2007 and Marco and Fernandez, 2007) but these papers are each robust and their findings are consistent with theory, so the conclusion can be relied upon.

2.5.1 Government Ownership

As discussed above, GOBs may take more risk and have worse performance than SOBs because they are controlled by public officials who have no significant cash flow rights and instead use their control to pursue social or political aims. The findings of Iannotta *et al* (2007) cited above lend strong support to this view. Different business models may also explain differences in risk between public- and private-sector banks. For instance, Pennathur *et al* (2012) find indications that public sector banks in India pursue less non-interest income (such as from corporate finance and financial-markets trading) than other banks. If government banks have a less-diversified income base, and if diversification mitigates risk, then government banks will be riskier.

Boubakri *et al* (2005) report that banks selected for privatisation in 22 developing countries generally have worse performance and solvency and that their risk-return profile improves over time, which suggests that the transition to private ownership makes them do better. However, this study does not account for the performance recovery that may happen anyway in underperforming banks without ownership change or privatisation, or the potential effects of any change in ownership (regardless of whether private or public ownership was the initial state). It is simpler to study the effects of government versus non-government ownership as static states (albeit ones that prevail over time in the context of panel models) rather than relying on studies of privatisation.

A number of empirical studies have focused explicitly on the implications of government ownership for bank risk and performance. Interestingly, Karas *et al* (2010) employ an empirical method different from the usual approach of regression modelling and use Data Envelopment Analysis (DEA) to analyse factors linked to the efficiency of banks in Russia, with efficiency defined as the ratio of total costs to the value of capital employed by the bank. DEA is an approach based on optimisation that estimates a production frontier of one or several outputs produced from a number of inputs. Other studies of bank efficiency have used similar methods. This study finds no difference in efficiency between government- and privately-owned banks. However, it is possible that this result does not generalise well to other countries because of the high levels of corruption in transition economies, and especially in post-transition Russia, which may have the effect of making government and private banks equally inefficient.

Examining the Asia-Pacific region, Hossain *et al* report results that are contrary to theory in that they find that, compared to private-sector banks, state ownership results in smaller losses during crisis periods without reducing returns during benign periods. However, this study has a number of serious methodological flaws. It uses stockmarket returns as a dependent variable and adjusts this only for world stock index returns, which means that investor expectations of government aid (which could be higher for state-owned banks) and other market factors could affect the results as much as the fundamental value and risk of bank assets. In addition, it relies on ownership data at the country level rather than the bank level. Finally, the same instrumental variables are used for each of several variables on regulation that are included in the model (meaning that the model is under-identified) and the instruments used (distance from the equator and religious composition – Catholic or Protestant) may be irrelevant as their causal effect on bank regulation is very doubtful.

Cornett *et al* (2010) also consider the Asia-Pacific region. They analyse annual financial data from Bankscope and other commercially-available sources for several hundred banks in 16 Asia-Pacific countries over the period 1989-2004, a sample which is interesting because it includes the Southeast Asian financial crisis of 1997-2000. This study reveals that, compared to private-sector banks, state-owned banks were less profitable and more risky prior to 2001 and that they suffered more rapid deterioration during the crisis years of 1997-2000, but that the negative effects of state ownership diminished in the 2001-2004 period. These findings are consistent with theoretical predictions in relation to state-owned banks made in Shleifer and Vishny (1997). The changes in the 2001-2004 period are interesting and suggest that other characteristics (which are omitted in this study) can mitigate the adverse effects on risk and performance of government ownership. The only control variables include were foreign ownership, bank size and year, making these results vulnerable to omitted variables bias. But the results remain convincing because of agreement with other empirical studies and with theoretical predications.

Al-Tamimi and Jellali (2013) examine the hypothesis that shareholder-owned banks are less risky that state-owned banks because they have incentives to preserve shareholder value while state-owned banks pursue political and social objectives. However, they acknowledge that government protection could lower risk in state-owned banks. They study a sample of 15 banks in the United Arab Emirates over the period 1998-2010. The sample was selected to include all domestically-owned banks other than those which were new, or small with incomplete data. Four of the banks included had an Islamic-finance business model, which prohibits interest and instead involves joint ventures and risk- and profit- sharing of various kinds.

As dependent variable they use the ratio of Risk-Weighted Assets (RWA) over total assets as a proxy for risk-taking behaviour. A problem with this approach is that RWA is not a consistent measure. The meaning of a given ratio of RWA over total assets has varied over time as the banking system has progressed through the Basel I to III international capital accords. It is likely to have varied across countries as different national regulators have imposed their own standards for the advanced internal models for estimating capital requirements that are permitted under Basel II and III for banks with the necessary capabilities. In addition, it is likely to have varied across banks as different banks have used either regulator-prescribed formulae or internal models for computing RWAs. Other omitted variables are also likely to have affected the ratio of RWA over total assets, such as characteristics of the business strategy, governance structure and individual directors. Such effects can be controlled by including dummy variables for period, bank and country (with the latter obviously not relevant for Al-Tamimi and Jellali), or by using panel data models at the bank level with dummies for year and country. But, since Al-Tamimi and Jellali do not employ such methods, their results are not convincing.

The most convincing results on the impact of government ownership are in a second study from Iannotta *et al* (2012). Using data from Bankscope, the rating agencies Standard & Poor's and Fitch and official sources, they apply the same sample selection criteria as in Iannotta *et al* (2007) and thus examine a sample of 210 banks from 16 European countries over the period 2000-2009. Dependent variables are based on rating agency grades, which they argue avoids the problems of endogeneity and inaccuracy inherent in using accounting-based measures of risk. Since rating agency grades are based in part on accounting data, this rationale is debatable, but it is nevertheless arguable that agency grades are a reasonable measure of default probability in the case of corporate entities. This is supported by the back-testing of their grades published by rating agencies (e.g. Standard and Poor's, 2012). The authors enumerate agency grades to create a numerical scale and use both issuer grades (which are a measure of default risk) and individual grades (which remove the effect of implied government support).

Using a panel model, they find that government ownership has a significant positive association with underlying risk (that is, risk after the effect of government support has been removed) and a significant negative association with default risk. The former result is interpreted as meaning that government ownership leads to increased risk-taking in the way that Shleifer and Vishny (1997) predict. The latter result shows that there is greater government support for state-owned banks that enter distress, such that they exhibit a lesser default risk than private-sector banks. Finally, both underlying risk and government protection increase in election years. These results are as theory predicts and are supported by the earlier work of the same authors in Iannotta *et al* (2007), which reaches similar conclusions on the effects of government ownership using different dependent variables.

The association of government ownership with issuer and individual ratings is found to be particularly strong for German banks. When German banks are removed from the sample, the findings remain robust for individual ratings but cease to be significant for issuer ratings. This implies that government-owned banks in all countries have greater underlying risk, but that the extent of implied government support varies.

Since the results employ rating agency grades as dependent variables they could simply reproduce biases inherent in such grades (such as a subjective belief that government-owned banks are riskier). However, the controls that are present and the use of a panel model, together with the credibility given to agency corporate grades by published back-testing studies makes it likely that the results are reliable.

Dong *et al* (2014) use a panel model to show that state-owned banks in China engage in greater risk-taking compared to other banks. This lends further support to the view that state-owned banks are generally riskier.

In conclusion, several empirical studies find that government ownership is associated with increased risk (Angkinand and Whilborg, 2010, Iannotta *et al* 2012 and Dong *et al* 2014) while others find that it is associated with higher risk and lower return (Iannotta *et al* 2007 and Cornett *et al* 2010). These results are clear and are consistent with the predictions of agency theory

2.5.2 Managerial Ownership

As discussed above, Sullivan and Spong (2007) argue that non-owner managers, unless they are subject to performance-related pay, have a lower risk appetite and weaker profit motive compared to shareholders. This is because they seek to protect the value of firm-specific human capital. In banks where managers do have a significant ownership stake (without managers having their personal wealth concentrated in the bank's equity) we would therefore expect to see greater risk-taking than in banks where control and ownership are separate. However, as discussed earlier, one can also make an argument that in certain situations managers have a risk appetite similar to, or higher than, shareholders. This, in turn, implies that substantive managerial shareholdings will not affect, or may even reduce, risk-taking. Given these contradictory hypotheses, the impact of managerial shareholding on risk is a purely empirical question.

Using data for South Korea, Lee (2008) reports a positive correlation of insider ownership with return on assets and a negative correlation of such ownership with the ratio of non-performing loans to total loans. The latter result is contrary to theory. However, since the only control included was for bank size, these results are not persuasive. Using data for South Korea and Japan, Chun *et al* (2010) report that managerial ownership increases risk in Japanese banks but does not do so in Korean banks. They find the increased risk of Japanese banks with higher managerial ownership is not compensated by increased profit. However, for the positive associations reported, this study relied on stock market returns and the volatility of such returns as dependent variables and did not include any controls related to wider financial-market dynamics. It is therefore likely to be severely biased by omitted variables that affect stock prices.

Forssbaeck (2011) considers a sample of 331 banks in 47 countries over the period 1995-2005. As dependent variables he uses the ratio of non-performing loans to equity and the Z-score. As regressors he uses the proportions of equity held by corporate insiders and institutional investors and dummy variables indicating that the largest shareholders are the government or foreign. Using panel models, he finds significant negative relationships between risk and both insider ownership and institutional ownership. The former is inconsistent with the prediction that non-owner managers are risk averse as they seek to preserve firm-specific human capital and instead supports the view that non-owner managers can have a higher risk appetite than shareholders under some circumstances. If we assume that institutional owners can exert more control than small individual owners, the latter result suggests that institutional investors are comparatively risk averse. This study is methodologically robust and the results are therefore convincing.

Anderson and Fraser (2000) consider a sample of 150 banks in the United States over the period 1987-1994 using data obtained from regulatory authorities, financial accounts and the Centre for Research in Security Prices (CRSP). As a dependent variable they use firm-specific risk (the volatility of the residuals left over when a systematic model is used to explain stock prices). As a regressor they use the equity holdings of insiders.

Using a panel model, they find a positive relationship between insider ownership and firm-specific risk. This is more convincing than the results of Chun *et al* (who also used market-based measures of risk and return) since the use of firm-specific risk after systematic risks have been removed allows one to control for various factors that affect equity prices, while the use of a panel model controls for unobserved heterogeneity at the bank level. However, details of the systematic risk model used are not disclosed and it remains possible that not enough of the many factors potentially affecting equity markets have been controlled for. In addition, the result on the effect of insider ownership contradicts that of Forssbaeck (2011), which suggests that the risk appetite of managers is context-dependent.

Laeven and Levine (2009) address the implications for risk and performance of shareholder control within banks. Analysing the effects of control rights of shareholders addresses essentially the same question as considering the effects of shareholdings held by managers: does closer alignment of shareholding and control result in higher risk and performance? The authors analyse data on 279 large banks across 48 countries for the period 1996-2001 using data from Bankscope, other databases, annual reports and company websites. As dependent variables they use the volatility of return on assets and the z-score. As a regressor they use the cash flow rights of executive managers and directors.

Using a pooled cross-sectional model, they find a positive association of managerial cash flow rights with bank risk. The contrast of this finding with that of Forssbaeck (2011) suggests that contextual factors, such as the transferability of managerial labour to other banks, are important in determining the effect of managerial ownership on risk and return.

The extent to which a bank is owned by its managers is not the only aspect of managerial ownership that can be expected to have an impact on risk-taking. While managers may have a substantial portion of their abstract wealth concentrated in the bank in the form of firm-specific human capital, manager-owners may or may not have their financial wealth concentrated in the equity of the bank. If their financial wealth is concentrated in the bank, their investment portfolio is not diversified and they are therefore likely to be more risk averse in their decisions.

Sullivan and Spong (2006) was the first empirical study to evaluate this hypothesis. Using data obtained from the Federal Deposit Insurance Commission (FDIC) they analyse a sample of 267 banks in seven US states in the years 1993 and 1994. This included data on the ownership stakes of managers in banks and their net personal worth. They demonstrate that 20 banks which failed and were removed from the sample had similar descriptive statistics to the included banks, indicating that their removal does not cause selection bias.

As a dependent variable they use the standard deviation of operating return on equity. As regressors they use managers' combined equity ownership over total personal worth of managers, monitors' combined equity ownership over total personal worth of monitors (with 'monitors' defined as Non-Executive Directors), the proportion of equity owned by hired managers and their families and the proportion of equity owned by owner-managers and their families.

Using a cross-section model, this study reveals a significant negative relationship between risk and the extent to which managers have their wealth concentrated in the bank. It finds a similar relationship for 'monitors'. In this way, it is confirmed that concentration of managers' wealth in a bank's equity leads to less risk-taking.

In summary, the literature contains conflicting results for the effects of managerial ownership. Forssbaeck (2011) finds a negative association of managerial ownership with risk while Anderson and Fraser (2000) and Laeven and Levine (2009) find a positive relationship. Chun *et al* (2010) finds a positive association in one country but not in another. This supports the hypothesis that non-owner managers (the counterfactual in these studies) may have a greater or lesser risk appetite compared to shareholders depending on such factors as remuneration structure and the ease with which they can move firm.

Two studies in the literature show more clearly that, when owners have their personal wealth concentrated in the equity of a bank, those banks take less risk compared to other banks (Amadou-Barry *et al,* 2010 and Sullivan and Spong, 2006). This is the expected behavioural response to a less-diversified portfolio: a lowering of risk appetite.

2.5.3 Foreign Ownership

There are clear reasons why foreign ownership of banks might be important for risk and performance. Viewed on a consolidated basis, internationally diversified institutions might have higher risk and return compared to other banks. They might, because of diversification, take more risk in each of their subsidiaries. And their larger resources of capital, skills and infrastructure might enable them to achieve a better risk-return trade-off. Alternatively, cross-border ownership might make monitoring and control more difficult, such that local management are able to follow their own risk appetite (which might be higher or lower than that of foreign owners). Because these effects could be contradictory, the role of foreign ownership in bank risk and performance is an empirical question.

Bhaumik and Piesse (2007) construct a portfolio-choice model that can explain the asset allocations to government bonds and risky credits of domestic Indian banks over the years 1995-2004, but they find that it cannot explain the behaviour of foreign-owned banks. This suggests that there may be a difference in behaviour between foreign-owned and domestic banks, although the model did not include controls for financial characteristics of banks and could thus be subject to omitted variables bias. Using data for South Korea, Choi and Hasan (2005) report that the number of Board directors representing foreign owners has a positive association with performance and a negative association with risk. This potentially reflects a better risk-return trade-off achievable as a result of foreign ownership. However, the study is not convincing as it only includes controls for bank size and deregulation.

Angkinand and Whilborg (2010) report a positive effect of foreign ownership on bank risk, however this effect is present in a cross-section model only and disappears in a panel model, suggesting that it is due to omission of unobserved heterogeneity. In any case, this study is not convincing as it relies on country-level data, creating vulnerability to omitted variables at the bank level and aggregation effects. The study by Forssbaeck (2011) cited earlier, which was more robustly controlled, finds no impact of foreign ownership.

Havrylchyk and Jurzyk (2011) focus on banks in Central and Eastern Europe. They construct a logit model of the propensity to be acquired by a foreign owner and then match each bank that was so acquired to another, non-acquired, bank with the closest propensity score at the time of acquisition. Using a differences-in-differences model, they show that acquired banks have significantly higher ROA one, three and five years after acquisition. Variables used in the logit model include return on assets, capital adequacy, bank size, state ownership and macroeconomic factors. These are unlikely to be the complete set of factors explaining the decision to acquire, and indeed the model only achieves a pseudo-R^2 of 12%, so this analysis is not completely convincing. In addition, it does not differentiate between the effect of takeover by foreign owners and takeover *per se*.

Results from Chen and Liao (2011) suggest that the effects of foreign ownership may be context-dependent, which is as we would expect from the theoretical discussion at the start of this section. Specifically, they find that foreign-owned banks are more profitable than domestically-owned banks when the parent bank is highly profitable and the host country features a banking sector with less competition.

Overall, empirical results for the effects of foreign ownership are contradictory. Angkinand and Whilborg (2010) report a positive effect of foreign ownership on bank risk, but Forssbaeck (2011) finds no effect and Results from Chen and Liao (2011) suggest the effects are context-dependent, being affected by profitability of the parent entity and levels of competition in the host market. It may be that the effects of foreign ownership depend on which of its corollaries (such as greater diversification or greater information asymmetry) are dominant.

2.5.4 Ownership Concentration

One theoretical perspective is that widely dispersed shareholder ownership of firms that are listed on the stock market generates equity price signals that provide an effective means of disciplining managers (Fama and Jensen, 1983a). An opposing perspective is that shareholder scale matters. Grossman and Hart (1980) show that dispersed shareholder control creates disincentives to expend resources on monitoring as other investors will benefit from this informational public good. Shleifer and Vishny (1986), meanwhile, argue that large shareholders can overcome this difficulty because they internalise the benefits of monitoring and can monitor at lower cost, because of their greater stake and economies of scale. So ownership concentration may increase shareholder control. If shareholders have higher risk appetite than managers who do not own shares, then concentrated ownership should be positively associated with profits and risk.

Using data for Japanese banks, Kim *et al* (2007) find evidence of a positive association between ownership concentrations and risk in the period 1986-1988 (when they state regulation was relaxed) but not in the periods before and after (when regulation was more stringent). This suggests that strong shareholder monitoring is present only when regulatory intervention does not suppress any instructions from shareholders to take more risk. However, this study relies on a cross-section model and only includes controls for

Keeley's Q (a measure of franchise value), membership of a Keiritsu (a cluster of coordinated Japanese firms with government guidance and centred on a bank) and loan write-offs. It is therefore very vulnerable to omitted variables bias and unobserved heterogeneity at the bank level and is not convincing.

Riewsathirathoran *et al* (2011) use data for 36 banks in 5 Asian countries over a five-year period and a measure of ownership concentration equal to the percentage of equity held by the top five shareholders. In a cross-sectional model, they find that ownership concentration is associated with lower profits and lower risk. These results, although published as a working paper and not peer-reviewed, are more convincing than Kim *et al* (2007) because a wider range of controls were included.

Auvray and Brossard (2012) study quarterly data for a sample of 76 banks in 18 European countries (11 of them euro-zone countries) over the period 1997-2005. They use data from the commercially available Bankscope and Datastream databases, the Thompson One Bank Ownership (TOBO) database and media sources. As dependent variables they use modelled probabilities of bank credit rating upgrades or downgrades. As regressors they use the percentages of equity held by certain numbers of the bank's largest shareholders and dummy variables that take a value 1 if the largest shareholder has a stake exceeding certain thresholds. They interact some of the regressors with the Merton-KMV Distance to Default (DD) indicator. This relies on equity prices, introducing the possibility of bias due to market factors unrelated to bank fundamentals, but it has been shown to be a significant predictor of default risk.

Using a lagged cross-section model, this study finds a positive association with risk for the dummy variable for the largest shareholder controlling more than 5% of equity. This result exists independently of interaction of this dummy with DD. The fact that these results contradict those of Riewsathirathoran *et al* provides a further indication that, as discussed in the preceding section, shareholders may have a higher risk appetite than managers in some settings and a lower one in others.

An issue with all of these studies is that they omit the wealth concentration of large owners. If these owners have their wealth concentrated in the bank and are thus not diversified, they will be more risk averse than otherwise. In addition the authors do not control for the effects of managerial share ownership.

Stable shareholding may have similar effects to concentrated shareholding, with long-termist shareholders having more incentive to monitor and control firms. Using data for Japan, Konishi and Yasuda (2004) report a non-linear relationship of bank risk with the ownership stake of shareholders they define as stable. They find that the level of risk decreases initially as the ownership stake increases, but subsequently increases again. This suggests that low but positive levels of stable shareholding undermine the ability of market discipline to force managers to take more risk, but that increasing concentration of stable ownership eventually substitutes effective monitoring for market discipline.

In conclusion, the presence of ownership concentrations in which large blocks of a bank's equity are owned by one investor appears to have a positive effect on bank risk. Kim *et al* (2007) and Auvray and Brossard (2012) find evidence of a positive association between ownership concentrations and risk. Riewsathirathoran *et al* (2011) find a negative association of ownership concentration with risk and performance, but this study is less-well-controlled and can thus be discounted. The conclusion that ownership concentrations are positively associated with bank risk is consistent with the hypothesis that ownership concentration is necessary for monitoring. It seems that concentrated shareholders can force managers to take risk greater than their preference in a way that dispersed shareholders cannot.

2.6 The Role of Governance Arrangements

Analysis of bank corporate governance leads us to consider a different set of incentive conflicts from owner-manager conflicts. Different managers and departments within banks may have different remuneration structures and therefore different incentives. Senior executives, financial-market traders and deal-makers may receive a large proportion of their pay as performance-related bonuses, including remuneration in shares, and therefore have incentives to take risk. By contrast, Non-Executive Directors (NEDs), risk managers, compliance officers and internal auditors receive little or none of their pay in this form and thus have fewer incentives to take risk. They may also have different professional cultures and be more likely to have incentives to preserve membership of professional bodies, such as law and accounting societies. Governance structures which affect the comparative power of different groups within bank management may therefore be important in determining bank risk and performance. Mehran *et al* (2011) provide an informative survey of the literature on how bank governance affects risk and performance.

Many empirical studies have sought to evaluate the predictions of agency theory in respect of the implications of bank governance. I review this empirical literature in this section. As in section 2.5, I give more attention than elsewhere in the literature review to the specifics of data sets and methodologies, in order to reflect the centrality of these papers to my research and to evaluate a number of conflicting results in the literature.

A study by the World Bank (Anginer *et a*l, 2014) reports that independence in the governance structure at Board level leads to increased bank risk-taking, which they interpret as being due to Boards representing the risk-tolerant preferences of diversified shareholders. However, this study relies on composite measures of Board strength (which makes it more difficult to interpret causal mechanisms) and controls at the country level (which creates pronounced vulnerability to omitted variables bias at the bank level).

Analysis from the International Monetary Fund (Brandão-Marques *et al* 2014) summarises bank- and country-level studies examining the effects of bank governance on risk and performance. They also report new results suggesting that greater independence amongst bank Board members leads to reduced risk. However, although this study included bank fixed effects and country-level controls, bank-specific controls were limited to return on book assets, log book assets, the deposit-to-asset ratio, the Tier 1 capital ratio, and revenue growth. There may therefore be omitted variables bias.

Aebi *et al* (2012) collect data from commercially-available databases, annual reports and regulators for 372 US banks over the period 2007-2008. As dependent variables they use buy-and-hold returns and return on equity. They use a diverse and interesting range of regressors consisting of a dummy for the presence of Chief Risk Officer (CRO) at board level, a dummy for whether the CRO reports directly to the board (independently of the CEO), a dummy for the presence of a risk committee at board level, board size, the percentage of independent directors on the board, the meeting frequency of the risk committee, the number of directors in the risk committee, the percentage of directors in the risk committee who are independent, a dummy variable for the presence of a dual CEO-Chairman, the percentage of directors who joined the board before the CEO, the percentage of directors over the age of 72, the percentage director non-attendance at board meetings, the existence of a board nominations committee consisting only of independent directors and a general corporate governance index.

Using a cross-sectional model, they find a significant positive impact on returns of the CRO reporting directly to the Board, a negative impact on returns of the CRO reporting only to the CEO and no impact for the presence of a CRO. This suggests that CRO independence of the CEO is more important than his/her presence. They also found a positive impact on returns of board size and the frequency of meeting of the risk committee, but a negative impact of the possession of a risk committee. This suggests that the possession of an active risk committee is beneficial and that risky firms perhaps tend to maintain inactive risk committees. Director non-attendance, intuitively, is found to be harmful. The proportion of directors who are independent has a negative impact. This latter result could be explained if regulators have forced firms seen as risky to strengthen their boards but these firms remained risky. Other governance features had no significant effects.

These results are of interest because of the diverse range of governance indicators explored and results relating to the CRO and risk committee, which can be interpreted in accordance with agency theory. However, this study was based on a brief, abnormal time period and omitted controls for ownership type, sophistication in risk management and liquidity resources. The results are therefore persuasive but remain open to challenge.

Pathan (2009) analyses a sample of 212 large US Bank Holding Companies over the period 1997-2004 using data obtained from Bankscope, Datastream, regulators and annual reports. As a dependent variable, he uses a measure of firm-specific risk similar to that cited in Anderson and Fraser (2000) cited above, together with the volatility of stock returns and the Z-score. As regressors he uses board size, the percentage of directors who are independent, an index of shareholders' rights, an index of Board entrenchment, and a dummy variable for the presence of a dual CEO-Chairman.

Using a panel data model, he finds that board size, director independence, shareholders' rights and a dual CEO-Chairman all have a significant negative association with bank risk. The result for independent directors is as expected from theory since these individuals do not receive remuneration linked to bank performance. The result for board size is as expected from theory if we assume that larger Boards are larger because they contain more independent directors or more aggregate experience. The result for a dual CEO-Chairman is consistent with other studies by Yang and Zhao (2014) and Rus *et al* (2011) which suggest, respectively, that separating the roles of CEO and Chair confuses decision-making, while also weakening the personal accountability for risk perceived by the CEO. Anginer *et al* (2016) report that a banks having joint CEO-Chairman leads to lower leverage ratios. This finding is consistent with the results of Pathan *et al* (2009) in the sense that it implies lower risk.

Dong *et al* (2014) use a panel model to show that banks in China with a CRO on the Board engage in less risk taking than other banks. This study was well-controlled, although it included limited controls for external conditions or balance sheet composition, and it accords with Aebi *et al* (2012).

A number of conclusions can be drawn from this body of literature. The presence of independent directors on a bank's Board leads to reduced risk and performance (Brandão-Marques *et al* 2014, Pathan 2009 and Aebi *et al* 2012). A dissenting result is Anginer *et al,* 2014 but this study had a number of serious empirical weaknesses, as noted above, and can thus be discounted.

Two papers that examined the role of Board size (Pathan, 2009 and Aebi *et al,* 2012) both find that it has a negative impact on risk. This suggests that the availability of a greater set of skills and experience at a senior level leads to better decision-making such that lower risk is achievable without sacrificing returns.

A single study (Pathan, 2009), examines the effects of combining the CEO and Chairman roles and shows that a dual CEO-Chairman has a negative association with bank risk. This is not what we would expect if we believed, as regulators appear to, that separating these roles would yield more independent oversight and thus mitigate the high risk appetite of bonus-remunerated CEOs. Instead, it is consistent with other literature (Yang and Zhao, 2014 and Rus *et al*, 2011) indicating that separating the roles in this way leads to confused decision-making and less personal accountability on the CEO for managing risk.

Results relating to the presence of a CRO as a full Board director appear clear-cut, but are based on very few papers and are questionable because they appear to contradict results for an independent Chairman. Aebi *et al* (2012) show that a CRO on the Board has a positive impact on returns, while Dong *et al* (2014) show that it has a negative impact on risk. Both of these studies must be treated with doubt because they relied on narrow research settings and it is questionable why independent monitoring by the Chairman would have such very different effects compared to independent monitoring by the CRO. Instead, it is possible that both kinds of independent monitoring lead to higher risk or lower return.

So, according to the empirical literature, independent directors lower risk and return, a larger Board lowers risk, and a Joint CEO-Chairman unexpectedly lowers risk. The empirical literature also suggests that a CRO on the Board improves the risk-return trade-off, but this may not be true in that we could expect this role to have similar adverse effects to an independent Chairman.

2.7 The Role of Remuneration in Banks

Remuneration is a topic of central interest in agency theory. Given the proposition of classical microeconomics that individuals respond to incentives, it follows that linking remuneration to different outcomes will lead to different management behaviours and that these behaviours may or may not align with the interests of owners and other parties. In addition, if the outcomes to which remuneration is linked are hard to measure, or if they are linked to other outcomes that are hard to measure, incentive structures may have consequences their designers view as undesirable (Brookfield and Ormrod, 2000). For instance, if incentivised to maximise profit or market share, managers may do so by increasing risk and concealing that risk if it is difficult for shareholders to detect that they have done so.

The majority of studies of remuneration in banks have focused on the incentives of the CEO, although a few have been broader. The CEO has a uniquely powerful role in most firms. Other than authorities reserved to the Board or Board sub-committees, and any reporting lines that are independent of the CEO (such as the CRO and head of internal audit may have), the CEO has wide-ranging powers over strategy and its execution. The incentives of the CEO are therefore a crucial governance question, worthy of consideration apart from general governance issues. They may also serve as a proxy for the effects of pay incentives on executive behaviour more generally.

Using data for US Bank Holding Companies, Acrey *et al* (2011) report an insignificant or negative association between bank risk indicators and compensation of the CEO in the form of performance-related bonuses or unvested options. This is contrary to theory but the empirical study had no obvious defects and so is credible. It may simply be that CEO performance bonuses do not encourage risk-taking in all circumstances.

Bai and Elyasiani (2013) analyse a sample of 132 US Bank Holding Companies over the period 1992-2008 using data from Standard & Poor's Execucomp database on executive remuneration, regulators and the CRSP. As a dependent variable they use the Z-score and the volatility of return on assets. As regressors they use the percentage of CEO compensation in the compensation of the top five executives in the bank and 'vega', a modelled coefficient measuring the effect of a change in bank stock price on CEO wealth.

Using a panel model, they find that vega has a significant positive association with bank risk while CEO pay share has a significant negative association with bank risk. This is as theory predicts: CEOs are incentivised to take risk when their remuneration is linked to bank performance and are incentivised to be cautious when they have a high base salary. Given that the results accord with theory and the range of controls involved, including use of a panel model to control for unobserved heterogeneity at the bank level, these findings are persuasive. The contradiction between these results and those of Acrey *et al* (2011), who also focused on US bank holding companies, suggests that the Acrey *et al* results could be biased by unobserved heterogeneity because they did not also use a panel model approach.

The corporate finance literature supports the hypothesis that CEO variable remuneration is positively related to risk-taking. In a sample of acquiring US banks, Hagendorff and Vallascas (2011) show that CEOs with remuneration that is more sensitive to the bank's share price are more likely to engage in risk-inducing mergers.

As well as its level, the nature of performance-related remuneration may be important. If CEOs receive such remuneration in cash rather than shares, their incentives are entirely short-term and they may be incentivised to take even higher risk than if remuneration is in shares. Fahlenbrach and Stulz (2011) report no evidence that banks whose CEOs received a larger fraction of their remuneration in cash bonuses performed worse during the financial crisis of 2007-2009. This result is contrary to theory, which predicts that higher variable remuneration leads to greater risk-taking and thus worse performance in a crisis.

Beyond CEO remuneration, only two studies focus on the effects of remuneration at the bank executive level more generally. The first such study is Uhde (2015), who examines 63 banks in 16 EU countries (generally the largest banks in each territory) over the period from 2000 to 2010 and concludes that excess variable remuneration, whether it takes the form of cash or shares, increases risk-taking. Excess variable remuneration is defined as the residual of a regression of executive variable pay on bank size, country and time dummies.

The second such study is Efing *et al* (2015), who take a different approach and use payroll data for 67 EU banks to consider the effects of variable remuneration (defined as bonuses in this case) in the treasury and capital markets divisions, using variable remuneration in other divisions as an instrument to capture the effect of general remuneration policy, as opposed to division-specific policy. They find a significant positive association of variable remuneration in the treasury and capital markets divisions with the level and volatility of earnings from these divisions, with the effect on volatility appearing to overwhelm the effect on level of earnings.

In conclusion, empirical results relating to the role of remuneration appear consistent with theory. Higher variable and performance-based remuneration is leads to increased risk-taking. There are dissenting results (Acrey *et al,* 2011 and Fahlenbrach and Stulz, 2011), but Bai and Elyasiani (2013) and Hagendorff and Vallascas (2011) each show robustly that the performance-sensitivity of CEO pay has a positive effect on risk, while Uhde (2015) and Efing *et al* (2015) each show that excess variable pay of executives and traders leads to increased risk-taking.

2.8 The Roles of Complexity, Diversification and Size

Complexity, diversification and size are fundamental topics in industrial and financial economics and are likely to be important for risk and return in banks. Complexity relates to diseconomies of scale. In basic microeconomic theory (e.g. Varian, 2009), economies of scale arise as fixed overhead costs are spread over more units of production, leading to a lower unit cost.

However, at a certain scale and associated level of complexity, difficulties arise in coordinating different elements of the firm, such that more effort and money is spent on coordinating different teams within the organisation. This means that unit costs (and other financial outcomes) begin to deteriorate as size moves beyond a certain level. Competitive forces may then mean that firms in a sector tend to have sizes between the minimum and maximum efficient scale for that sector.

In banking and finance, complexity may increase risk by making organisations more opaque or magnifying the number of channels through which contagion of systemic risk can occur. For instance, Gai *et al* (2011) construct a theoretical network model of a banking system and use it to show how contagion of funding risk can propagate through this network. They demonstrate that greater complexity and concentration can magnify the fragility of the network. This supports the view that Systemically Important Financial Institutions (SIFIs) pose a threat to the stability of the financial system and economy and regulators have explicitly made complexity one of the criteria for identifying a SIFI (Bank for International Settlements, 2013).

Meanwhile basic finance theory (e.g. Jones, 2008) suggests that diversification generally causes imperfectly correlated risks to offset one another, such that lower risk can be achieved at a given level of return. This should be true of any investment portfolio, including the portfolios of assets held by banks. This model relies on assumptions a) that sufficient information is available on risk and return for shareholders and managers to take steps to ensure that they are commensurate, and b) that correlations of return with total risk are evident even when we recognise that total risk contains both idiosyncratic and systematic components.

Firm size is also important in basic microeconomics, with larger firms more likely to achieve monopoly status or other forms of market power (such as the ability to dictate prices for asset classes in which they are a dominant trader). In the economics of banking (e.g. Mishkin, 2012) size is likely to be associated with greater systemic importance of a bank since it is more likely to be a key component of the national and global financial system. This makes it more likely that larger banks will be bailed-out by governments in the event they experience distress. They may therefore experience moral hazard effects (greater risk-taking because they expect to be protected from adverse consequences) and implied subsidies (cheaper financing costs because investors do not expect the bank to be allowed to fail). One could also hypothesise that, because of these advantages, larger banks are able to attract more skilled and more ambitious staff, although there is no formal theory detailing this.

No empirical studies have investigated the role of complexity in banking. Markman and Venzin (2014) compute an index of risk that combines financial performance and volatility and show that this correlates with indices of portfolio and product complexity. However, this analysis relies exclusively on bivariate correlations (for the purpose of showing that their indicator correlates with other indicators of interest to risk managers) and thus cannot be said to support any causal hypothesis.

The empirical literature on bank diversification is richer, but contains some mutually contradictory results. Wall (1987) using US data finds no evidence that the presence of a non-bank subsidiary has an effect on bank risk. By contrast, Brewer (1989) also using US data reaches a contradictory conclusion – that the presence of non-bank subsidiaries reduces risk. The principal difference between the studies is a different dependent variable – accounting volatility in the former and stock price volatility in the latter, indicating that diversification may impress investors but does not necessarily affect underlying performance. In accordance with this view, Baele (2007) finds evidence that diversification of bank income streams leads to higher stock-market valuations and lower firm-specific volatility of the stock price.

Shiers (2002) employs data on US banks with branches in different states of the USA, together with data on the differing economic characteristics of states, to show that geographical and sectoral diversification both mitigate risk. Similarly, Using a Credit Value at Risk (C-VaR) model with simplifying assumptions for 49 of the largest banks globally over the period 1992-2009, Fang and van Lelyveld (2014) report that geographical diversification lowers credit risk.

Mergaerts and Vennet (2016) use data on 550 EU banks to show that different business models (as identified by factor analysis) are associated with different risk and return profiles, revealing that business model diversification is associated with enhanced performance. Meslier *et al* (2014) report a similar finding that diversification to include interest and non-interest income increases bank performance in emerging markets. By contrast, Mercieca *et al* (2007) find no evidence that diversification of income streams in smaller European banks has an effect on performance.

Inspired by debate over the "Too Big To Fail" (TBTF) status of the largest national and global banks and the experience of the Global Financial Crisis of 2007-2009, a number of recent studies have focused on the effects of bank size. Bhagat *et al* (2015) report a positive effect of bank size (total assets) on risk-taking. Similarly, in a study at the country level, Laeven *et al* (2015) report a positive effect of bank size on systemic risk.

Hughes and Mester (2013) attempt to isolate the effect of bank size on performance by estimating bank production functions. They do so using a full accounting for the cost structure of banks and controlling for factors, such as funding costs, that could be subject to implied subsidy effects. They report positive effects of scale on performance. Beccalli *et al* (2015) use a similar approach for European banks and reach the same conclusion, with the extra finding that economies of scale are reduced for large banks in small economies, and can even become diseconomies at a certain point. A third paper that uses a similar approach and again reaches the same conclusion that bank size positively affects performance, this time using US data, is Hughes *et al* (2001).

In conclusion, there are no empirical results on the effects of bank complexity. Empirical results relating to bank diversification are fairly clear-cut and in line with theory: diversification lowers risk and increases return. The dissenting results are Wall (1987) and Mercieca *et al* (2007). By contrast, Brewer (1989), Shiers (2002) and Fang and van Lelyveld (2014) all show that bank diversification reduces risk. Mergaerts and Vennet (2016) and Meslier *et al* (2014) show that diversification increases performance. Baele (2007) shows that diversification leads to higher performance and lower risk. Results relating to bank size are even more clear-cut and are in accordance with theory: larger bank size leads to increased risk and increased performance.

2.9 Gaps in the Literature

Taking the existing empirical literature as a starting point, it becomes clear that several avenues for future research remain open in this field, and I address several of them in my research. One of the more obvious deficiencies of the relevant literature is the fact that key results are dependent on a few papers and other results are plagued by contradictory findings. For instance, our understanding of the effects of each of the following is either dependent on one or a few papers or is affected by the presence of a significant number of contradictory findings: mutual ownership, foreign ownership, managerial ownership, ownership concentrations, independent Directors, Board size, a CRO on the Board and a joint CEO-Chairman. Only for state majority ownership, executive remuneration, diversification and size can I report a substantial body of essentially uncontested literature.

A further issue is that, despite the range of theoretical and empirical literature that exists on the effects of bank ownership and governance, simultaneity between risk and return has not been taken into account in this field. Basic finance theory (e.g. Jones 2008) treats risk and return as simultaneous but empirical studies focused on bank ownership and governance have not included this. This could prove important if omitting simultaneity leads to bias in estimating other effects.

Another area that remains open for investigation is the role of information-processing capability in banks. Considerations relating to the completeness and accuracy of information, and its asymmetry between agents, are fundamental in economics (Bircher and Butler, 2007). Bebczuk (2003) argues that limitations relating to information are important in finance. This implies that imperfect or inaccurate information relating to risk and / or return may lead to mispricing of risk such that assets with the same level of risk have different returns.

An important indicator in this regard is the presence of regulatory permission to use the Internal Ratings Based (IRB) approach under Basel 2/3 regulation. The IRB approach involves estimating regulatory capital requirements using statistical models estimated on the bank's own portfolio data to quantify credit risk. In order to obtain permission from the national regulator to use IRB, stringent tests relating to information systems, modelling and governance must be met, making IRB a good proxy for information processing capability – provided that one controls for size, which tends to be correlated with IRB permission. A second feasible indicator of information processing capability in banks is the previous financial services experience of Directors, which is likely to impact the quality of their decisions. However, no empirical studies have sought to address the questions of whether having IRB permission or having more-experienced Directors, as indicators of information processing capability, are associated with reduced risk or increased performance.

Remuneration is a further area of banking where, although have been numerous studies, important questions remain unanswered. The majority of studies on the effects of bank remuneration structures focus on the CEO level, and two others consider executive remuneration more generally and remuneration in the capital markets divisions of banks. These are discussed in section 2.7. However, there are no studies which consider the effects of remuneration structures at all levels in a bank. This is an important omission since the aggregation of actions at all levels in a bank could be as important as decisions at the most senior levels.

Bank complexity is important in the theoretical literature as a potential driver of diseconomies of scale and as a source of risk due to increased interconnection with other financial services firms. However, no empirical studies have examined the role of complexity in banks in determining risk and return.

Studies in the literature also have limitations in terms of the selection of variables employed in models. Some studies include a very limited set of control variables, such that they are especially vulnerable to omitted variables bias. The literature also omits dependent variables relating to outcomes of central interest when considering risk and return, such as bank failure, bank growth and loan interest income.

Finally, while studies have employed pooled data for many countries or have considered one specific country (such as the US, Germany, Japan or China), there are no studies examining the effects of ownership and governance on bank risk and return specifically in a UK context. Given the significance of the UK as a banking centre, and the need for UK-based bank managers and regulators to understand the particularities of the UK system, this is a significant practical gap. It also represents a missed opportunity to consider a setting in which mutual ownership corresponds to a single clear type of legal entity (the depositor-owned building society) that is similar to a bank in essentially all respects other than ownership, such that causal effects of ownership type can be clearly identified.

Chapters where empirical results are presented (Chapters 4 to 8 below) explain the gaps in the literature more fully and use them to develop hypotheses to test, in an attempt to increase our understanding of how bank ownership and governance affect risk and return.

2.10 Conclusions

In summary, the empirical literature tells us that state majority ownership increases risk and return, while mutual ownership reduces risk and return. Foreign ownership and managerial ownership each have effects that are very much context-dependent. Concentration of owners' personal wealth in banks' equity reduces risk, while the presence of shareholders that own large blocks of the bank increases risk.

The presence of more independent directors and a larger Board both lead to less risk, as does the presence of a joint CEO-Chairman. The presence of a CRO on the Board appears in a limited number of empirical studies to cause increased performance and reduced risk, but this is doubtful because the relevant studies relied on narrow contexts and it is unclear why independent monitoring by a CRO would have entirely different effects from independent monitoring by the Chairman.

Higher variable and performance-based pay at senior levels lead to higher risk. Finally, bank diversification increases returns and reduces risk, while bank size increases risk and returns.

However, the literature contains significant gaps. Many key findings are based on one or a few empirical papers, simultaneity between risk and return is not accounted for even though theory suggests it should be important and the effects of banks' comparative ability to process information relating to risk and return has not been considered. Similarly, studies relating to the causes and consequences of bank pay have not considered levels below senior executives, bank complexity has been overlooked, dependent variables of key interest to regulators and bank managers have been omitted and no studies have focused on a UK context.

In my empirical Chapters (Chapters 4 to 8) I use the literature develop specific hypotheses and I test these using an econometric methodology (described in Chapter 3) that has a high degree of commonality across all empirical Chapters. My research expands our understanding of the role of bank ownership and governance beyond that which would be possible based only on the literature described thus far.

Chapter 3: Methods and Data

3.1 Introduction

My research strategy in this thesis is to test hypotheses relating to the effects of bank ownership and governance on risk and performance by building and evaluating econometric models with measures of bank performance and risk as dependent variables and indicators of governance and ownership as explanatory variables. In this Chapter I describe the models and data I use to test my hypotheses and the data processing I have carried out. I also provide details of assumptions and conventions used in obtaining and processing data, and I include descriptive statistics to show that potential dependent and explanatory variables have appropriate characteristics for modelling.

3.2 Summary of Hypotheses

In each of my Chapters where empirical results are presented – Chapters 4 to 8 – I develop specific hypotheses that are subsequently tested *via* an econometric methodology that has a high degree of commonality across all of these Chapters. It is appropriate that hypotheses are developed in full in the empirical Chapters, in the context of relevant literature and leading directly to their testing, but it is nevertheless useful that I provide a summary here. In econometrics, hypotheses must be understood before models and data can be selected and explained.

In Chapter 4, I start from the argument of general finance theory (e.g. Jones 2008) that return is higher when risk is higher, because investors demand sufficient return to compensate for risk. I then develop, and subsequently test, the hypothesis that this correlation should hold for measures of risk and return derived from the profit and loss statements of banks, assuming that bank shareholders have sufficient information to demand that banks earn adequate return for the risk arising from investments made by the bank.

In Chapter 5, I use earlier results in the literature such as Iannotta *et al* (2007) to develop hypotheses that state majority ownership and mutual ownership (meaning ownership by depositors in my sample) each have effects on indicators of risk and return – specifically that state ownership lowers return and increases risk while mutuality lowers them both. I also take earlier empirical results such as Chen and Liao (2011) and theory relating to diversification (Markowitz, 1952) and information asymmetries (Bebczuk, 2003) to develop the hypothesis that a foreign parent has effects on risk and return, with the sign of these effects being a purely empirical matter, depending on whether diversification or information asymmetries are dominant. I then test these hypotheses in a novel framework in which risk and return are simultaneous, and aim to resolve conflicts in the literature relating to the effects of a foreign parent.

In Chapter 6, I start from the arguments of Bebczuk (2003) that information asymmetries are fundamental in finance, along with studies by Yang and Zhao (2014) and Rus *et al* (2011) which suggest that separating the roles of CEO and Chairman can be damaging, and studies such as Renneboog and Zhao (2011) which suggests that governance structures intended to control remuneration can be subverted to increase it. I then develop (and subsequently test) hypotheses that bank risk and return are affected by factors that entail different abilities to process information (such as the number of persons on the Board, previous financial services experience of Directors and permission to use certain kinds of credit modelling framework) and by other aspects of governance (including the proportion of non-executives on the Board, the presence of a Joint CEO-Chairman, the presence of a Chief Risk Officer on the Board and the presence of a Remuneration Committee).

In Chapter 7 I develop and test hypotheses that average pay in banks is affected by banks' returns, loan impairments, certain governance structures and whether the bank is a mutual or an investment bank. This is based on theoretical and discursive papers in banking and other sectors identifying each of these as potentially important for pay (see section 7.2 for details). Later in Chapter 7, I use the theory of efficiency wages as described by Akerlof and Yellen (1987) and agency theory to develop hypotheses that bank pay measured in certain ways has effects on bank risk, return and growth, before testing these hypotheses empirically.

Finally, in Chapter 8, I develop hypotheses that bank risk and return are affected by relative and absolute size of the bank, complexity and diversification. This is done because these are important issues often discussed alongside questions of governance and ownership (as shown in the literature discussed in section 8.2) and because the relative importance of governance and ownership can only be assessed in comparison to other factors.

The remainder of Chapter 3 discusses the models and data to test these hypotheses.

3.3 Approach to Hypothesis Testing

The main purpose of Chapter 3 is to discuss models and data, all together in one place, to avoid repeating the same information many times in the empirical Chapters. This need arises from several basic features of my research. First, I am considering a limited set of dependent variables reflecting aspects of risk and return that are of interest to banks, their regulators and society. Second, for each of my hypotheses I am generally interested in impacts on more than one of these dependent variables. Third, since my hypotheses are stated as effects on risk and return (not on specific indicators) and since there is reason to believe that anything which affects risk also has an effect on return (see section 4.2 for discussion), then models for each dependent variable must contain broadly the same explanatory variables.

This means that, for each of the six dependent variables I use, there is one basic model equation that contains a full set of explanatory variables relating to ownership and governance, plus a set of controls relating to balance-sheet characteristics and external conditions that could affect risk and return. Some of these equations are estimated simultaneously, whereas others are used as single-equation models. Variation occurs in terms of adding regressors to test ancillary hypotheses, and testing robustness by dropping sets of regressors or changing estimation procedure, but the basic approach remains the same.

The result is that identical, or very similar, equations are used in different chapters. The empirical Chapters differ from one another in that they each discuss an entirely different set of explanatory variables, including ownership (Chapter 5), governance and information-processing capability (Chapter 6), pay (Chapter 7) and size (Chapter 8). So, even where the same equations (or very similar equations) are used in more than one Chapter, the analysis focuses on evaluating an entirely different set of right-hand-side variables in that equation.

In my empirical Chapters, robustness testing is conducted by estimating models more than once (with some regressors dropped in some estimations) to ensure that results are not dependent on one model specification. Estimation procedures are also varied to ensure that results are not dependent on one estimator. In addition, when a Chapter uses an equation that is a variation on an equation used in an earlier Chapter, I check that it re-produces the results reported in that earlier Chapter; this serves as an additional means of robustness testing and is thus better than always using the exact same model specification in every Chapter.

In any case, to avoid extensive repetition of methodology across the empirical Chapters, the common empirical approach that they all use is discussed here, once.

3.4 Dependent and Explanatory Variables

As dependent variables to test the hypotheses summarised in section 3.2, I use realised measures of bank return and bank risk. Realised measures are used (as opposed to any kind of expected measure, such as implied volatility) in order to ensure that my analysis focuses on relationships between objective, observable quantities.

For returns, I use Return on Assets (ROA) because it is a measure of asset performance that is normalised to a stable measure of bank size, along with Return on Equity (ROE) because results for this outcome can be compared with those for ROA in informative ways, and loan interest income (as a ratio of gross loans) because interest earned on loans is a principal source of income for banks. As measures of risk I use loan impairments (as a ratio of gross loans) because it is a pure measure of adverse asset outcomes and is again normalised to balance sheet size, and an indicator of bank failure because it represents the most adverse risk event that can occur in banking. Similar measures of risk and return are used in the literature, for instance Aebi *et al* (2012) uses return on equity while Forrsbaeck (2011) uses a measure of loan impairments normalised to an indicator of bank size.

My choice of loan impairments as a dependent variable is driven by the fact that, as noted in Section 2.3, my study is motivated by the history of instability in the banking system. To inform refinements to banking policy and regulation, I aim to understand factors which affect outcomes at the bank level, especially bank solvency. That is, I am interested in the operations of banks and the accounting measures they report, especially the solvency position of their accounts, and not in effects of bank risk on the wealth of shareholders or in any external, market-based measure of bank risk.

This contrasts with other studies, which do use market-based measures of risk, such as measures derived from credit spreads or measures of firm-specific risk that are obtained by removing systematic components from share price volatility (Jones, 2008). Such market-based measures reflect the market's combined view of bank risk, but are not directly part of outcomes which affect bank solvency and stability and are thus not the appropriate measures for my study. They can also be distorted when issues other than bank-specific risk affect share price volatility, although multi-factor models that correct for such influences are used to address this issue.

In addition, a major objective of my study is to include as many as possible of those entities which meet the economic definition of a bank (as per Section 2.2) and to make comparisons between different types of such entities. It would be impossible to include mutual banks (40% of my sample), or small unlisted banks, or to ascertain the effects of mutuality, if market-based measures of risk were used. This is because these entities do not have listed equities and generally do not have debt instruments in issue from which credit spreads could be derived.

For these reasons, it was necessary to use a measure of risk derived from financial accounts. One possible option was the volatility of ROA or ROE. However, with annual-frequency panel data available over ten years and quarterly data having high missing-value rates, it would not have been feasible to derive a statistically-robust volatility measure in this way.

Loan impairments as a ratio of gross loans, however, represents a suitable measure. It is directly part of the financial accounts of a bank, and directly affects the bank's stability by eroding equity and thus solvency. It is a clear adverse outcome, making it a good measure of realised risk. It is normalised to gross loans, such that it is not distorted by differences in the size of banks or in the proportion of bank balance sheets made up by loans. Finally, it is available and well-populated in my data.

Measures of loan impairments and non-performing loan balances are used by regulators, academics and advisors to track levels of stress, at the national and bank-specific levels. For instance, the International Monetary Fund reports this data and used it to track the status of the global banking system in the aftermath of the 2007-2009 banking crisis and the Eurozone debt crisis that began in 2009 (IMF Financial Stability Reports and associated data releases, April 2011, April 2013 and November 2016).

It is notable that the IMF data has temporal and spatial patterns consistent with economic experience, indicating that it is a reliable measure of realised risk. In the US and UK, for instance, impaired loans were low prior to 2007, rose sharply during the crisis years and declined again from 2010. In Italy and Spain, by contrast, impaired loans continued to rise for several years after 2010. Ghosh (2015) also demonstrates variation through time in non-performing loans in the US that corresponds with economic experience. Similarly, private sector advisors report data from the ECB, EBA and bank accounting information showing a cross-country comparison in 2013 that is also in line with economic experience, with Greece, Ireland and Italy having the highest rates of impaired loans and Sweden, Norway and Switzerland having the lowest (Oliver Wyman, 2014).

It could be argued that loan impairments may be flawed as a measure of risk, such as if accounting and audit practice are so poor that impairments are not recognised at all. However, it is not plausible that the measure could be flawed to this extent, and the temporal and spatial patterns found in the studies outlined above indicate that the loan impairments ratio functions well as an indicator of realised risk. Because this indicator corresponds to economic experience at the macro-financial level, the bank-level data from which macro-financial aggregates are derived must also contain important information on risk. For this reason, previous important studies comparing the risk levels of different banks have used loan impairments or loan losses as dependent variables (e.g. Iannotta *et al*, 2007 and Forrsbaeck, 2011). It is possible that the full extent of loan impairments takes time to emerge, but this is addressed by the fact that my study employs lagged regressors.

As noted, other measures of risk used in the finance literature consist of various forms of firm-specific risk. For the reasons stated above, such measures are not suitable for achieving the objectives of the present study. However, there are empirical results indicating a positive correlation between banks' non-performing loans and the volatility of their share price (e.g. Banca D'Italia Financial Stability Report No. 1, April 2016 and Oludare *et al*, 2015). This is consistent with the experience of the global financial crisis of 2007-2009 in which concerns over the quality of bank mortgage loans (and related assets) and increasing loan impairments led to increases in market measures of bank risk (Kindleberger and Aliber, 2011). So, if it had been possible and appropriate to use market-based measures of risk in this study, one would not expect regression results to differ much from those I obtain.

Of my dependent variables, ROA and loan impairments can be considered the main measures of risk and return. This is because ROA is a pure measure of performance, normalised to bank size, while loan impairments is a pure measure of adverse asset outcomes, normalised to the total set of assets on which they can arise (loans). I assume that ROE is the outcome of greatest interest to shareholders because it represents the efficiency of their equity stake in generating returns (Atrill and McLaney, 2006).

My dependent variables are measures of realised, as opposed to expected, risk and return. Because finance theory deals with expected risk and return, using my selected measures to test the specific hypotheses I have outlined entails assuming that ownership and governance structures have the same effects on realised risk and return as they do on expected risk and return. This is a reasonable assumption: there is no reason why explanatory variables that are predicted to increase expected returns would not, on average, have the same effect on realised returns. Since realised returns are drawn from the distribution of potential returns, we will observe high returns more frequently in cases where expected returns are high. The same argument applies to risk. In any case, in empirical work, we must rely on quantification of realised outcomes, not unobservable potentials. Precise definitions of the relevant dependent variables are provided in section 3.8.

Not all dependent variables are used for all hypotheses. The default options are return on assets and loan impairments, because these are my principal measures of risk and return. Combined failure is also used for all hypotheses relating to ownership and governance because it can be seen as a holistic consequence of other impacts on banks and because of the importance of bank failure in adversely impacting the economy and society (Bernanke, 1983).

Alongside measures of risk and performance, I also frequently make use of growth in total assets as a dependent variable to check if effects on banks' risk and performance are accompanied by effects on their rate of provision of investment to the wider economy. (The finding is usually that there are no such effects and the results are therefore often not shown due to space constraints, although they can be provided on request).

Certain indicators of risk and return are important as dependent variables for certain hypotheses. I use loan interest income in testing hypotheses relating to the effects of state majority ownership, because there is literature suggesting that state-owned banks grant soft loans (Gonzalez-Garcia and Grigoli, 2013). Similarly, where hypotheses relate to the effects of proficiency in using information at Director level, I use return on equity as a dependent variable. This is because, as argued above, it is the outcome of greatest interest to shareholders, and thus it is the outcome I assume Directors will try hardest to maximise when they have the ability to do so. (Given that Directors are representatives of shareholders in large part).

The introductions of Chapters 4 to 8, and specific empirical sections within these Chapters, explain the dependent variables used, and the basis for the choice.

Turning to the other side of the regression equations, to control for external conditions that vary over time but which are identical for all banks, such as macroeconomic and regulatory conditions, I use dummy variables representing each year from 2004 to 2012. The year 2003 is taken as the base year. Part of the rationale for this is that there is a business cycle that varies through time (Romer, 2006) and which can affect outcomes for banks (Allen and Gale, 1998). The other part of the rationale is that regulatory conditions vary through time and this can also have impacts for banks (Noss and Toffano, 2016). I also estimated models using a selection of macroeconomic variables in place of year dummies, but the results were not materially different from using year dummies, so this approach was not followed and the results are not reported.

To control for characteristics of banks that vary between entities and potentially also through time, and which may affect outcomes of interest, I include a range of bank-specific controls encompassing business model, balance sheet structure and overall bank size. The rationale for this is simply that risk and return can vary across business models (such as if different kinds of portfolios and services entail different risk and return). Specifically I consider exposures of banks to one another on the basis that this can transmit risk (Tian *et al,* 2013), the extent of securities holdings as it has been argued that this may affect bank risk and return (Allen and Jagtiani, 2000), the extent of fee-earning advisory activity as this can affect the risk-return trade-off through diversification effects (Pennathur *et al,* 2012), the extent to which deposits make up the liabilities of the bank as insufficient deposit financing can affect risk and return (King, 2013), the extent of equity financing as leverage is one of the most basic drivers of risk and return (Atrill and McLaney, 2006 and Valencia, 2014) and bank size as this has been identified as a driver of risk-taking behaviour (Bhagat *et al,* 2015).

The choice of equity ratio (statistically equivalent to leverage ratio) as a control variable, rather than some ratio of regulatory capital (total regulatory capital, tier 1 capital or core tier 1 capital ratio) requires explanation. The equity ratio is a well-defined concept, based on established accounting standards (Atrill and McLaney, 2006 and International Accounting Standards Board, 2015). Regulatory capital ratios, by contrast, have a denominator (Risk-Weighted Assets, RWAs) that is quantified based on bank-internal models (Bank for International Settlements, 2006 and 2009). There is extensive evidence of inconsistency in the quantification of RWAs across banks, with the same assets attracting very different RWA treatments in different banks (e.g. Ferri and Pesic, 2016). In addition, regulators report that simple leverage (equity ratio) is a better predictor of bank resilience than regulatory capital ratios (Haldane, 2013). Therefore, equity ratio is preferred over leverage ratio because it has a more-consistent meaning across banks and is more strongly linked to relevant bank-level outcomes.

These considerations led me to include the following control variables (with definitions as in section 3.8):

- Exposure to Banks;
- Securities Holdings;
- Advisory Activity;
- Current Deposits Over Liabilities;
- Equity Ratio;
- Size over GDP.

To control for effects that outcome variables may have on one another, I also include several of the continuous dependent variables I use (ROA, ROE, loan interest income and loan impairments ratio) as explanatory variables for one another. Except where there is specific evidence of simultaneity, this is done at a lag, as for other regressors. One rationale for including these as controls is that basic accounting (e.g. Atrill and McLaney, 2006) shows that one outcome may affect another, for instance if lower returns or higher impairments affect the occurrence of bank failure. As another rationale, I argue the outcomes a bank has experienced in respect of one metric of interest may affect how it pursues other outcomes of interest in the succeeding periods. For instance, if the loan book has experienced impairments, a bank may initiate other activities (such as cost cutting, redundancies or new business) designed to bolster ROE. Responses designed to cut costs by reducing headcount are common during crisis periods (Haltenhof, 2014).

To test the hypotheses in Section 3.2, I use several kinds of explanatory variables: measures of ownership type, measures of governance structure, measures of information-processing ability and measures of remuneration.

The measures of ownership type I use encompass the most basic characteristics of ownership, specifically whether it is by profit-seeking private shareholders, the state or a collective of ordinary individuals (depositors in this case) along with a distinction between domestic and foreign ownership. The rationale for including these is to test the hypotheses summarised in section 3.2 (and developed in more detail in sections 5.2 to 5.3). Specific explanatory variables included are as follows (again with definitions as in section 3.8):

- State Majority Ownership;
- Mutual Ownership;
- Foreign Parent.

Measures of governance used include variables which provide an indication of the balance of power between agents with different incentives and different abilities to use information and coordinate with one another. The rationale here is again to test hypotheses summarised in section 3.2 (and developed in more detail in sections 6.2 to 6.4). Specific explanatory variables included are as follows (again with definitions as in section 3.8):

- Board Size;
- Director Ratio;
- Joint CEO-Chairman;
- CRO Present on Board;
- Commercial Director on Board.

As an indicator of information-processing capacity I use the proportion of Directors with previous financial services experience, which may be related to the ability to process information relating to risk and return. I also use the presence of permission from the national financial services regulator to use Internal Ratings Based (IRB) models for the quantification of credit risk, as defined in the 2004 Basel II international accord on bank capital adequacy. The regulator makes such permission contingent on meeting certain standards in respect of credit portfolio data, risk modelling and use of model outputs in credit decisions. As such, it provides a proxy for sophistication in processing information. Finally I include the proportion of Directors who are female, on the grounds that a low proportion of female Directors may reflect discrimination and unused skills and thus impaired information processing. Again, the rationale is to test the hypotheses stated in section 3.2 (and developed in more detail in sections 6.2 to 6.4). Specific explanatory variables included are as follows (again with definitions as in section 3.8):

- No-Experience Ratio of Board;
- IRB Permission;

- Female Ratio of Board.

To test hypotheses summarised in section 3.2 (and developed in more detail in sections 6.2 to 6.4) on the effects of governance structures intended to control remuneration I use indicators of the presence of a remuneration committee and of executive remuneration disclosures. To test hypotheses summarised in section 3.2 (and developed in more detail in sections 7.2 to 7.3) on the effects of remuneration I use a measure of average pay at all levels in the bank. Specific explanatory variables included are as follows (again with definitions as in section 3.8):

- Remuneration Committee Present;
- Executive Remuneration Disclosed;
- Average Pay.

Taking the various sets of regressors listed in this section (bullet lists above) and combining them leads to a full set of regressors that is used as a basic model specification for all my dependent variables (ROA, ROE, loan interest income, loan impairments, growth in total assets and combined failure). This is because, as explained in section 3.3, my key dependent variables are all indicators of risk and return. I expect the same aspects of banks to affect different measures of return because these measures of return are all indicators of underlying profit appetite, and I expect the same aspects of banks that affect return to also affect risk, because risk and return are linked.

Thus, the baseline set of regressors for all dependent variables is as follows (Table 3.1). Minor differences of model specifications from this baseline are explained in the relevant sections of empirical Chapters (Chapters 4 to 8).

Table 3.1 Basic set of regressors for modelling each of my dependent variables.

- State Majority Ownership;
- Mutual Ownership;
- Foreign Parent;
- Board Size
- Director Ratio;
- Joint CEO-Chairman;
- CRO Present on Board;
- Commercial Director on Board.
- Cumulative Governance;
- CRO or Chairman;
- Low NED.
- No-Experience Ratio of Board;
- IRB Permission;
- Female Ratio of Board.
- Remuneration Committee Present;
- Executive Remuneration Disclosed;
- Average Pay;
- Size Over GDP;
- Exposure to Banks;
- Securities Holdings;
- Advisory Activity;
- Current Deposits Over Liabilities;
- Equity Ratio;
- Year Dummies.

Note: necessary variations to this set are explained in empirical sections of Chapters 4 to 8.

The regressors stated are included in lagged form only to account for the fact that, because bank assets are long-lived, the financial consequences of commercial decisions made due to particular ownership and governance structures may take time to appear, but are unlikely to take more than one year to show an effect since the financial and operational management of banks operates on a one-year cycle. In addition, lagged explanatory variables are less likely to be subject to reverse or simultaneous causation.

Although my models are linear-in-parameters, they accommodate non-linearities such as interaction terms. This is important to preserve realism. I do not attempt to use a log-linear specification since, although this yields parameter estimates that are percentage elasticities, many of the explanatory variables of greatest interest are dummy variables that cannot be expressed as logs. I do not express financial variables in real (inflation-adjusted) terms since they each consist of ratios of one financial quantity to another such quantity from the same period. They thus take the same value regardless of whether the numerator and denominator have been inflation-adjusted or not.

3.5 Econometric Approach

In any natural or social science, relying on empirical findings entails assumptions that a) the system under investigation operates according to reasonably stable parameters that describe the effect of one variable on another and b) the relevant parameters can be estimated by observing the system. In a general sense, these assumptions are validated by the regularities that are necessary and observed in natural and social systems (Gauch, 2012), thereby solving the problem of induction (Hume, 1748). In any specific empirical setting, in order for econometric models to identify causal effects, explanatory variables must be determined outside the model (exogenous), models must contain enough controls to account for co-varying factors, sufficient variations of models must be shown to confirm that associations are not specific to one approach, and there must be diagnostics to detect various biases that may arise (Greene, 2012).

To test the hypotheses summarised in section 3.2, I use well-controlled econometric models meeting the above criteria. The core of my research strategy is that these models have measures of risk and return as dependent variables and measures of governance, ownership and other factors of interest as explanatory variables, alongside a range of controls. This approach makes it possible to determine if the relationships I hypothesise are present and statistically significant, or not.

The generic situation I consider is where a range of explanatory variables separately affect a dependent variable, with no reason to believe the relationship is non-linear. In this setting, a simple linear model is sufficient to estimate causal effects while controlling for co-variates. Therefore, the most basic econometric models I employ are linear regressions estimated by Ordinary Least Squares (OLS). These involve a dependent variable $\boldsymbol{y_{it}}$ that is given by a random error term $\boldsymbol{\varepsilon_{it}}$ plus the products of a suitable range of explanatory variables $\boldsymbol{X_{it}}$ with their associated parameters $\boldsymbol{\beta}$ (with the matrix of explanatory variables including a vector of 1s to serve as an intercept term). Banks are represented by subscript i and years by subscript t. This gives equations of the form

$$\boldsymbol{y_{it}} = \boldsymbol{X_{it}\beta} + \boldsymbol{\varepsilon_{it}} \qquad (3.1)$$

Whenever I use OLS I also, as a robustness test, use panel models with the same dependent and explanatory variables, estimated by means of the random effects estimator. This is necessary to verify that results obtained by OLS are not simply the consequence of omitted heterogeneity across panel units, while also showing that results obtained by random effects are not the consequence of failure to meet a key moment condition (zero cross moment of regressors with the term for unobserved heterogeneity). Ordinarily, one would verify the latter using the Hausman test, but this is not feasible in a setting where some regressors are dummy variables that do not change over time for certain banks, such that fixed effects models cannot be estimated to compare to random effects models via the Hausman test. So instead I verify that the result is present in both OLS and random effects. In my random effects models, observations are identified for bank i and time point t and contain two error terms: a term $\boldsymbol{u_i}$ to encompass unobserved heterogeneity at the bank level and an idiosyncratic error term $\boldsymbol{\varepsilon_{it}}$. This gives us equations of the form

$$\boldsymbol{y_{it}} = \boldsymbol{X_{it}\beta}+\boldsymbol{u_i}+\boldsymbol{\varepsilon_{it}} \qquad (3.2)$$

Where two dependent variables are treated as simultaneous, it is necessary that I use multi-equation models with joint estimation (using two-stage least squares or the generalised method of moments) of equations of the following form. These have $\boldsymbol{z_{it}}$ representing a new dependent variable, $\boldsymbol{\alpha}$ and $\boldsymbol{\delta}$ and $\boldsymbol{\theta}$

representing new parameters to be estimated, and $\boldsymbol{v}_{it}$ representing idiosyncratic error. This gives us equations of the form

$$\boldsymbol{y}_{it} = \boldsymbol{z}_{it}\boldsymbol{\alpha} + \boldsymbol{X}_{it}\boldsymbol{\beta} + \boldsymbol{\varepsilon}_{it} \qquad (3.3)$$

$$\boldsymbol{z}_{it} = \boldsymbol{y}_{it}\boldsymbol{\delta} + \boldsymbol{X}_{it}\boldsymbol{\theta} + \boldsymbol{v}_{it} \qquad (3.4)$$

Similarly, in cases where there are theoretical reasons to expect causal interactions amongst regressors, I use structural models of the following form (again estimated using two-stage least squares or the generalised method of moments). These have $\boldsymbol{x}_{1it}$ representing an endogenous regressor that is a subset of $\boldsymbol{X}_{it}$ and $\boldsymbol{X}_{2}$ representing another sub-set of regressors that have causal effects on $\boldsymbol{x}_{1it}$. This gives us equations of the form

$$\boldsymbol{y}_{it} = \boldsymbol{X}_{it}\boldsymbol{\beta} + \boldsymbol{\varepsilon}_{it} \qquad (3.5)$$

$$\boldsymbol{x}_{1it} = \boldsymbol{X}_{2it}\boldsymbol{\theta} + \boldsymbol{v}_{it} \qquad (3.6)$$

My multi-equation models are estimated using two approaches. The first is a 2-Stage Least Squares (2SLS) approach in which the first stage involves estimating the portions of the endogenous terms that are explained by all the exogenous terms, while the second stage uses these portions in estimating the model equations as stated (e.g. equations 3.3 and 3.4). The second approach is the Generalised Method of Moments (GMM). This involves taking a moment condition that is assumed as given (zero cross-moment of instruments and residuals), substituting into this statement an expression for the residuals in terms of regressors and parameters, solving for parameters, and then inputting empirical values of explanatory and dependent variables.

I only accept results from multi-equation models when they are significant in both two-stage least squares and GMM. This is because each estimation method has different limitations. 2SLS is often subject to large standard errors in parameter estimates because estimated portions of endogenous regressors used in the second stage tend to be correlated with exogenous terms, while GMM can be biased or have size distortions in significance tests due to weak instruments. Employing both is a prudent means of improving the robustness of results.

Finally, in models where the dependent variable is binary, I use probit models, involving a cumulative normal transformation ϕ to a dependant variable bounded by 0 and 1, because this is necessary to express the form of the dependent variable. Estimation is by numerical optimisation starting from a random seed. Logit models were not used simply because the choice between logit and probit is considered arbitrary. Tobit and truncated models were not used because there is no reason to suspect censoring or truncation in the data – financial variables are simply reported in banks' financial accounts as they are while characteristics of governance and ownership are fully observable facts. Linear probability models were rejected on the basis that they can predict probabilities greater than 1 or less than zero, which is clearly not meaningful.

The approach chosen gives us equations of the form

$$\boldsymbol{y_{it}} = \boldsymbol{\phi}(\boldsymbol{X_{it}\beta})+\boldsymbol{\varepsilon_{it}} \qquad (3.7)$$

In single-equation linear models estimated by OLS and random effects I use R-squared as the measure of fit. R-squared is not used for multi-equation models since each equation can have a small R-squared (little more predictive power than a constant) even if the model overall has high power and contains highly significant parameter estimates. For probit models, pseudo-R-squared is used, with this being based on the ratio of the model likelihood to the likelihood of a null model containing only an intercept.

To measure the joint significance of all regressors I use the F statistic in single-equation models estimated by OLS and in multi-equation models estimated by 2SLS. I use the Wald Chi-squared statistic in single-equation models estimated by random effects and in probit models. For multi-equation models estimated by GMM, I report the GMM criterion (cross-moment of instruments and residuals) as of the final iteration of numerical estimation.

Econometric studies must deal with a range of empirical issues that arise in models. Arguably, the most fundamental of these are parameter identification (meaning the set of explanatory variables and associated parameters to include) and parameter stability. If we cannot identify a set of parameters that uniquely explain an observed data distribution, or if parameters are not reasonably stable over time, then causal inference is not possible. In my work, identification of explanatory variables to include is provided by earlier studies that identify features of governance and ownership which might affect risk and return. Parameter stability can be assumed because the basic institutions and corporate law of the United Kingdom did not change appreciably over the period of my study.

A further key consideration which any empirical study must address is ensuring that results are not affected by endogeneity. We seek explanatory variables that are exogenous, that is with values determined outside the model, such that any correlations we detect in a controlled model can be interpreted as causal. Endogeneity occurs when a regressor behaves as if it was determined within the model. This may occur a) when there is reverse or simultaneous causality between this regressor and the dependent variable, or b) when there is an omitted variable that affects the dependent variable and which is correlated with the regressor of interest such that the parameter estimate measures the combined effect of two variables, or c) when a regressor is measured with error such that we cannot distinguish this error from the residual term, or d) when error terms are autocorrelated, such that higher or lower errors may occur in the same period as a regressor is high or low and may thus be estimated as part of the effect of that regressor.

Each of these forms of endogeneity manifests as a correlation between the regressor affected and the residuals, reflecting the fact that something associated with that regressor has been left out of the model. Endogeneity results in biased parameter estimates, such that we can confuse a significant with an insignificant parameter or even estimate the wrong sign for a parameter. It must therefore be avoided.

My specification strategy is expected to be robust against endogeneity problems arising from reverse or simultaneous causation. As noted in Section 3.10, explanatory variables relating to governance, ownership and business model are remarkably stable over time for individual banks. This is because such features represent relatively fixed, constitutional choices made by banks, which do not generally change in response to variations in commercial outcomes, at least not over the time scales considered in this study. These features can therefore be taken as variables that are given exogenously and not affected by the changing financial outcomes which I use as dependent variables. We can thus assume (subject to empirical testing) that significant associations detected are causal in nature. In addition, use of lagged regressors strengthens the argument that we have exogeneity since it makes it unlikely that we have reverse or simultaneous causality.

Endogeneity due to error in the measurement of key regressors is very unlikely since explanatory variables relating to ownership and governance structures are precise categorical or count-variable terms that are measured with certainty. Finally, endogeneity due to omitted variables is unlikely due to the systematic and comprehensive nature of my specification strategy, although it can never be ruled out entirely in a non-experimental study.

All models were accompanied by diagnostic tests for violation of assumptions relating to the presence of independently identically distributed residuals, which must be satisfied in order to obtain unbiased, statistically significant parameter estimates. Specifically, I test for endogeneity (using auxiliary regressions with residuals as dependent variable), heteroskedasticity (using the Breusch-Pagan test or Hall-Pagan test), multicolinearity (using Variance Inflation Factors) and non-normality (using a Skewness-Kurtosis test).

Tests reveal the presence of heteroskedasticity in all my models, significant at the 1% level. The most important consequences of heteroskedasticity are to affect estimation of the standard errors of parameters around their central point estimates. Standard errors are estimated separately from the model itself, using functions that involve the estimated variance of the residuals over the sum of squared deviations of regressors from their means – such that we estimate smaller standard errors when we have more variation in regressors (that is, more information). They are used in hypothesis testing to estimate the probability that the parameter is significantly different from zero.

Heteroskedasticity involves residual variance that is not constant over the range of values of explanatory variables and, if this is correlated with deviations of regressors from their means, we may not recognise that our biggest regressor deviations are correlated with the largest errors and we will thus over-estimate how much information we have. This causes us to under-estimate parameter standard errors, and potentially to over-estimate parameter significance. Serial correlation causes a similar problem if it means that residuals are larger or smaller in periods where certain regressors tend to deviate above or below their mean.

To address these issues, I use standard errors that are clustered at the bank level. This involves computing sums through time for banks of residuals and of deviations of regressors from their mean (thereby obviating any effect of serial correlation). Residuals are then adjusted by the deviation of regressors from the mean for that observation (thereby obviating any effect of heteroskedasticity), residual variance is calculated, and standard errors are obtained as outlined above. This procedure removes the effect of heteroskedasticity and serial correlation on evaluation of parameter significance. Where diagnostic statistics for heteroskedasticity are reported, they are reported for results prior to the introduction of clustered standard errors (otherwise the test would be unable to detect the problem).

Skewness-Kurtosis tests reveal the presence of non-normality in the residuals of most models, significant on at least the 10% level and in most cases at the 5% or 1% level. However, since I have over 350 observations in each model – which is not approaching the asymptotic case but is much greater than the minimum number required to estimate standard errors – I conclude that any model parameters which are significant are likely to be reliable, especially if they are significant at the 5% or 1% level and are resilient in robustness testing.

My models generally have VIFs of 1-8 for the regressors of interest. This indicates that multicollinearity, which involves correlation of regressors with one another and therefore reduces the sharpness of the parameter estimates that can be obtained, has multiplied standard errors by factors of 1-2.8. This makes it more challenging to obtain statistically significant results. However, I do not remove regressors as the VIFs are not excessively high (they often exceed 100 for severe multicollinearity), there is no one obvious regressor to remove and I do not wish to unbalance my control strategy. In any case, it has clearly been possible to obtain significant results, despite the presence of multicollinearity, and I verify (using models with subsets of regressors) that multicollinearity does not cause sign reversal (as it sometimes can).

A further potential problem is that results may somehow be specific to a single model specification. This can occur if we omit a regressor that could also explain a result, or if we include a regressor that sharply changes the observation number, such that a significant result appears in a sub-sample. To address this danger, I carry out robustness testing by varying the set of regressors included and varying estimation techniques. These techniques serve to show that results are not dependent on one specification or estimator. Results are accepted only when they are found to be robust in such testing.

A final statistical issue that must be considered is the potential for data mining bias. Any study that examines dozens or hundreds of pair-wise correlations will always show a number of significant associations, just by chance, even if correlations are considered as part of multivariate models. For instance, if we examine 100 pair-wise associations then we would expect 5 to appear significant at the 5% level, just by chance. Focusing on these 5 and accepting them as significant is an example of data mining bias.

There are two reasons to believe that my work is robust against data mining bias. First, I find many more significant associations than chance alone can explain. Across all models examined in my econometric strategy (including all model versions used in robustness testing and models not shown, but excluding year dummies), a total of 3174 pair-wise correlations were examined. By chance alone, we would expect 159 of these to appear significant at the 5% level and 32 to appear significant at the 1% level. In reality, I found 958 associations that were significant at the 5% or 1% level – indicating that my model specification strategy has explanatory power far beyond what chance alone can explain.

Second, I only deem causal effects to be robust where the parameter remains significant across variations of specification and estimator used in robustness testing. Since one would expect such variation to quickly eliminate results that were due to chance alone, the possibility that my results are due to data mining bias can be excluded.

All models were estimated and evaluated using the commercially-available statistical software STATA, versions 12 and 14. STATA identifiers used in regression output are as defined in section 3.8.

3.6 Data Sources and Processing

Data was extracted from the commercially-available database Bankscope. This source contains data on several hundred financial variables, using a standardised format, for approximately 30,000 banks in all major world regions for all years since 1998 and encompasses both annual and quarterly data.

The data I extracted is at annual frequency[2] for all years from 2003 to 2012 for UK banks. This covers a balanced selection of a benign economic period (2003-2007) and a stressed period (2007-2012), thereby ensuring that parameter estimates are not specific to the quality of economic conditions. It excludes 2013 as this year contained only unaudited estimates at the time of data extraction and would change the clear balance of the sample between benign and stressed periods. In terms of specific variables, I extracted those variables required to test my hypotheses, as per sections 3.4 and 3.8.

Employing accounting data in an analysis of the economic and financial consequences of bank ownership and governance arrangements entails an assumption that accounting variables accurately reflect the economic reality they are intended to measure. This is, of course, only imperfectly true. However, given the long-standing, robust framework for auditing of financial accounts in the UK, imperfections are likely to be limited in scope. In addition, there is little reason to expect imperfections in the application of accounting standards to be systematically associated with any of the explanatory variables I analyse.

Without filtration by business model (removing from the data set entities that are not true banks, such as investment managers and brokerages) or parent / subsidiary status, I obtain data on 711 legal entities for the United Kingdom. Filtration to remove entities that are not retail, private, commercial, corporate, investment or universal banks or building societies, and to ensure that only one entity per corporate group is present in the data reduces this to

[2] I also extracted quarterly data, but did not progress with processing or using this data since it has many more missing values than the annual data.

115 banks. In all but two cases, the one legal entity included per corporate group was the consolidated UK parent entity (i.e. the entity at the top of the corporate structure in the UK, even if there was an ultimate parent outside the UK). In these two cases, there was a UK subsidiary in the data set with substantially greater total assets than the UK parent and this was thus included instead as it is clear that there was an issue with the consolidation. Total observations for these 115 banks over the 10-year period numbered 762.

Where banks are established *de novo* and come into existence during a year, a record is included for them in my data for the year in which they come into existence. Where banks cease to exist during a year due to failure, a record is also included for them for that year, but not for subsequent years. Where banks cease to exist during a year due to merger or acquisition, no record is included for them for that year in order to avoid double-counting with the new group entity that is thereby created and which is also present in the data set[3]. I also, for all banks present in my data set, painstakingly collected by hand data from annual reports and the Pillar 3 disclosures required under Basel banking rules. The data collected in this way relate to all of the ownership and governance variables stated in sections 3.4 and 3.8. Refer to section 3.8 below for further details of manually collected variables and other variables used in this study. The use of manually-collected data gives my research unique information not used in other studies.

[3] Note that the data contain records for an entity entitled ABN-AMRO (Guernsey) that continued to exist and be recorded in the database after the acquisition of ABN-AMRO operations and assets in the UK by the Royal Bank of Scotland Group in 2007. This is because ABN-AMRO (Guernsey) is a residual component of the original parent entity that was not acquired by Royal Bank of Scotland, presumably because its parent wished to retain a private banking presence in the offshore banking market of the UK Channel Islands.

In addition to the Bankscope data and data manually collected on banks, I extracted from the World Bank database data on 13 macroeconomic variables for the UK for each of the relevant years and merged this into my dataset on the basis of year. Ultimately, only GDP data was used in order to express bank size as total assets over GDP. Other macroeconomic variables were not used as controls because I found that doing so yielded results no different from just using year dummies.

3.7 Banks in the Data

The following list (Table 3.2) summarises the 115 banking entities included in my data set, along with a description identifying each as either a retail bank, private bank, commercial / corporate bank, universal bank or building society. For the purposes of my analysis, a bank is defined as any organisation in the data extract which borrows funds (from depositors or wholesale markets) and either invests these or uses them to support capital markets activities, such as market-making or proprietary trading in securities, currencies or commodities. This is in line with the relevant definition of a bank for a study such as this, as discussed in section 2.2.

A retail bank is defined as a bank which borrows from private individuals and lends to private individuals and small businesses. A building society is a retail bank which is owned mutually by depositors. A private bank is defined as a bank which borrows exclusively from comparatively wealthy individuals. A commercial or corporate bank is defined as a bank which is financed by borrowing from individuals and businesses and invests mainly in loans to small, medium or large enterprises. An investment bank is a bank which is financed by borrowing from wholesale markets and invests mainly in loans to large corporates or capital markets activities. A universal bank is a bank which engages in most or all of the above activities and may also engage in other financial-services activities, such as insurance, brokerage or asset management. These definitions do not have rigid boundaries between them, but this is not important here since they are only used to describe the entities included in my study and serve no other purpose in subsequent analysis.

Table 3.2 Banks included in the data set used in this thesis.

	Entity	Type of Bank	Accounting Year End (All at Month End)
1	Abbey National Treasury Services Plc	Corporate bank	December
2	ABN AMRO (Guernsey) Limited	Private bank	December
3	Ahli United Bank (UK) Plc	Universal bank	December
4	AIB Group (UK) plc	Retail bank	December
5	Aldermore Bank Plc	Retail bank	December
6	Alliance & Leicester Plc	Retail bank	December
7	Anglo & Overseas Trust Plc	Private bank	----
8	Ansbacher & Co Limited	Private bank	----
9	Arbuthnot Banking Group Plc	Private bank	December
10	Banc of America Securities Limited	Investment bank	December
11	Bank Leumi (UK) Plc	Universal bank	June
12	Bank of Ireland (I.O.M.) Limited	Retail bank	December
13	Bank of London and The Middle East Plc-BLME	Corporate bank	December
14	Bank of New York Mellon (International) Ltd (The)	Investment bank	December
15	Barclays Plc	Universal bank	December
16	Barnsley Building Society	Building society	December
17	Bath Investment & Building Society BIBS	Building society	December
18	BMCE Bank International Plc	Corporate bank	December

	Entity	Type of Bank	Accounting Year End (All at Month End)
19	Bradford & Bingley Plc	Retail bank	December
20	Britannia Building Society	Building society	December
21	British Arab Commercial Bank Plc	Corporate bank	December
22	Brown, Shipley & Co Limited	Private bank	December
23	Butterfield Bank (Guernsey) Limited	Private bank	December
24	C. Hoare & Co	Private bank	March
25	Cambridge Building Society	Building society	December
26	Cattles Limited	Retail bank	December
27	Celtic Bank Limited	Retail bank	----
28	Chelsea Building Society (The)	Building society	December
29	Cheshire Building Society	Building society	December
30	Citibank International Plc	Universal bank	December
31	Close Brothers Group Plc	Corporate bank	July
32	Clydesdale Bank Plc	Retail bank	September
33	Co-operative Bank Plc (The)	Mutual bank	December
34	Coventry Building Society	Building society	December
35	Credit Suisse International	Universal bank	December
36	Cumberland Building Society	Building society	March
37	Darlington Building Society	Building society	December
38	Derbyshire Building Society	Building society	December
39	Duncan Lawrie Holdings Limited	Private bank	December

	Entity	Type of Bank	Accounting Year End (All at Month End)
40	Dunfermline Building Society	Building society	December
41	Europe Arab Bank Plc	Corporate bank	December
42	European Islamic Investment Bank Plc	Investment bank	December
43	Fairbairn Private Bank Ltd	Private bank	December
44	FBN Bank (UK) Limited	Retail bank	December
45	FCE Bank Plc	Commercial bank	December
46	Furness Building Society	Building society	December
47	GMAC Commercial Finance Plc	Commercial bank	December
48	Gulf International Bank (UK) Ltd	Corporate bank	December
49	Habib Allied International Bank Plc	Retail bank	December
50	Hanley Economic Building Society (The)	Building society	August
51	HBOS Plc	Retail bank	December
52	Heritable Bank Plc	Retail bank	December
53	Hitachi Capital (UK) Plc	Commercial bank	March
54	HSBC Holdings Plc	Universal bank	December
55	Investec Plc	Corporate bank	March
56	Ipswich Building Society	Building society	November
57	Itau BBA International Limited	Corporate bank	December
58	JP Morgan International Bank Ltd	Universal bank	December

	Entity	Type of Bank	Accounting Year End (All at Month End)
59	Kaupthing Singer & Friedlander Ltd	Retail bank	December
60	Kent Reliance Building Society	Building society	December
61	Lambeth Building Society	Building society	January
62	Lazard & Co Holdings Limited	Investment bank	December
63	Leeds Building Society	Building society	December
64	Leek United Building Society	Building society	December
65	Lloyds Banking Group Plc	Retail bank	December
66	Lloyds TSB Bank Plc	Retail bank	December
67	London Scottish Bank Plc	Retail bank	March
68	Manchester Building Society	Building society	December
69	Mansfield Building Society	Building society	December
70	Market Harborough Building Society	Building society	December
71	Melton Mowbray Building Society	Building society	December
72	Merrill Lynch International Bank Limited	Investment bank	December
73	Mitsubishi UFJ Securities International plc	Investment bank	March
74	Monmouthshire Building Society	Building society	April
75	Morgan Stanley & Co. International Plc	Investment bank	December

	Entity	Type of Bank	Accounting Year End (All at Month End)
76	N M Rothschild & Sons Limited	Investment bank	March
77	National Counties Building Society	Building society	December
78	Nationwide Building Society	Building society	April
79	Nedbank Private Wealth Limited	Private bank	December
80	Newbury Building Society	Building society	October
81	Newcastle Building Society	Building society	December
82	Nomura Bank International Plc	Corporate bank	March
83	Northern Bank Limited	Retail bank	December
84	Northern Rock (Asset Management) Plc	Retail bank	March
85	Northern Trust (Guernsey) Limited	Investment bank	December
86	Nottingham Building Society	Building society	December
87	Paragon Group of Companies Plc	Retail bank	September
88	Portman Building Society	Building society	December
89	Principality Building Society	Building society	December
90	R Raphael & Sons Plc	Private bank	February
91	Rathbone Brothers Plc	Private bank	December
92	RBC Investor Services Limited	Corporate bank	October
93	Royal Bank of Scotland Group Plc (The)	Universal bank	December
94	Saffron Building Society	Building society	December
95	Santander UK Plc	Retail bank	December
96	Scarborough Building Society	Building society	April

	Entity	Type of Bank	Accounting Year End (All at Month End)
97	Scottish Building Society	Building society	January
98	SG Hambros Bank (Channel Islands) Limited	Private bank	December
99	Skipton Building Society	Building society	December
100	Southern Pacific Mortgage Limited	Retail bank	----
101	Standard Bank Plc	Universal bank	December
102	Standard Chartered Plc	Universal bank	December
103	Stroud & Swindon Building Society	Building society	December
104	Sumitomo Mitsui Bank Corp. Europe	Corporate bank	March
105	Swansea Building Society	Building society	December
106	Tesco Personal Finance Group Limited	Retail bank	February
107	Tipton & Coseley Building Society	Building society	December
108	UFJ International Limited	Corporate bank	March
109	Unity Trust Bank Plc	Retail bank	December
110	Vernon Building Society	Building society	December
111	Virgin Money Plc	Retail bank	December
112	VTB Capital Plc	Corporate bank	December
113	Weatherbys Bank Limited	Private bank	December
114	West Bromwich Building Society	Building society	March
115	Yorkshire Building Society	Building society	December

3.8 Variable Definitions and Descriptive Statistics

Variables used in this thesis are defined as in the table below (Table 3.3) where descriptive statistics are also shown. Variables defined as ratios have been calculated from the various terms described in the definition of the variable, as provided in Bankscope or sources used in manual data collection. Some variables include multiplication by an arbitrary scalar (100 or 1,000,000) in their definition. This serves only to address the issue of inconveniently small regression parameters being estimated when these scalars are not included, or differences in units between the numerator and denominator of a ratio. This does not affect evaluation of whether or not the parameter is statistically significant.

Table 3.3 Variables used and descriptive statistics.

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
return_on_assets	Net income over total assets, all multiplied by 100	756	0.37	2.25	-33.48	23.93	-1.19	107.7	-13.29	23.26	N/A
return_on_equity	Net income over total equity, all multiplied by 100	756	4.42	23.67	-511.35	69.47	-15.1	310.7	-13.3	20.2	N/A
loan_interest_income	Loan interest income over gross loans, all multiplied by 100	560	6.65	13.58	0.00	258.49	14.2	237.7	2.7	10.4	N/A
growth_total_assets	Total assets at the current year minus total assets at the preceding year, all over total assets at the preceding year and then multiplied by 100	643	9.13	25.98	-60.67	208.32	3.0	19.8	-19.3	46.7	N/A

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
loan_impairments	Loan impairment charge over gross loans, all multiplied by 100	645	0.63	1.90	-17.33	29.91	5.8	105.8	-0.1	2.9	N/A
combined_failure	Takes a value of 1 if any of the following occurred: default or bankruptcy, bailout or stress acquisition, asset protection, tier 1 breach or regulatory capital breach	760	0.07	0.26	0	1	N/A	N/A	N/A	N/A	54 / 760
state_majority_ owner	Takes a value of 1 if a national government owns more than 50% of the shares, and 0 otherwise	751	0.05	0.21	0	1	N/A	N/A	N/A	N/A	39 / 751

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
mutual_ownership	Takes a value of 1 if the bank is owned by depositors and / or employees, and 0 otherwise	760	0.40	0.49	0	1	N/A	N/A	N/A	N/A	305 / 760
foreign_parent	Takes a value of 1 if the bank is owned by a parent entity that is based outside the United Kingdom, and 0 otherwise	760	0.29	0.45	0	1	N/A	N/A	N/A	N/A	218 / 760
board_size	Number of non-executive directors plus number of executive directors	529	11.53	3.73	0	31	1.2	5.4	7	18	N/A
director_ratio	Proportion of the Board who are Non-Executive Directors	528	0.72	0.14	0.27	1	-0.4	3.0	0.45	0.93	N/A
rem_co	Takes value 1 if a Remuneration Committee is present, and 0 otherwise	556	0.89	0.32	0	1	N/A	N/A	N/A	N/A	489 / 556

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of “1s” / Total Obs.
exec_rem_ disclosed	Takes value 1 if executive remuneration is disclosed, and 0 otherwise	554	0.63	0.48	0	1	N/A	N/A	N/A	N/A	349 / 554
joint_ceo_ chairman	Takes a value of 1 if the Board Chairman and CEO of the bank are the same individual, and 0 otherwise	532	0.09	0.28	0	1	N/A	N/A	N/A	N/A	43 / 532
cro_present_on_ board	Takes a value of 1 if a Chief Risk Officer (CRO) is present as a full director on the Board of the bank, and 0 otherwise	528	0.06	0.24	0	1	N/A	N/A	N/A	N/A	38 / 528

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
comm_dir_board	Takes a value of 1 if a Commercial Director is present as a full director on the Board of the bank, and 0 otherwise	553	0.40	0.49	0	1	N/A	N/A	N/A	N/A	216 / 553
female_ratio	The proportion of the Board who are female	456	0.13	0.08	0	0.5	0.4	3.7	0	0.37	N/A
no_exp_ratio	The proportion of the Board who have not previously worked in financial services	371	0.43	0.23	0	1	0.2	2.4	0.08	0.85	N/A

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
cro_or_chair	Takes a value of 1 if either Chief Risk Officer (CRO) is present as a full director on the Board or there is a Chairman separate from the CEO, and 0 otherwise	760	0.74	0.44	0	1	N/A	N/A	N/A	N/A	562 / 760
cumul_gov	Takes the value 3 if a bank has all three of an independent Chairman, CRO on the Board and NEDs being over 50% of the Board. Takes the value 2 if two of these are the case, and so on	617	1.90	0.48	0	3	N/A	N/A	N/A	N/A	N/A

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of "1s" / Total Obs.
low_ned	Takes a value 1 if NEDs are less than half the Board, and 0 otherwise	760	0.07	0.25	0	1	N/A	N/A	N/A	N/A	53 / 760
irb_permission	Takes a value of 1 if the bank has permission from the national financial services regulators to use the Internal Ratings Based (IRB) approach for credit risk measurement and management, and 0 otherwise	754	0.10	0.29	0	1	N/A	N/A	N/A	N/A	72 / 754

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of “1s” / Total Obs.
big_and_irb	Takes a value of 1 if irb_permission has value 1 and the bank has assets greater than 10% of GDP, and 0 otherwise	754	0.05	0.22	0	1	N/A	N/A	N/A	N/A	40 / 754
exposure_to_ banks	Loans and advances to banks over total assets	700	0.19	0.20	9.5E-05	0.99	1.8	5.7	.01	.63	N/A
securities_ holdings	Total securities holdings over total assets	730	0.21	0.21	0	1.00	1.7	5.8	0.003	0.67	N/A
advisory_activity	Net fees and commissions over total assets	701	0.01	0.03	-0.01	0.39	6.7	68.7	0	0.06	N/A
equity_ratio	Equity over total assets	760	0.09	0.11	0.00	0.99	5.1	33.0	0.02	0.19	N/A
current_deposits_ over_liabs	Customer current deposits over total liabilities	665	0.56	0.33	0	1.00	-0.3	1.6	0.02	0.99	N/A

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of “1s” / Total Obs.
size_over_gdp	Total bank assets over GDP (with total bank assets first multiplied by 1,000,000 to reflect the fact that it was in millions while GDP was in units)	760	0.07	0.26	7.9E-05	2.05	4.0	29.0	0.0001	0.46	N/A
average_pay	Total remuneration expenditure divided by the number of employees (in GBP thousands)	598	150	680	10	1011	10.1	136.9	26	357	N/A
excess_pay	The portion of average_pay not explained by equation 7.3 (in GBP thousands)	413	1.7E-07	101.64	-219.1	1043.4	4.5	40.6	-123	98	N/A
number_ employees	The total number of people working for the bank	602	10108	40914	2	331458	5.3	33.2	39	82953	N/A

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.	Skew	Kurtosis	5th Percentile	95th Percentile	Number of “1s” / Total Obs.
world_rank_by_ assets	Rank by total assets, compared to all other banks in Bankscope in the same year	520	3282	2463	18	10152	0.7	2.6	276	7667	N/A
Year Dummies	Year dummies that take the value of 1 for each particular year between 2003 and 2012, and zero otherwise	-	-	-	-	-	-	-	-	-	N/A

Note: The mean, standard deviation and outliers for these variables all have economically reasonable values. Outliers have been checked and relate to cases where the denominator and / or numerator changed sharply or the variable took an extreme value due to stress or other special conditions. For instance, very low negative return on equity occurs when there are large losses and these have caused the equity (denominator in the ratio) to become very small. As explained in section 3.13, a few extreme outliers are removed in regression analysis to avoid excessive impact on estimates, and influential observations analysis has been carried out to verify that such excessive impacts have indeed been avoided.

Specific outliers occurring in this data set were examined and confirmed to be reasonable. For instance, large negative values of ROE occurred in years when banks made large losses and, because of these losses, the equity base (the denominator in the ratio) became small. Large positive loan interest income occurred in cases where loan balances shrank markedly during the year (such that the denominator at year-end was small). Negative loan impairments occurred in a few cases because of re-valuation of loan books. Advisory activity had a small negative value in a few cases where banks appear to have paid for such services. The biggest banks had assets equivalent to just over twice UK GDP (with the largest being HSBC in 2012). Some investment banks with limited numbers of employees and high top salaries had average pay of up to just over £10m GBP (with the highest being Morgan Stanley International in 2006).

For binary variables, the measure of distribution is simply the number of "1" values present, compared to the total number of observations. Some variables are highly skewed, but I utilise only those where the number of minority cases exceeds 5% of the sample (≈37 observations). This is enough to represent real variation, not the presence of a few idiosyncratic cases. Variables that were discarded because the number of minority cases was too low are discussed in Section 3.9 below. In comparisons performed via regression models, effects of a limited number of minority cases can be detected if the scale of the effect is large enough to be statistically significant. Achieving significance is made easier by the efficiency of estimators, which is in turn assisted by my using an extensive set of controls for co-variates.

For continuous variables, the measures of distribution I use are skew, kurtosis, the 5th percentile and the 95th percentile. These yield results consistent with the empirical distributions that are reported in Section 3.9. For instance, negative skew for ROA and ROE is observed due to cases where there was large negative performance due to stress (Section 3.13 describes how a few extreme outliers are excluded from analysis). High kurtosis is evident in cases where there is a "typical" range of values in which many observations reside (e.g. ROA between -1% and +2%). This is not problematic because neither the theory of OLS nor the theory of random effects nor that of multi-equation empirical modelling nor that of the probit model relies on any assumption relating to the distribution shape for dependent or explanatory variables. We need only sufficient variation for modelling and Section 3.9 shows that this is present, including within the "typical" ranges. The distribution shape for residuals does matter, but this ceases to be important as observation number approaches the asymptotic case (often several hundred). Please refer to Section 3.9 for more complete information on variable distributions.

The manually-collected variable IRB Permission takes a value of zero in all years prior to 2007, since this was the time at which the IRB regime took effect. However, this is not problematic since what I am testing by including this variable is simply the consequences of banks having both a) permission to use internal models for calculating the regulatory capital required to address credit risk and b) an accompanying regulatory requirement that such models be used for decision-making purposes, including decisions to grant or refuse credit.

It is also important to understand associations of variables with one another. This has implications for occurrence of multicollinearity in models. The assessment of correlations amongst regressors is best achieved using Variance Inflation Factors (VIFs) because these are based on multivariate correlation. I include VIFs with all models. However, for completeness, bivariate correlations are shown here.

Many measures of association exist (Siegel and Castellan, 1988). For the case of one count or continuous variable versus another count or continuous variable, one may use Pearson correlation. For a count or continuous variable versus a binary one, Pearson correlation is also acceptable. It is based on correspondence of deviations from averages, so it works acceptably for binary versus continuous correlation.

The binary versus binary situation requires more specialised measures, of which there are many choices. Polychoric correlation infers associations between latent continuous variables that are assumed to determine observed binary states. Measures based on the Chi-squared statistic compare the observed frequency of a pairing of states to the expected frequency under a null hypothesis of no association. The Phi coefficient adjusts Chi-squared for sample size. Cramer's V adjusts Chi-squared for sample size and for low numbers of observations for either variable. The Kappa coefficient is simpler and is based on numbers of concordant and discordant pairs. The Lambda statistic treats one variable as dependent and the other as independent.

For my data, Cramer's V is most suitable. It has a robust theoretical basis using Chi-squared and the two adjustments it entails are both relevant. There is no reason to treat one variable as independent and the other as dependent since I am primarily assessing at correlations amongst regressors. I therefore show two correlation tables, containing Pearson correlation and Cramer's V, respectively. I include all variables in the former and only binary variables in the latter (Tables 3.4 and 3.5 below). It is notable that correlations are generally low, with very few falling outside a range from -0.5 to +0.5 (shown in amber). More importantly, in Chapters 4 to 8, VIFs show that multivariate correlations of regressors are also limited.

Interestingly, no existing bivariate association statistic fully captures the economics behind associations in my data. For instance, state ownership and mutual ownership are mutually exclusive. But they attract a Pearson correlation of only -0.23 and a Cramer's V of only -0.18, rather than values closer to -1.0. The reason is that there are many observations where neither state ownership nor mutual ownership exists so, computationally, the formula for Cramer's V cannot identify that they are mutually exclusive. There could be scope for new operational research to develop a statistic that recognises when there are zero instances of a combination of states and boosts the positive or negative association accordingly. For my current research, this is not an issue since the aim is only to understand the extent of multicollinearity, which is in any case better addressed through VIFs as reported in Chapters 4 to 8, rather than bivariate correlations.

Table 3.4 Pearson correlation as a measure of association for continuous, count and binary variables

	loan_impairments	loan_interest_income	return_on_assets	return_on_equity	growth_total_assets	board_size	director_ratio	average_pay	female_ratio	no_exp_ratio	exposure_to_banks	securities_holdings	advisory_activity	equity_ratio	curr_dep_over_liabs	size_over_gdp	state_majority_owner	mutual_ownership	foreign_parent	rem_co	exec_rem_disclosed	joint_ceo_chairman	cro_on_board	comm_dir_board	irb_permission
loan_impairments	1.00																								
loan_interest_income	0.00	1.00																							
return_on_assets	-0.50	-0.11	1.00																						
return_on_equity	-0.19	-0.02	0.32	1.00																					
growth_total_assets	-0.24	0.09	0.17	-0.24	1.00																				
board_size	0.30	0.04	0.07	0.01	0.11	1.00																			
director_ratio	0.22	0.08	-0.35	-0.21	-0.05	0.35	1.00																		
average_pay	0.13	0.05	-0.05	-0.20	0.07	0.26	0.43	1.00																	
female_ratio	-0.08	-0.15	0.01	0.01	-0.18	-0.01	0.01	-0.25	1.00																
no_exp_ratio	-0.06	-0.08	0.14	0.05	0.04	0.24	0.24	0.05	0.18	1.00															
exposure_to_banks	0.30	0.40	-0.22	0.02	-0.04	0.24	0.32	-0.05	-0.12	0.27	1.00														
securities_holdings	0.16	-0.04	0.04	-0.23	0.08	0.38	0.30	0.68	-0.09	-0.11	-0.21	1.00													
advisory_activity	0.20	0.02	0.46	0.10	-0.07	0.19	-0.17	0.04	0.14	0.08	0.14	0.20	1.00												
equity_ratio	0.45	0.61	-0.23	0.07	-0.10	-0.05	0.02	-0.01	-0.15	-0.14	0.40	-0.06	0.31	1.00											
current_deposits_over_liabs	-0.38	-0.15	0.21	0.17	-0.11	-0.44	-0.44	-0.48	0.22	0.22	0.02	-0.50	0.00	-0.11	1.00										
size_over_gdp	0.08	-0.05	-0.07	-0.15	0.15	0.39	0.25	0.13	0.00	-0.17	-0.19	0.55	-0.09	-0.20	-0.42	1.00									
state_majoity_owner	0.12	-0.04	-0.19	-0.07	-0.10	0.06	0.34	0.21	-0.13	-0.14	0.06	0.27	0.00	0.04	-0.28	0.34	1.00								
mutual_ownership	-0.47	-0.14	0.02	0.10	-0.06	-0.64	-0.40	-0.43	0.14	0.00	-0.35	-0.52	-0.39	-0.23	0.64	-0.45	-0.29	1.00							
foreign_parent	0.28	0.02	-0.19	-0.21	0.02	0.39	0.57	0.58	-0.15	0.25	0.49	0.30	0.06	0.00	-0.39	-0.08	0.19	-0.61	1.00						
rem_co	0.08	-0.05	-0.09	-0.04	0.00	-0.18	-0.17	0.08	0.02	-0.35	-0.49	0.13	-0.06	0.00	-0.19	0.11	0.07	0.05	-0.21	1.00					
exec_rem_disclosed	-0.12	-0.16	0.10	0.12	-0.06	-0.10	-0.32	-0.44	0.33	-0.27	-0.40	-0.14	0.01	-0.22	0.07	0.13	-0.05	0.26	-0.57	0.45	1.00				
joint_ceo_chairman	0.06	-0.04	-0.20	-0.08	0.05	0.03	0.28	0.15	-0.01	0.20	0.12	-0.10	0.01	-0.04	-0.14	-0.08	-0.05	-0.23	0.37	-0.05	-0.20	1.00			
cro_present_onboard	-0.07	-0.03	0.00	0.02	0.01	-0.05	-0.05	-0.07	-0.02	0.04	-0.10	-0.08	-0.04	-0.06	-0.01	-0.05	-0.05	0.09	-0.01	0.05	0.03	-0.04	1.00		
comm_dir_board	-0.10	-0.09	0.20	0.11	0.16	0.10	-0.33	-0.18	-0.06	-0.12	-0.12	-0.18	0.15	-0.07	0.03	-0.07	0.06	0.05	-0.24	0.03	0.24	-0.09	0.04	1.00	
irb_permission	0.06	-0.02	-0.06	-0.19	0.02	0.39	0.32	0.23	0.13	0.01	-0.02	0.49	-0.04	-0.17	-0.30	0.73	0.20	-0.43	0.12	-0.11	-0.06	-0.09	0.01	-0.18	1

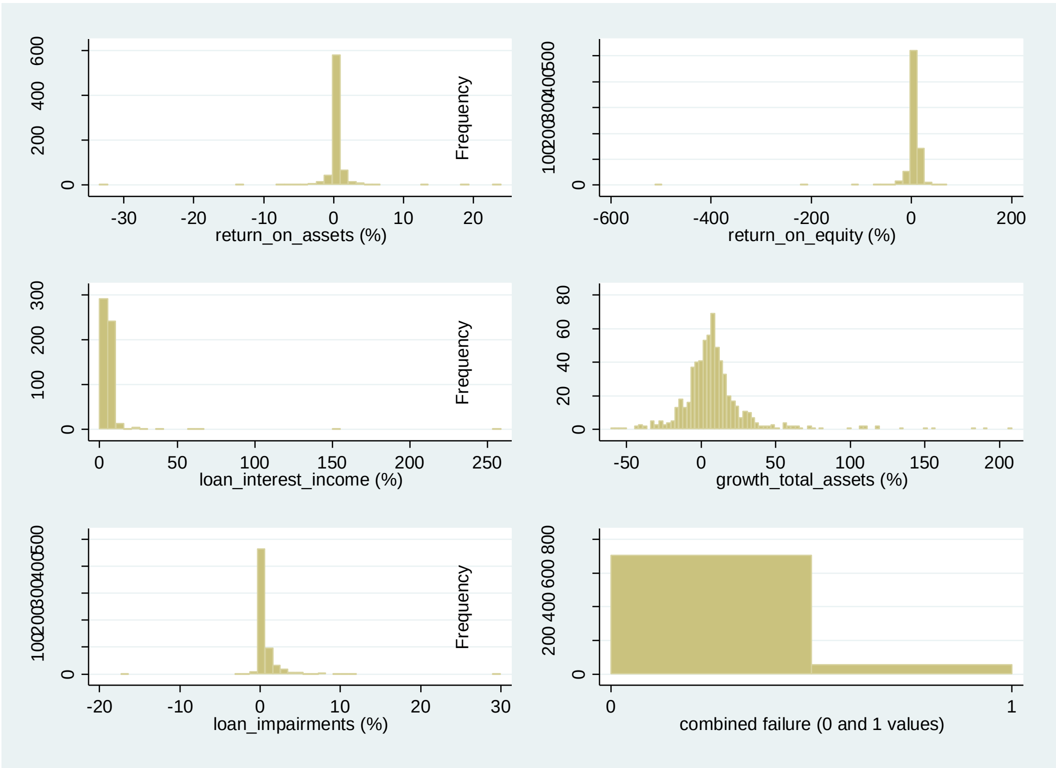
Table 3.5 Cramer's V as a measure of association for binary regressors

	state_majority_owner	mutual_ownership	foreign_parent	rem_co	exec_rem_disclosed	joint_ceo_chairman	cro_on_board	comm_dir_board	irb_permission
state_majoity_owner	1.00								
mutual_ownership	-0.18	1.00							
foreign_parent	0.13	-0.52	1.00						
rem_co	-0.16	0.17	-0.22	1.00					
exec_rem_disclosed	-0.15	0.39	-0.53	0.43	1.00				
joint_ceo_chairman	-0.07	-0.30	0.33	-0.03	-0.10	1.00			
cro_present_onboard	-0.06	-0.08	0.08	-0.02	-0.18	-0.05	1.00		
comm_dir_board	-0.05	-0.05	-0.06	0.09	0.12	-0.08	0.00	1.00	
irb_permission	0.14	-0.11	0.02	0.04	0.05	-0.07	-0.02	-0.08	1.00

3.9 Empirical Distributions

In this section, I present sets of histograms (Fig. 3.1 and Fig. 3.2) showing empirical distributions for each of the variables considered in my analysis. Variables are as defined in Section 3.8. This analysis confirms that the central tendencies and tail values present can be interpreted as economically reasonable. It also shows that variables have sufficient variation for inclusion in regression models. Binary variables are included in the same way as continuous and ordinal variables so as to show that there is sufficient representation of both states (0 and 1) for use in models.

Figure 3.1 Empirical Distributions of Dependent Variables.



Note: variable abbreviations and definitions are as per section 3.8.

Figure 3.2 Empirical Distributions of Explanatory and Control Variables.

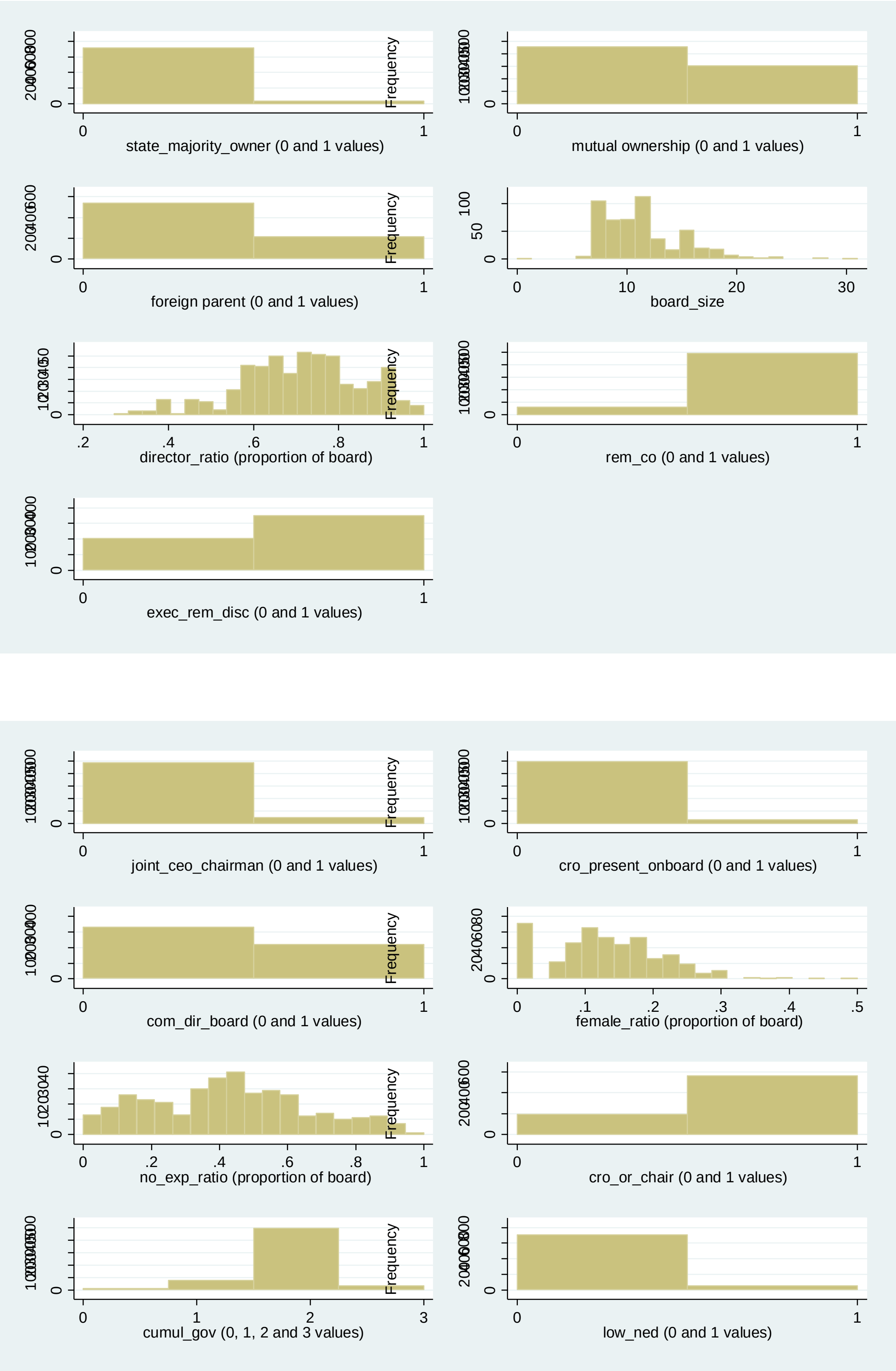


Figure 3.2 (contd.) Empirical Distributions of Explanatory and Control Variables.

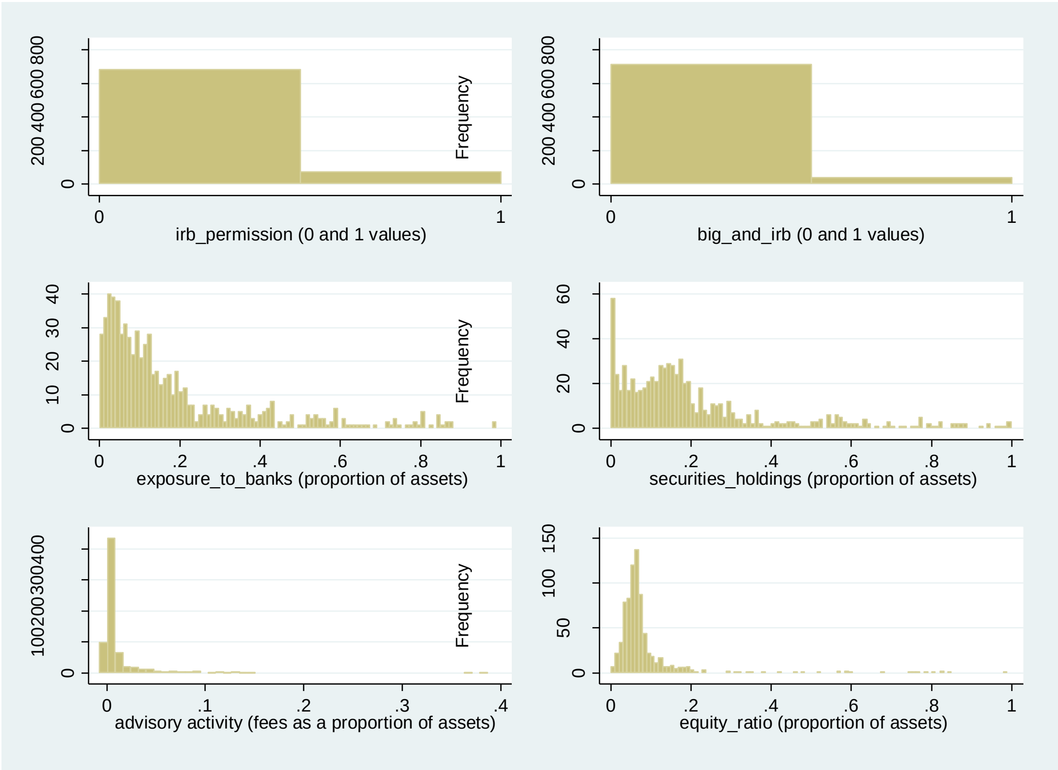
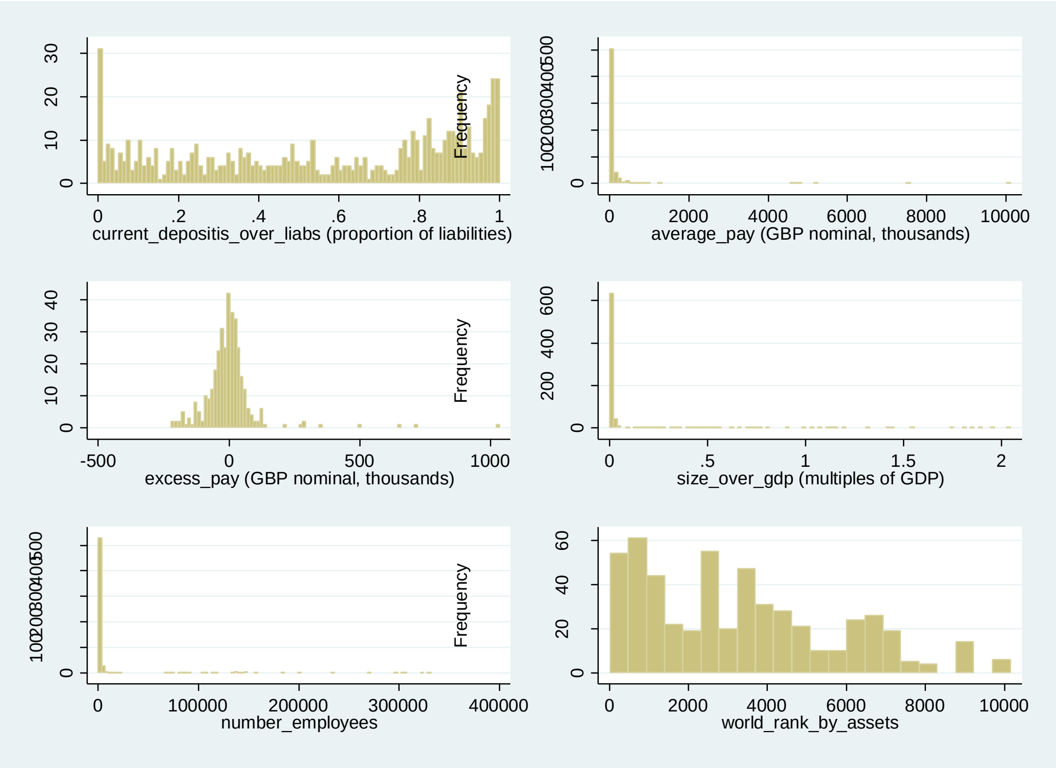


Figure 3.2 (contd.) Empirical Distributions of Explanatory and Control Variables.



Note: variable abbreviations and definitions are as per section 3.8. This includes various interaction terms created in Chapter 6 and the measure excess_pay created in Chapter 7.

These descriptive plots demonstrate that the variables used are suitable for inclusion in regression models on the grounds that they have clear variation in their values and take on economically reasonable values. In addition, descriptive statistics shown in section 3.8 show that they have low or very low missing-value rates.

A small set of other variables (not shown) were considered as potentially useful indicators of risk but were excluded as unsuitable at this stage in the analysis. A variable called other impairments (impairments on non-loan assets) was excluded on the basis that a) it is populated for only 211 out of

762 potential observations and b) loan impairments (normalised to the size of the loan book on which such impairments can occur) can be used instead as a dependent variable that reflects realised risk. A variable called total impairments was also excluded because it consists of the sum of loan impairments and other impairments and also had a serious missing-value problem.

The variable Audit Committee / Board Risk Committee present was also of potential interest to determine if this structure mitigates risk in the way regulators expect, but was excluded as a potential explanatory variable on the basis that, out of 322 cases where this variable was populated, only 8 zero values were observed (2.5% of cases). Internal Audit function present was of potential interest for similar reasons, but was likewise excluded on the basis that, out of 316 cases where this variable was populated, only 8 zero values were observed (2.5% of cases). These patterns do not represent variation of a variable, but rather indicate the presence of idiosyncratic cases that differ from norms that are near-universal in the sample. Indeed, given that regulation has long required UK banks to possess Board-level audit or risk committees and internal audit functions (UK Corporate Governance Code, 1998), it is surprising that even this level of variation is present (although it may be explained by the 'comply or explain' principle embedded in the Code).

Other variables with skewed distributions are retained, on the basis that there is still sufficient variation for modelling. State majority owner takes a value of '1' in 42 out of 756 populated cases (5.6% of cases). However, this is a sufficient number of '1' values to represent real variation in the population, not just a few idiosyncratic cases. Indeed, there are well-known cases of state-owned banks in the sample I used. Bank size, as measured by total assets as a proportion of GDP, shows limited variation but it does have real variation, with many observations having values distributed between zero and 5%, plus a relatively even but very thin distribution over all values above that up to 205%. This is sufficient variation to be of interest for modelling, especially since the extremes of the distribution represent radically different sizes of entity (small local banks compared to global banking groups).

3.10 Stability of Explanatory Variables

A crucial, and very useful, feature of this data set is that many of the explanatory variables of greatest interest, relating to ownership, governance and information processing capacity, are very stable over time. The status of being state-owned, a mutual organisation or owned by a foreign parent tends not to change at all from one year to the next. The composition of Boards tends to change little year on year. Likewise, the practices of having the CEO and Chairman be separate individuals, or having a CRO on the Board, once adopted, tend not to be abandoned. IRB permission, once obtained, is generally not lost or relinquished.

This is important in that it gives reason to believe these variables are exogenous; they are given aspects of bank structure that may affect dependent variables of interest but which, because they do not change, do not appear to be susceptible to reverse or simultaneous causality, at least not over the time scales considered in this analysis. Provided I control for covariates that might be correlated with these explanatory variables, I should have exogeneity. Thus, a severe problem that can affect regression modelling – endogeneity – is minimised. To confirm this conclusion, models I run are accompanied by diagnostic tests for the presence of endogeneity.

The following analysis (Table 3.6) shows autocorrelation coefficients at a lag of one year for explanatory variables used in hypothesis testing. All have a value of 0.88 or greater and several approach perfect autocorrelation. This supports the argument for exogeneity, as explained above, and potential effects of autocorrelated residuals are addressed by using clustered standard errors.

Table 3.6 Autocorrelation coefficients over one year of regressors and control variables.

Variable	Autocorrelation Coefficient
State Majority Owner	0.95
Mutual Ownership	1.00
Foreign Parent	1.00
Board Size	0.91
Director Ratio	0.93
Remuneration Committee Present	0.91
Executive Remuneration Disclosed	0.98
Average Pay	0.98
Joint CEO-Chairman	0.88
CRO Present On Board	0.90
Commercial Director Present On Board	0.92
Female Ratio	0.86
No Experience Ratio	0.92
IRB Permission	0.87
Exposure to Banks	0.91
Securities Holdings	0.93
Advisory Activity	0.98

Variable	Autocorrelation Coefficient
Equity Ratio	0.96
Current Deposits Over Liabilities	0.96
Size Over GDP	0.98

3.11 Key Data Conventions

A number of key conventions and definitions are important in understanding the data I extract and in ensuring it is used in an appropriate way to test hypotheses. These are described in this section. It is important to state these in order to show that my results are robust to definitional issues.

The data I use from Bankscope are on an annual, calendar-year basis, with variables presented with universal definitions across banks, using the Fitch Universal Format. Stock variables from the balance sheet are as of year-end. Flow variables from the profit and loss account or cash flow statement are for the course of twelve months from one year-end to the next.

For banks that do not have a December year-end, Bankscope includes data for the bank accounting year-end nearest to a December year-end. For my analysis, this variation in accounting year-ends is almost irrelevant as the great majority of the banks in my sample had a December year-end for financial reporting purposes. Those that did not mostly had year-ends close to December. Out of 111 entities for which I could obtain annual reports, 85 (77%) had year-ends at the end of December and 106 (95%) had year-ends between the end of September and the end of March. In any case, since the external economic and regulatory conditions that are included in my models (captured through year dummies) tend to be stable from one quarter to the next and the fundamental ownership and governance characteristics of banks themselves do not change from quarter to quarter (as shown in section 3.10) a slight mismatch in the time points at which banks are compared should have only minimal effects on the analysis.

I record governance data collected from annual reports and pillar III disclosures as the values that prevailed for most of the calendar year. For instance, if a bank had 8 non-executive directors for most of the year but lost one of them three months before the calendar year-end, then I record the number of NEDs present for the year as 8. This is possible because banks disclose arrival and departure dates for directors during the year. In this way, performance and impairments accumulated over the year are compared with the governance structure that prevailed for most of the year. This definitional point is very unlikely to be important for comparisons across banks since, as shown in Section 3.10, the explanatory variables I use are remarkably stable over time.

All of the data included in my sample relate to UK entities. In most cases, the entity is simply a bank with the ultimate parent entity based in the UK and all its operations in the UK. In other cases, it is the UK subsidiary of a foreign bank, with only the balance sheet and income statement of the UK entity included in my data. So, in all cases, I consider only the balance sheets and income statements of UK businesses, with the assets, liabilities and income statements of non-UK operations excluded.

In cases where a foreign parent had control over a UK branch or subsidiary, the composition of the foreign parent's Board was generally used as the basis of the governance and ownership data I collected. A separate UK Board was used only in a few cases where the annual report of the company stated explicitly that it had decision-making independence from the parent. This convention provides further support for the argument, discussed in more detail in Section 3.10, that governance variables are exogenous: if a characteristic originates with an overseas parent entity, it is even less likely to be subject to reverse causality in which it is affected by financial characteristics of the branch or subsidiary.

For a few continental European banks where there is both a supervisory Board and a managerial Board at parent level, I include only the supervisory Board in defining variables relating to Board composition. This is because the supervisory Board has oversight over the managerial Board and can over-rule its decisions, while the managerial Board is more similar to an Executive Committee (ExCo) in a UK or US corporate governance context. This was relevant only for a few banks.

Non-Executive Directors are defined in my data as Directors who do not have any executive responsibilities identified by the annual report. In applying corporate governance codes and guidelines, banks may operate other definitions of non-executive status, such as having no executive responsibilities and having had no such responsibilities with the same or a related organisation at any time in the past. However, since banks may vary in their application of definitions established in governance codes – such as in what counts as a ‘related organisation’ – adopting their definitions could lead to inconsistency in my data. I therefore adopt the simpler, more objective standard of simply counting NEDs as directors who do not have specifically-identified executive responsibilities.

By this definition, Chairmen and Vice / Deputy Chairmen of banks are classified as non-executive since they do not have specific identified executive responsibilities and instead serve mainly to oversee the CEO and other executives.

3.12 Data Processing Audit

As discussed above, data processing in this thesis involved merging extracts of financial data from Bankscope with manually-collected data on ownership and governance, and with World Bank data for UK GDP, all using bank-year as a merge key. Data collection and processing steps were carried out with a very high level of caution to avoid introducing error. In order to provide further assurance that data collection and processing did not introduce error, I carried out a sample-based audit of the final processed data set. This showed that the data are reliable. Please refer to Appendix A for details.

3.13 Imputation and Outliers

Addressing the problem of missing values is an important issue in applied statistics and econometrics. If more than a small proportion of values is missing for a given variable, imputation with replacement values is generally necessary. This is because the alternative is to completely remove any data point containing a missing value for any variable, which would carry a greater cost in terms of estimator unbiasedness, consistency and efficiency. If several variables have missing values, removing records when anything is missing can result in loss of most of the data set and, thus, an unrepresentative sample.

I carried out imputation only after all of the descriptive analysis described in sections 3.8 to 3.10 above had been completed. This was necessary for me to understand the data as it is, before making replacements to facilitate regression modelling.

In conducting imputation, it was necessary to choose between two alternative approaches:

1) Backward replacement in which a missing value is replaced with the value at the subsequent time point for the relevant variable and bank or, if this fails, replacement with the average value for the relevant variable for the bank; or
2) Model-based imputation using the predicted values obtained from models with the variable with missing values as dependent variable, all other regressors as potential independent variables, and a machine learning algorithm to find the most predictive imputation model. This

approach ultimately involves hypothesis testing using several replicate data sets with different estimates of missing values to estimate the final regression models, which has the effect of introducing an additional error component.

Approach (1) has a strong empirical rationale in my data set in that the relevant characteristics of banks show a very high level of autocorrelation (see section 3.10), such that the best estimate for a missing variable is likely to be the value at the succeeding time point. Compared to approach (2) it has the desirable characteristics that it is simpler, more easily understood and does not introduce additional variance through the variance inherent in using several replicate data sets.

Approach (2) may be realistic in that different characteristics of banks are correlated and we can use this information to estimate what the missing values would have been. However, the extent of the autocorrelations reported in section 3.10 suggests that approach (1) is likely to be as good a predictor of missing values as approach (2), without the additional complexity that approach (2) involves. For these reasons, all of the research presented in this thesis has been carried out using approach (1) in missing value imputation.

Missing-value replacement was carried out at the level of the actual derived variables used in regression (such as equity ratio) rather than the underlying variables used in deriving such ratios (such as equity capital and total assets). This is because financial ratios are more definitive of the nature of a bank than absolute amounts and are therefore more likely to be stable over time as bank management pursue specific financial strategies.

I do not carry out imputation for values of dependent variables that are missing because they are missing at very low rates, because dependent variables do not show the same degree of autocorrelation, and because their imputation would entail greater potential for affecting parameter estimates – especially for parts of the data where an imputed dependent variable was regressed on imputed regressors.

After imputation, my panel of data remained mildly unbalanced (for instance due to certain banks coming into or out of existence during the period analysed). However, this has no impact on the study because none of the estimators used requires a balanced panel.

In my models, a small number of observations are removed due extreme outliers in the dependent variables that would have unduly affected parameter estimates. This entailed removal of 6 bank-year data points, out of 761 total observations. The criteria for removing data points were as follows:

- Removal of cases where loan impairments were more negative than -10% of gross loans (because this removed one extreme outlier and it is abnormal to have large negative impairments);
- Removal of cases where loan interest income exceeded 100% of gross loans (because this removed four extreme outliers and it is abnormal to have loan interest income exceeding gross loans);

- Removed cases where return on equity was more negative than -250% (because this removed one extreme outlier).

Such removal was carried out only for extreme values of dependent variables, not for explanatory variables. This was because the dependent variables had the clearest extreme outliers and are most likely to unduly affect many parameter estimates. For explanatory variables, influential observations analysis confirmed that no single observation had a significant effect on parameter values.

3.14 Observation Numbers in Models

The number of observations in my models is typically less than the maximum in this data set (761) because the observation number for some dependent variables (which are not subject to missing-value replacement) can be as low as 560, because some explanatory variables after backward replacement can still have observation numbers as low as 616 (with missing cases not entirely matching the dependent variable) and because the operation of lagging sacrifices 115 observations. Nevertheless, the approach to missing-value replacement employed is considered best to ensure results are not artefacts of replacement, while lagging is necessary to allow for delayed effects and to maximise the chances of exogeneity.

3.15 Conclusions

This Chapter describes the shared methodology that is used to test all of my hypotheses, in order to avoid reiterating it several times in empirical Chapters. I describe models that contain all fundamental aspects of banks – ownership, governance, information processing capacity and financial state – as regressors, along with indicators of performance and risk as dependent variables. Explanatory and control variables have been selected carefully to encompass a full range of attributes of banks. Model parameters in subsequent Chapters are estimated by a range of approaches in order to show robustness to changes in estimation method, and robustness to variations in model specification is shown by estimating models that contain subsets or all of the full set of regressors. This strategy makes it possible to answer my core research questions in a way that controls for co-varying factors and is robust to changes in model specification and estimation method.

Data to estimate my models is obtained by combining financial data with institutional data collected by hand. The data set achieves a balance of stressed and unstressed economic periods and has a sufficient observation number for analysis.

Descriptive statistics show that all of the variables employed for modelling have sufficient variation and that their means and extreme values are economically plausible. A data audit revealed no errors in data sourcing or processing and it was found that regressors are highly stable over time. The latter means I have an *a priori* rationale for arguing that many of my regressors are exogenous (on the basis that they cannot have been subject to reverse or simultaneous causality if they do not change), although I also test this argument empirically. It also means that I can carry out missing value imputation by backward replacement with subsequent values for the same bank and variable, which is carried out for all regressors, but not dependent variables.

In conditions where it is not possible to use real or quasi experiments, the type of approach presented here provides the strongest basis for empirically testing hypotheses of interest. Results obtained are shown in each of Chapters 4-8 and conclusions and practical implications are discussed in Chapter 9.

Chapter 4: Simultaneity of Risk and Return

4.1 Introduction

In this chapter I test the hypothesis that bank risk and return are simultaneous. I use the methodological approach set out in the preceding Chapter, with equations used in a simultaneous estimation framework. The dependent variables are ROA and loan impairments, because these are my most important measures of risk and return, and because simultaneity was not evident for other measures. Robustness of simultaneity is tested by using many variants of the simultaneous model throughout this thesis.

For the first time in the literature on banking, I show that simultaneity is present between ROA and loan impairments as realised measures of bank return and risk. These variables are used in the empirical literature as measures of return and risk, but no studies in the literature on bank ownership and governance treat them as simultaneous.

My demonstration of a simultaneous relationship is important for two reasons. First, it shows that a basic tenet of finance theory – the simultaneity of risk and return – holds in this setting. Second, it creates a framework in which to evaluate the effects of different aspects of governance and ownership, against a background where no studies in the literature on bank ownership and governance take account of such simultaneity between risk and return. This is vital in order to show that results are not biased due to omitted simultaneity.

In the sections that follow, section 4.2 considers literature relating to the association of risk and return in finance, section 4.3 develops a specific hypothesis to test, sections 4.4 and 4.5 show that simultaneity is present and section 4.6 shows that bias in other estimates results if this simultaneity is ignored. Section 4.7 synthesises results and explains how they provide a framework for Chapters 5 to 8.

4.2 The Theory of Risk and Return

Basic accounting (Atrill and McLaney, 2006) shows that loan impairments and return on assets may be related in that loan impairments enter the profit and loss account as a negative item. Beyond this, finance theory suggests that risk and return are determined simultaneously (Jones, 2008 and Mishkin, 2012). If the return changes, it must be because of new activities in the underlying issuer of the security or speculative forces in financial markets, each of which entail risk. Likewise, if the risk changes, then returns will generally adjust in response. The latter occurs because investors demand a given return for a given risk. If the return is too low, investors who hold the asset will seek to sell, prices will fall and returns will be driven up. Conversely, if the return is excessive, new investors will seek to buy the asset, prices will rise and returns will fall.

This relationship holds for tradable assets such as shares. However, I argue that it should also hold for measures of risk and return derived from the profit and loss statements of banks. If bank shareholders see that banks have invested in assets which are riskier, and there is sufficient information for them to know that this is so, they will demand that the bank seeks higher return on those assets because both the risk and the return ultimately flow back to them as owners.

Key parts of finance theory are constructed on the foundation of a risk-return linkage. In Modern Portfolio Theory (MPT), for instance, risk is treated as the standard deviation of expected return, such that the risk of different positions combines according to a quadratic function that takes account of their correlation (Markowitz, 1952). The risk-return mix of different portfolio combinations of tradable assets thus plots as an efficient frontier, with combinations below the frontier being inefficient and combinations above it being achievable only through leverage.

Investors have different degrees of risk aversion, reflected in the extent to which the price they will pay for a lottery deviates from the certainty equivalent obtained by probability-weighting the different outcomes. In MPT they select a point on the efficient frontier based on where their set of parallel indifference curves, along which utility is constant, have the same slope as the frontier, such that utility is maximised subject to the frontier. As discussed, bank shareholders may behave in an analogous manner by insisting that banks they control (or at least influence) ensure that investments made by the bank earn higher returns when those investments are riskier, compared to other available investments.

However, the simultaneity between risk and return that is present in theory may be absent in certain applied situations. Investors may lack adequate information about risk to price assets in a manner that brings about the expected risk-return association. Situations such as this where limitations relating to information prevent markets from adjusting in the manner expected are important in economics (Bircher and Butler 2007).

More recent work in behavioural economics and neuro-economics provides further reasons why simultaneity of risk and return may not always be present Wilkinson, 2008 and Glimcher and Fehr, 2013). Even when information is available, individuals do not always respond to it in rational, consistent ways. Several well-documented behavioural biases illustrate this. Trend following and herding involve relying on the assumptions of other investors rather than fundamental information. Framing, narratives and mental accounting involve responding differently to the same information depending on how it is presented. Anchoring and status quo bias occur when a single piece of information is relied upon because it was selected at some stage, or when there is an assumption the current situation will continue. Confirmation bias, overconfidence and self-attribution all involve responding only to information that reinforces prior beliefs and belief in self. Representativeness bias occurs when small samples of data are used for excessively general inferences. Loss aversion entails avoiding actions that would mean recognising a loss, while money illusion and reference points involve responding inappropriately to nominal prices or arbitrary price thresholds.

Not all of these behavioural biases are present in all situations. But they stem from a common fundamental cause: human cognitive limitations, especially when faced with complexity or limited information. This makes it necessary to verify that the risk-return simultaneity assumed in theory for financial assets is present in practice for banks. If it is present, it is then necessary to use multi-equation models that take account of this simultaneity in order to ensure that its omission does not lead to biased results.

A small number of studies in the relevant literature on bank ownership and governance do use multi-equation models in a narrow way to test the robustness of results to an assumption that one particular explanatory variable is endogenous. The study by Leven and Levine (2009) discussed in section 2.5.2, reporting that managerial ownership increases risk, confirmed its results using a simultaneous equations framework in which the regressor Tobin's Q (a measure of franchise value) is made endogenous. Likewise, the study by Pathan (2009), showing that the presence of more independent directors leads to lower risk, confirms its results using a simultaneous equations framework in which the proportion of independent directors is made endogenous.

Other studies use multi-equation frameworks simply because an explanatory variable takes the form of a modelled parameter. For instance, the study by Bai and Elyasiani (2012) discussed in section 2.5.2, showing that the sensitivity of bank CEO pay to stock price has a significant positive association with bank risk, intrinsically used a multi-equation framework.

A few empirical studies more tangential to my core questions have used simultaneous equation models. Cornett *et al* (2009) find that each of the following are endogenously determined: bank performance, the sensitivity of CEO pay to performance, an indicator of earnings management and the proportion of the Board which is independent. The consequence of board independence found in this study is a bidirectional positive relationship with the performance-sensitivity of CEO pay, but the effects of other ownership and governance structures are not considered and risk and return are not treated as simultaneous.

Elyasiani and Jia (2008) employ an empirical framework in which bank performance and the stability of institutional ownership are simultaneous, revealing a positive effect of stable institutional ownership on performance. Elyasiani and Zhang (2015) use simultaneous equations to evaluate the effects of Director busy-ness (in the sense of multiple other directorships) on bank risk and performance, and find that busy-ness is associated with beneficial outcomes, but they do not consider effects of other ownership and governance structures. Cooper (2009) uses a three-equation model of simultaneity between private-bank performance, the proportion of insiders on the Board and senior-level remuneration, revealing that insider representation leads to higher pay.

All of these studies differ from my work in the framework used, the questions asked and the results obtained. In summary, no empirical studies have assessed the effects of ownership and governance on bank risk and return using a framework in which bank risk and return are treated as simultaneous.

4.3 Literature Gaps and Hypotheses

As discussed in Section 2.9, no empirical studies have assessed the effects of ownership and governance on bank risk and return using a framework in which bank risk and return are treated as simultaneous. This is a gap in the literature that must be addressed.

Therefore, in this Chapter I seek to test the following hypothesis:

> **H4.1:** Measures of bank risk and bank return are simultaneous with one another because of risk-return simultaneity in the underlying assets in which banks invest and/or because of direct accounting effects linking measures of risk and return.

It should be noted that, irrespective of the cause of simultaneity, when it is present it must be accounted for in models in order to avoid bias that could arise from confounding of a simultaneous effect with the effect of some other regressor.

4.4 Simultaneity of Loan Impairments and ROA

I tested for simultaneity of risk and return using two-equation models with measures of risk and return included both as dependent variables and as explanatory variables (lagged and unlagged) for one another. Such models have not been reported previously in studies of bank ownership and governance.

Initially, I used this approach to test for simultaneity between loan interest income and loan impairments. This revealed that there is no simultaneity between loan impairments and loan interest income and no significant association with a lag (results not shown for reasons of space but can be provided upon request). This suggests that, at the portfolio level at least, loan interest income does not correlate with impairments in the manner that might be assumed based on finance theory. This, in turn, suggests that the banks in my sample are unable to price loan portfolios with different degrees of risk so as to adequately reflect portfolio default rates. This is very surprising given that there are many studies at the level of individual loan accounts showing robustly that banks engage in risk-based pricing (e.g. Magri and Pico, 2011). This suggests some market friction affecting the banks I observe which prevents such risk-based pricing of interest rates from being evident at the loan-portfolio level. Perhaps competition from a subset of lenders in the market which lack adequate information to price loans efficiently causes the expected correlation between loan interest and loan impairments to weaken at an aggregated level.

In any case, there is robust simultaneity between loan impairments and ROA as measures of risk and return, respectively. The simultaneous relationship shown in table 4.2 below is negative, likely because large impairments have a direct negative effect in accounting terms on ROA. However, the expected positive risk-return association is present with a lag of one year. The presence of this correlation in the absence of one between loan interest income and loan impairments suggests that banks are able to adjust their cost and / or income profile overall so as to align return with risk in a way that meets the expectations of their shareholders, even if they cannot achieve such alignment at the level of loan portfolios.

Models used to test hypotheses are estimated using the following equations (Table 4.1) with equation numbers used for cross-reference in regression tables.

Table 4.1 Dependent and explanatory variables in models for testing the hypothesis that risk and return are simultaneous.

Dependent Variable: loan_impairments	
All Equations (4.1 and 4.3)	Equation (4.3)
return_on_assets	L.growth_total_assets
L.return_on_assets	L.loan_interest_income
L.state_majority_owner	
L.mutual_ownership	
L.foreign_parent	
L.board_size	
L.director_ratio	
L.rem_co	
L.exec_rem_disclosed	
L.average_pay	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_deposits_over_liabs	
L.size_over_gdp	
Year Dummies	

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

Table 4.1 (contd.) Dependent and explanatory variables in models for testing the hypothesis that risk and return are simultaneous.

Dependent Variable: return_on_assets	
All Equations (4.2 and 4.4)	Equation (4.4)
loan_impairments	L.growth_total_assets
L.loan_impairments	L.loan_interest_income
L.state_majority_owner	
L.mutual_ownership	
L.foreign_parent	
L.board_size	
L.director_ratio	
L.rem_co	
L.exec_rem_disclosed	
L.average_pay	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_deposits_over_liabs	
L.size_over_gdp	
Year Dummies	

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Loan impairments and ROA are used as dependent variables because they are the main measures of risk and return in my study. In terms of explanatory variables, models differ from the baseline specification stated in Table 3.1 in two respects. Firstly, loan impairments or ROA are added as explanatory variables for one another because the purpose of these models is to test for simultaneity. These are each included with and without a lag in order to test for simultaneous and delayed-simultaneous effects. Secondly, additional explanatory variables (ones which cause a change in observation number) were added to equations 4.2 and 4.2 as a robustness test. A further robustness test involving a complete change of estimation method is reported in section 4.5.

Although this model aims to test simultaneity of risk and return, a full set of explanatory variables relating to ownership, governance and balance sheet characteristics is included, as per Table 3.1. This is because (as hypothesised in sections 5.3 and 6.4) there are reasons to expect the specific ownership and governance variables included to affect risk and return. In addition, it is reasonable to expect risk and return to vary with balance sheet characteristics since these characteristics reflect different business profiles, which will differ in financial outcomes, as explained in section 3.4. Omission of these factors could bias estimates of the effects of risk and return on one another, so they are included.

Results obtained using these equations are reported below (Tables 4.2 and 4.3). Models are estimated in linear form because a) there is no reason to expect specific nonlinear relationships to exist and b) this format is sufficient to estimate whether significant relationships exist while controlling for co-variates. Estimation is performed by 2SLS and (in the next section) GMM because these methods have different vulnerabilities to bias and using both shows robustness to a change in estimation method. Second-stage results from 2SLS are below and Appendix B shows first stage results for this and all other 2SLS estimations in this thesis.

Table 4.2 2SLS estimation results for models with simultaneity of risk and return.

	Model 1		Model 2	
	(4.1) loan_ impairments	(4.2) return_on_ assets	(4.3) loan_ impairments	(4.4) return_on_ assets
return_on_assets	**-5.056*** **		**-4.846*** **	
	(1.102)		**(1.564)**	
L.return_on_assets	**2.505*** **		**2.469** **	
	(0.804)		**(1.104)**	
loan_impairments		**-1.998** **		**-1.754*** **
		(0.802)		**(0.643)**
L.loan_impairments		**1.357** **		**0.877* **
		(0.685)		**(0.451)**
L.state_majority_owner	0.989	-1.022	0.167	-1.613*
	(0.802)	(0.796)	(0.855)	(0.828)
L.mutual_ownership	-2.425***	-0.682	-2.580***	-0.886*
	(0.734)	(0.515)	(0.856)	(0.470)
L.foreign_parent	-1.786**	-0.659	-1.733**	-1.120**
	(0.714)	(0.508)	(0.714)	(0.502)
L.board_size	0.110*	0.0598	0.0697	0.102**
	(0.0616)	(0.0468)	(0.0578)	(0.0486)
L.director_ratio	-1.684	-0.140	-0.767	0.391
	(1.600)	(1.209)	(1.509)	(1.050)
L.rem_co	-0.0893	0.430	0.0644	0.857*
	(0.612)	(0.496)	(0.617)	(0.497)
L.exec_rem_disclosed	-0.0601	-0.000494	-0.494	-0.144
	(0.441)	(0.340)	(0.412)	(0.282)
L.average_pay	5.741**	-2.916	1.108	-2.031
	(2.829)	(2.455)	(2.109)	(1.710)
L.joint_ceo_chairman	-3.093***	-0.658	-3.685***	-0.485
	(0.806)	(0.511)	(1.401)	(0.617)
L.cro_present_onboard	-0.253	-0.149	-0.241	-0.364
	(0.734)	(0.565)	(0.692)	(0.494)
L.comm_dir_board	-0.176	-0.326	-0.448	0.107
	(0.318)	(0.270)	(0.341)	(0.221)
L.female_ratio	-0.953	0.243	-1.267	0.395
	(1.971)	(1.536)	(1.860)	(1.340)
L.no_exp_ratio	0.890	0.617	0.461	0.921
	(0.900)	(0.694)	(0.860)	(0.653)
L.irb_permission	-1.069*	-0.368	-1.808**	-0.492
	(0.632)	(0.476)	(0.755)	(0.382)
L.exposure_to_banks	-1.912	2.042	-1.721	3.202*
	(1.617)	(1.623)	(2.083)	(1.817)
L.securities_holdings	-4.075**	2.016	-1.803	2.695
	(1.885)	(1.748)	(1.888)	(1.712)

L.advisory_activity	59.73***	1.540	83.58**	-23.97
	(15.12)	(11.40)	(34.83)	(24.74)
L.equity_ratio	-15.49**	17.91*	-32.65	34.78*
	(6.830)	(9.929)	(20.85)	(18.03)
L.curr_deposits_over_liabs	1.097	-0.594	1.687	-1.072
	(0.699)	(0.631)	(1.064)	(0.758)
L.size_over_gdp	0.104	-0.212	0.687	-0.249
	(0.718)	(0.558)	(0.726)	(0.482)
L.growth_total_assets			0.00305	0.000530
			(0.00610)	(0.00406)
L.loan_interest_income			0.0232	-0.0216
			(0.0213)	(0.0133)
Constant	3.959**	-1.128	4.288	-2.789
	(1.894)	(1.571)	(2.631)	(1.971)
Observations	393	393	297	297
VIFs	1.30-6.44	1.27-6.51	1.28-7.23	1.28-7.35
F statistic	5.58	2.18	8.52	3.96
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Hall-Pagan	<0.001	<0.001	0.0102	<0.001
Pr > Breusch-Pagan	<0.001		<0.001	

Year dummies included but not shown
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 4.1. Where two equations are estimated simultaneously they are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using two-stage least squares. Estimated parameter values are shown along with star symbols for statistical significance. Classical standard errors are in parentheses. Diagnostics using Hall-Pagan, Breusch-Pagan and system tests reveals the presence of heteroskedasticity in each equation and the system overall, such that GMM with clustered standard errors is used in the next section to verify results. VIFs for this set of regressors vary from 1.27 to 7.35, but this has not prevented the detection of significant associations or caused sign reversal (shown by taking smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, as expected given the predetermined nature of these regressors. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan and Pr>Hall-Pagan are probabilities of obtaining test statistics at least as extreme as those obtained under the null hypothesis of spherical error variance.

This analysis (Table 4.2) shows as clearly as possible the presence of a simultaneous relationship. This result is discussed in more detail after it is shown to be robust in the next section.

4.5 Validation in a GMM Framework

After estimation of the above models, diagnostics using Hall-Pagan, Breusch-Pagan and system tests reveals the presence of heteroskedasticity in each equation and the system overall. Since the 2SLS estimation employed does not support calculation of robust standard errors, a GMM estimator with standard errors clustered by bank was used as a complement. Employing GMM also shows that the result is robust to a change of estimation method, which is important given that 2SLS and GMM have different vulnerabilities to bias and other empirical problems. Results from GMM estimation reveal that the simultaneous relationship is robust. Models are estimated using equations 4.3 and 4.4 above, albeit with a GMM estimator in place of 2SLS. Results are as follows.

Table 4.3 GMM estimation results for models with simultaneity of risk and return.

	Model 2	
	4.3 loan_ impairments	4.4 return_on_ assets
return_on_assets	**-1.841*** (0.134)**	
L.return_on_assets	**0.322*** (0.0984)**	
loan_impairments		**-0.506*** (0.0297)**
L.loan_impairments		**0.0265 (0.0445)**
L.state_majority_owner	-0.732 (0.461)	-0.334 (0.246)
L.mutual_ownership	-1.471*** (0.387)	-0.849*** (0.218)
L.foreign_parent	-1.254*** (0.477)	-0.751*** (0.256)
L.board_size	0.0773*** (0.0270)	0.0438** (0.0178)
L.director_ratio	-0.213 (0.643)	-0.206 (0.343)
L.rem_co	0.609** (0.255)	0.269** (0.126)
L.exec_rem_disclosed	-0.298 (0.188)	-0.169* (0.0993)
L.average_pay	-0.668 (1.039)	-0.135 (0.575)
L.joint_ceo_chairman	-1.461** (0.660)	-0.909* (0.469)
L.cro_present_onboard	-0.387 (0.252)	-0.219 (0.153)
L.comm_dir_board	-0.104 (0.0946)	-0.0756 (0.0661)
L.female_ratio	-0.527 (0.492)	-0.567* (0.305)
L.no_exp_ratio	0.847*** (0.264)	0.485*** (0.165)
L.irb_permission	-0.696*** (0.248)	-0.437*** (0.149)

L.exposure_to_banks	1.344*	0.318
	(0.802)	(0.469)
L.securities_holdings	0.629	0.170
	(0.752)	(0.381)
L.advisory_activity	25.85***	20.20***
	(6.744)	(3.216)
L.equity_ratio	6.402**	0.370
	(2.577)	(1.280)
L.current_deposits_over_liabs	-0.0952	0.152
	(0.289)	(0.177)
L.size_over_gdp	0.0879	0.0251
	(0.258)	(0.143)
L.growth_total_assets	-0.00124	-8.08e-05
	(0.00342)	(0.00185)
L.loan_interest_income	-0.0118*	-0.00188
	(0.00625)	(0.00291)
Constant	0.322	0.439
	(0.729)	(0.402)
Observations	299	299
VIFs	1.31-7.23	1.28-7.35
GMM criterion Q(b)	$1.09 \times e^{-17}$	$2.11 \times e^{-19}$
Pr > F endo reg	>0.999	>0.999

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 4.1. The two equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for multicollinearity and non-spherical error variance was not possible for this estimator but can be assumed to be similar to results in Table 4.2. VIFs for this set of regressors vary from 1.28 to 7.35, but this has not prevented the detection of significant associations or caused sign reversal (shown by taking smaller sets of regressors – results not shown). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, which is as expected given the predetermined nature of these regressors. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.)

The clearest result in the above analysis (Table 4.3) and the preceding section is a simultaneous negative relationship between ROA and loan impairments. Taking the GMM estimates as definitive (because GMM is more efficient and less vulnerable to bias than 2SLS), and given how the units are defined, it appears that an increase in ROA of 1% (of total assets) is associated with a simultaneous change in loan impairments of -1.8% (of gross loans). From the other equation in the model it appears that an increase in loan impairments of 2% (of gross loans) is associated with a simultaneous change in ROA of -1.0%. These effects are roughly consistent with one another.

Given that the same-period simultaneous relationship is negative, as opposed to the positive risk-return correlation in finance theory, the most likely interpretation is that it is due to simple accounting effects. Loan impairments constitute write-downs in the value of loan assets, and such write-downs enter the Profit and Loss (P&L) account as negative items (Atrill and McLaney 2006). Thus, loan impairments lead directly to lower income and, since income is the numerator in the ROA ratio, to lower ROA.

This interpretation is supported by the fact that movements in the loan impairments ratio of a given size correspond to movements in ROA of about half that size. This is consistent if gross loans account for half of bank assets. Given that gross loans, on average, account for 58% of total bank assets in this data set, it does indeed appear that the simultaneous relationship is a result of accounting effects.

Even though this is the case, it is nevertheless vital to take account of this simultaneity in models. If we have cases where a given regressor affects ROA and / or loan impairments and we estimate the effects of this regressor without allowing for effects of ROA and loan impairments on each other, we will have bias. Thus, two-equation models are used throughout my work when loan impairments and ROA are the dependent variables. Single-equation models are used for other dependent variables.

Alongside same-period simultaneity, there is also a lagged positive effect of ROA on loan impairments. Again taking GMM estimates as definitive, this suggests that an increase in ROA of 1% (of total assets) leads to an increase in loan impairments of 0.3% (of gross loans) at a lag of one year. There is also some evidence of a lagged positive effect of loan impairments on ROA, but this is not robust in GMM with clustering of standard errors. This association is consistent with basic finance theory, as discussed in section 4.2: anything which increases return is normally expected to increase risk and vice-versa.

Not much can be concluded from the size of the parameter estimates for the lagged effects, because they differ so much in size between GMM and 2SLS. The 2SLS results suggest that a given increase in ROA leads to a much larger increase in loan impairments, suggesting that risk limitation should be the priority in banks' decisions because pursuit of returns brings disproportionate risk. The GMM results suggest that a given increase in ROA leads to a much smaller increase in loan impairments, suggesting that return can safely be pursued without too much concern for risk.

Taking the balance of these lagged results from 2SLS and GMM, one is led to a conclusion that is consistent with basic finance theory: increasing return generally leads to an increase in risk substantial enough to care about, and vice-versa. Regulators must accept this trade-off in setting policy. However, I generally find that variables which lead to lower profit have no measurable effect on provision of credit to the wider economy (as indicated by the dependent variable growth in total assets). Since I assume that credit provision and avoidance of destabilising bank failures are of greater social importance than the private profits of banks (see section 9.3) this finding implies that regulators can reasonably have a bias towards limiting risk.

This lagged positive association of risk and return that I detect exists because the returns and risk arising in a bank's portfolio ultimately flow through to investors who own that bank, and investors will insist that banks act in a manner where higher return is earned to compensate for higher risk in investments made by the bank. One would expect this association to be evident at every time lag, because bank assets are long-lived and some investments made by banks in the past that had higher returns will eventually bring higher impairments, because the higher return existed as compensation for higher risk. The correlation is reversed in the current period due to simple accounting effects, as explained.

In summary, hypothesis H4.1 is accepted: bank risk and return are indeed simultaneous on certain measures.

4.6 Comparison with Single-Equation Models

A principal motivation of the multi-equation framework used in sections 4.4 and 4.5 is to ensure that results are not biased by omitting simultaneity of risk and return. This being so, it is important to show how parameter estimates differ when equations 4.3 and 4.4 above are re-estimated using single-equation OLS. Results obtained from such estimation are as follows.

Table 4.4 Estimation results for models of ROA and loan impairments using single-equation OLS.

VARIABLES	(4.3) loan_impairments	(4.4) return_on_assets
return_on_assets	-1.372***	
	(0.196)	
L.return_on_assets	0.0758	
	(0.159)	
loan_impairments		-0.397***
		(0.0526)
L.loan_impairments		-0.0488
		(0.0385)
L.growth_total_assets	-0.00236	-0.000503
	(0.00393)	(0.00171)
L.loan_interest_income	-0.0174**	-0.000109
	(0.00842)	(0.00286)
L.state_majority_owner	-0.878*	-0.228
	(0.476)	(0.293)
L.mutual_ownership	-1.387	-0.910
	(1.342)	(0.845)
L.foreign_parent	-1.246***	-0.765***
	(0.443)	(0.280)
L.board_size	0.0908***	0.0443**
	(0.0231)	(0.0198)
L.director_ratio	0.180	-0.138
	(0.622)	(0.405)
L.rem_co	0.693**	0.218*
	(0.269)	(0.129)
L.exec_rem_disclosed	-0.279	-0.175
	(0.188)	(0.106)
L.average_pay	-0.730	0.137
	(0.927)	(0.647)
L.joint_ceo_chairman	-1.157***	-0.987*
	(0.429)	(0.502)
L.cro_present_onboard	-0.358	-0.181
	(0.300)	(0.161)
L.comm_dir_board	-0.0304	-0.0864
	(0.0975)	(0.0795)
L.female_ratio	-0.202	-0.636*
	(0.563)	(0.344)
L.no_exp_ratio	0.683**	0.372*
	(0.276)	(0.193)
L.irb_permission	-0.638**	-0.458***
	(0.281)	(0.168)

L.exposure_to_banks	1.738**	-0.0180
	(0.774)	(0.437)
L.securities_holdings	0.793	-0.167
	(0.777)	(0.325)
L.advisory_activity	14.22**	24.03***
	(5.665)	(3.627)
L.equity_ratio	12.74***	-2.722
	(3.431)	(2.231)
L.current_deposits_over_liabs	-0.325	0.291
	(0.263)	(0.191)
L.size_over_gdp	0.00187	0.0375
	(0.251)	(0.154)
Constant	-0.482	0.685
	(0.709)	(0.480)
Observations	303	297
R-squared	0.884	0.852
VIFs	1.24-7.67	1.29-7.48
F statistic	795.4	40.0
Pr > F	<0.001	<0.001
F (endo reg)	0.00	0.00
Pr > F endo reg	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 4.1. The two equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing using the Breusch-Pagan test reveals the presence of heteroskedasticity, such that clustered standard errors are used. VIFs vary from 1.24 to 7.48, but this has not prevented the detection of significant associations or caused sign reversal (shown by taking smaller sets of regressors). Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

This analysis (Table 4.4) reveals that the lagged positive association of risk and return reported in sections 4.4 and 4.5 would be overlooked if single-equation models were used. A number of other important biases would also occur if I relied on single-equation models. First, it would have appeared as if state majority ownership lowers loan impairments, the opposite of what the literature predicts. Second, I would have concluded that mutual ownership has no interesting effects at all, entirely contrary to the literature. Third, it would have appeared as if Board size positively affects both impairments and returns. Fourth, it would have appeared that a Joint CEO-Chairman has a negative effect on both impairments and returns. Fifth, and finally, it would appear as if the presence of a remuneration committee has a positive effect on both returns and impairments. Each of these errors would have altered the interpretation of my results in important ways. Specific problems that have been avoided by virtue of using multi-equation models are discussed in sections 5.4, 5.5 and 6.5.

4.7 Conclusions

The main conclusion of this chapter is that I accept hypothesis H4.1: there is indeed a robust simultaneous relationship between ROA and loan impairments. The same-period relationship appears to be entirely due to accounting effects, but it is nevertheless vital to include it in models where the effects of ownership and governance on risk and return are assessed. As demonstrated in section 4.6, failing to do so creates vulnerability to bias and raises the possibility that key results in the literature have been affected by such bias. One of the objectives of the next two Chapters is to determine if key results relating to the effects of ownership and governance hold when we allow for this simultaneity.

Alongside the same-period simultaneous relationship, there is a positive lagged effect of ROA on loan impairments, and possibly vice-versa. The lagged effect of ROA on loan impairments suggests that any factor which increases the return earned from bank assets tends to also increase risk. This is consistent with basic finance theory (Jones, 2008): increased asset returns are demanded as compensation for taking more risk. The converse relationship, if true, is also consistent with finance theory: increased risk will lead to increased return as the price of the relevant assets drops when it is sold by more risk-averse investors.

This finding is important in a number of respects. First, it shows the general applicability of basic finance theory as explained in Jones (2008). There are many situations where the risk-return correlation predicted by basic finance theory breaks down, as discussed in Bebczuk (2003) and other works referenced in section 6.3. However, if we can demonstrate that higher return is associated with higher risk within entities as complex as banks, then the basic hypothesis that risk and return are correlated has very general applicability.

Second, showing same-period simultaneous and lagged-simultaneous relationships between bank risk and return it makes it essential that a simultaneous equations framework is used whenever return on assets and loan impairments are the dependent variables. If it is not, then bias may well be the consequence. Section 4.6 demonstrates that very different parameter estimates can arise when simultaneity is omitted, which could lead to entirely different interpretations of results.

Third, knowing that bank risk and return are correlated is important for interpreting results, even for dependent variables where a simultaneous equations framework is not needed. When we know that, even in an environment as complex as a bank, the classical risk-return trade-off can arise, then any effect on risk should be interpreted in the context of possible effects on return, and vice-versa. There may be situations where informational considerations cause this correlation to break down (as per Bebczuk, 2003) but, even here, we must discuss the correlation that could exist and why information limitations or asymmetries mean that it does not.

Chapter 5: The Role of Bank Ownership

5.1 Introduction

In this chapter I test hypotheses that different forms of bank ownership – by the state, depositors or a foreign parent – have effects on bank risk and return. This uses the basic methodological approach described in Chapter 3 and the simultaneous models developed in Chapter 4, with the main dependent variables being ROA, ROE, loan impairments and combined failure, as defined in section 3.8, because these are measures of risk and return. Loan interest income is also used as a dependent variable for effects of state majority ownership, because the literature argues that state-owned banks give soft loans. In addition, growth in total assets was also considered for all explanatory variables as a means to determine if effects on bank outcomes are accompanied by effects on investment in the wider economy. (The conclusion was that they are not, so these results are not shown, although they can be provided on request).

Unlike any previous study, I use multi-equation models to avoid the bias that results if simultaneity between risk and return is omitted. In this framework, I show that mutual ownership and a foreign parent each have a negative effect on both risk and return. This is the first time a multi-equation framework has been used in this way to show that important results relating to bank ownership hold when allowing for simultaneity of risk and return. The results for mutual ownership confirm theoretical predictions (Schleifer and Vishny, 1997) and earlier empirical work (Iannotta *et al,* 2007) and those for a foreign parent add to knowledge in the sense that the combination of effects I report has not been observed before. The effects of foreign ownership on risk and return suggest that cross-border information asymmetries overcome the greater resources and diversification that come with cross-border operations in banking.

The similarity of foreign-owned banks to mutual banks is contrary to the typical view of international banks as being efficient. Specifically, it suggests that distance from the ultimate shareholders leads to reduced pressure on managers to take risk and pursue profit, which are generally taken to be the priorities of shareholders (e.g. Jensen and Meckling, 1976).

I corroborate these results with findings from single-equation models showing that mutual ownership and a foreign parent have negative effects on return on equity, an indicator of return that was shown in the work reported in the preceding Chapter to not be simultaneous with risk. Another novel finding I obtain is that the presence of a foreign parent is associated with a greater likelihood of bank failure. This suggests that, in crisis periods, the adverse effects of foreign ownership on bank returns are more important than the beneficial effects on loan impairments (which may be the case because ROE has a direct impact on solvency and a foreign parent has a large impact on ROE). The same does not occur for mutual banks because the effect of foreign ownership on returns is roughly twice as large as that of mutual ownership.

Further novel findings are that state majority ownership has a negative effect on loan interest income (which was not previously used as a measure of performance in studies of this kind) and that state majority ownership increases the likelihood of failure events. The former is consistent with theoretical predictions (Schleifer and Vishny 1997) and earlier empirical work (Iannotta *et al* 2007) and suggests that state-owned banks obtain low earnings from loans because they have other priorities alongside financial ones. It cannot be the case that state-owned banks in this sample simply owned loans in periods when loan returns were lower – this interpretation is precluded by the inclusion of year dummies in models.

The effect of state majority ownership on bank failure probably occurs because state ownership arises in this sample mainly due to stress, and on-going stress raises the probability of further failure events. Control variables cannot be used to exclude this interpretation because the stress of 2007-2009 took forms that are not easily modelled in a study of this kind, including short-term liquidity movements and sentiment effects.

In addition, I find that state ownership, mutual ownership and a foreign parent have no effects on rates of growth in bank assets. This suggests that, although these can lead to lower performance for banks, they do not affect the provision of credit and other forms of investment to the wider economy. This suggests that mutual ownership, in particular, is associated with lower risk, less profit taken from customers, fewer conflicts of interest with customers (Gupta, 2014) and no loss of investment for the wider economy.

These findings are important because they confirm the effects of mutual ownership in a new framework against a background where only a few empirical papers have addressed the matter; they confirm the effects of state ownership with a new dependent variable that is indicative of granting soft loans; and they show for the first time that foreign ownership is associated (in some applied settings at least) with lower returns, lower loan impairments and higher risk of bank failure, but no effect on credit provision to the wider economy. These results naturally have policy implications, as discussed in section 5.7.

In the remainder of this Chapter, sections 5.2 and 5.3 respectively consider previous literature and use it to develop the specific hypotheses that I test. Section 5.4 tests hypotheses relating to state majority ownership while 5.5 deals with mutual and foreign ownership and 5.6 considers implications of all of these for bank failure. Section 5.7 synthesises results and considers policy implications.

5.2 Key Results in the Literature

As discussed in Chapter 2, the relevant literature using agency theory suggests that the objectives of owners affect the behaviour of firms, including banks (Schleifer and Vishny, 1997). State majority ownership is expected to lead to lower returns compared to shareholder-owned banks, at the same time as leading to higher risk. Mutual ownership is expected to lead to lower returns compared to shareholder-owned banks, at the same time as leading to lower risk. There is no clear prediction of the effect of foreign ownership: if information asymmetries and other effects of working across borders dominate then foreign ownership may have one set of effects, but if diversification and greater resources (of people, technology and financing) dominate then it may have different effects. Several studies using empirical data support the view that government ownership is associated with increased risk (Angkinand and Whilborg 2010, Iannotta *et al* 2012 and Dong *et al* 2014) and others find that it is associated with both higher risk and lower return (Iannotta *et al* 2007 and Cornett *et al* 2010).

The results for mutual ownership appear equally clear-cut, and are again in accordance with agency theory, although they are based on a very limited number of studies. Marco and Fernandez (2007) find that mutual ownership is associated with lower risk, while Iannotta *et al* (2007) find that it is associated with lower risk and lower return.

Empirical results for foreign ownership are contradictory. Angkinand and Whilborg (2010) report a positive effect of foreign ownership on bank risk, but Forssbaeck (2011) finds no effect and results from Chen and Liao (2011) suggest the effects are highly context-dependent, being affected by profitability of the parent entity and levels of competition in the host market. This suggests that foreign ownership is not a fundamental characteristic of a bank and that its effects depend on which of its corollaries (such as greater diversification or greater information asymmetry) are dominant in a particular applied setting.

In summary, the relevant empirical literature tells us that state majority ownership increases risk and return, while mutual ownership reduces risk and return. Foreign ownership and managerial ownership each have effects that are very much context-dependent. Concentration of owners' personal wealth in banks' equity reduces risk, while the presence of shareholders that own large blocks of the bank increases risk.

5.3 Literature Gaps and Hypotheses

As discussed in section 4.2, finance theory treats risk and return as simultaneous. My results in Chapter 4 confirm the hypothesis that they are simultaneous in the case of banks and I show that omitting this simultaneity can seriously bias estimates of other parameters. However, as discussed in section 2.9, no empirical studies have assessed the effects of ownership and governance on bank risk and return using a framework in which risk and return are treated as simultaneous. It is therefore necessary to re-test the effects of state, mutual and foreign ownership reported in the literature in a framework in which risk and return are treated as simultaneous.

Therefore, in this Chapter I seek to test the following hypotheses:

> **H5.1:** State majority ownership has a positive effect on risk and/or a negative effect on return, for the reasons stated in the literature (see section 2.5).
>
> **H5.2:** Mutual ownership has a negative effect on risk and/or a negative effect on return, for the reasons stated in the literature (see section 2.5).
>
> **H5.3:** A foreign parent entity has effects on risk and return, but the sign of these effects can only be determined empirically as it depends on which of the following are dominant: cross-border information asymmetries or the effects of greater diversification and resources.

Hypothesis H5.3 is obviously less precisely-specified than the other two, but this is inevitable given that the signs of the relationships involved are considered purely empirical matters.

To correct for possible bias in results arising from omission of simultaneity, the above hypotheses are tested in a simultaneous equations framework in which risk and return are allowed to affect each other simultaneously and with a lag.

5.4 State Ownership and Loan Interest Income

The empirical analysis below shows that state majority ownership has a negative effect on loan interest income in single-equation models. This is robust and consistent with the literature on agency theory. There have been no studies that have used loan interest income in this way, which is important because loan interest income is a measure of the extent to which income is prioritised and earned (in this case on loans) that is relatively homogenous across banks and thus comparable between state-owned banks and other banks. In addition, the omission of loan interest income as a dependent variable meant that the argument that state-owned banks grant soft loans (Gonzalez-Garcia and Grigoli, 2013) has not been tested as well as it could be, until now.

Models used to test hypotheses are estimated using the following equations (Table 5.1) with equation numbers used for cross-reference in regression tables.

Table 5.1 Dependent and explanatory variables in models for testing hypotheses that ownership types affect loan interest income.

Dependent Variable: loan_interest_income			
All Equations (5.1 to 5.4)	Equation (5.2)	Equation (5.3)	Equation (5.4)
L.state_majority_owner	L.joint_ceo_chairman	L.board_size	L.board_size
L.mutual_ownership	L.cro_present_onboard	L.director_ratio	L.director_ratio
L.foreign_parent	L.comm_dir_board	L.rem_co	L.rem_co
L.growth_total_assets	L.female_ratio	L.exec_rem_disclosed	L.exec_rem_disclosed
L.loan_impairments	L.no_exp_ratio	L.average_pay	L.average_pay
L.return_on_assets	L.irb_permission	L.joint_ceo_chairman	L.joint_ceo_chairman
L.return_on_equity		L.cro_present_onboard	L.cro_present_onboard
L.exposure_to_banks		L.comm_dir_board	L.comm_dir_board
L.securities_holdings		L.female_ratio	L.female_ratio
L.advisory_activity		L.no_exp_ratio	L.no_exp_ratio
L.equity_ratio		L.irb_permission	L.irb_permission
L.curr_dep_over_liabs			
L.size_over_gdp			
Year dummies			

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

Loan interest income is used as a dependent variable in these equations because it is argued in the literature that state banks give soft loans and thus earn less on their loans (Gonzalez-Garcia and Grigoli, 2013). In terms of dependent variables, my model specification differs from the baseline specification stated in Table 3.1 in that variables that are used elsewhere in my empirical work as dependent variables (growth in total assets, loan impairments, ROA and ROE) are added here as lagged explanatory variables (not simultaneous terms). This is because outcomes in these other key measures of performance could, in principle, affect decisions in respect of loan interest income, or reflect general risk appetite and strategic priorities, with implications for loan interest income. In the absence of simultaneity between loan interest income and any other financial outcome, these variables serve to control for the possibility that outcome variables in my study affect one another. This is especially important in the case of loan interest income as a dependent variable in light of literature (Tokle *et al,* 2015 and Trinugroho *et al*, 2014) showing that the general financial performance and status of banks can determine the loan interest rates they charge.

Although the specific objective of this analysis is to test hypotheses relating to the effects of ownership, it is necessary to include aspects of governance that I argue also have an effect (as per section 6.4) below. It is also necessary to include controls for balance sheet characteristics since these represent different business models that could entail different levels of loan interest income, as discussed in section 3.4. Thus, to have a properly-specified model that is not vulnerable to bias in estimating the effects of ownership characteristics, I include each of these categories of regressor in the model. Model specification is varied across equations to show robustness.

Models are estimated in linear form since there is no reason to expect specific nonlinear forms and a linear format is sufficient to test the effect of hypotheses whilst controlling for covariates. I use a mixture of estimation methods: OLS for equations 5.1 to 5.3 and random effects for 5.4. This is to ensure that results are not biased by unobserved heterogeneity (a vulnerability of OLS) or by correlation of panel-unit-specific intercepts with regressors (a vulnerability of random effects). If results are not specific to a particular estimation method, they are more credible. Results are as follows.

Table 5.2 Estimation results for effects of state ownership on loan interest income.

	OLS	OLS	OLS	Random Effects
	(5.1) loan_ interest_ income	(5.2) loan_ interest_ income	(5.3) loan_ interest_ income	(5.4) loan_ interest_ income
L.state_majority_ owner	**-5.172****	**-3.413****	**-3.515****	**-3.308***
	(2.560)	**(1.559)**	**(1.756)**	**(1.755)**
L.mutual_ownership	0.940	0.805	0.334	0.220
	(1.060)	(1.192)	(1.053)	(1.083)
L.foreign_parent	-0.991	0.244	-0.218	-0.296
	(1.505)	(1.251)	(1.079)	(1.109)
L.growth_total_assets	-0.00783	0.00254	0.00113	0.00101
	(0.0133)	(0.00864)	(0.00708)	(0.00707)
L.loan_impairments	-0.126	0.283	0.241	0.215
	(0.346)	(0.235)	(0.276)	(0.257)
L.return_on_assets	0.513	1.245**	1.184*	1.081*
	(0.462)	(0.547)	(0.641)	(0.607)
L.return_on_equity	-0.0125***	-0.0163***	-0.0179***	-0.0179***
	(0.00403)	(0.00335)	(0.00256)	(0.00218)
L.board_size			0.0956	0.113
			(0.121)	(0.131)
L.director_ratio			2.994	2.729
			(2.394)	(2.434)
L.rem_co			-0.612	-0.735
			(0.790)	(0.849)
L.exec_rem_disclosed			0.887*	0.924*
			(0.521)	(0.525)
L.average_pay			5.885	6.706*
			(3.772)	(4.044)
L.joint_ceo_chairman		-0.737	-1.544	-1.573
		(1.624)	(2.004)	(2.037)
L.cro_present_onboard		-0.244	0.609	0.487
		(0.353)	(0.531)	(0.516)
L.comm_dir_board		0.269	0.255	0.160
		(0.266)	(0.336)	(0.345)
L.female_ratio		1.645	1.776	2.166
		(2.268)	(2.760)	(2.933)
L.no_exp_ratio		-0.0332	-1.129	-1.166
		(1.532)	(1.403)	(1.442)
L.irb_permission		-0.944	-1.309	-1.680
		(1.405)	(1.590)	(1.873)

L.exposure_to_banks	15.85**	9.077*	8.303*	8.114
	(7.473)	(5.253)	(4.943)	(5.043)
L.securities_holdings	7.069	2.878	-0.803	-1.558
	(4.464)	(1.938)	(3.421)	(3.789)
L.advisory_activity	59.81	21.29	26.26	24.83
	(39.14)	(45.42)	(46.88)	(46.66)
L.equity_ratio	-4.873	1.833	2.136	1.425
	(6.887)	(5.460)	(6.330)	(6.597)
L.curr_dep_over_liabs	-2.434**	-1.696**	-0.859	-0.809
	(1.158)	(0.749)	(0.693)	(0.709)
L.size_over_gdp	-0.409	0.523	0.694	0.932
	(1.067)	(1.767)	(1.769)	(1.990)
Constant	5.582***	3.859*	1.307	1.730
	(1.613)	(1.943)	(2.805)	(2.849)
Observations	357	310	308	308
R-squared	0.276	0.269	0.291	0.289
VIFs	1.21-4.52	1.11-7.73	1.35-8.19	1.35-8.19
F statistic	9.5	110.8	105.0	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				2538.6
Pr > Chi^2				<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note Equation numbers are as stated in Table 5.1. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 4.1 to 4.3 are estimated using OLS, while 4.4 is estimated using a panel model with random effects, for comparison purposes. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.21 to 8.19, but this has not prevented the detection of significant associations or caused sign reversals (as shown using subsets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

The above results (Table 5.2) show a negative effect of state majority ownership on loan interest income that is robust across variations in specification and estimation method. Given the units employed, they suggest that loan interest income is 3.3% to 5.2% lower (as a percentage of gross loans) in state-owned banks compared to other banks. Against a mean value of loan interest income in this data set of 6.6%, these are large effects.

These results are consistent with agency theory and earlier empirical work, both of which suggest that state-owned banks have lower performance than other banks because they pursue other objectives, social or political in nature. In certain times and places, 'soft loans' have been used to boost the economy, the public sector, other target sectors or segments of the population from which the incumbent government seeks political support (e.g. Gonzalez-Garcia and Grigoli, 2013). Some of these goals may be considered more laudable than others, but they all have financial implications for banks.

Lending standards, in particular, can easily be adjusted for the sake of social and political objectives. Assuming demand for credit is present and financing is available to the bank, a state-owned bank need only reduce its credit score cut-offs for lending or adjust the interest rates payable on loans, selectively or in general, in order to expand the flow of credit. Thus, the presence of lower loan interest income for state-owned banks lends particular support to the hypothesis that such banks have other goals alongside financial ones.

This is plausible even in the UK, which is considered to have comparatively high standards in terms of avoiding public corruption and corporate governance. As explained by Churm *et al* (2012), in the aftermath of the global financial crisis and subsequent economic crisis in the years 2007-2012, the UK authorities introduced a policy known as the Funding for Lending Scheme (FLS) in which banks were granted concessionary Bank of England financing conditional on expanding lending to small and medium enterprises. This was accompanied by media pressure on banks in general and political pressure on state-owned banks in particular to actually lend, given the state of the economy.

Iannotta *et al* (2007) report that government ownership in European banks lowers operating income by 0.2% (of total assets) and lowers operating profit by 0.5% (of total assets). Average values of these dependent variables were low in their sample, at less than 1.3% and 3.3% respectively. Nevertheless, the comparative magnitude of effect I discover for loan interest income in my sample is at least three times as large, relative to the average value of the dependent variable.

This suggests that, in my sample, loan interest income is a variable which is particularly susceptible to the effects of state ownership. This cannot be because of the particular subset of state-owned banks included because these differ by country of origin and when they entered state ownership. Instead, it must be that state ownership generally has large effects on lending behaviour.

It could be argued that state-owned banks need to offer higher interest rates on deposits in order to attract such funding if they came into state ownership as a result of stress. If they do not, depositors might go elsewhere. State banks might then need to charge higher interest on loans in order to afford higher deposit interest rates. However, this is the opposite of what I observe and so can be ruled out.

Another alternative argument is simply that the state-owned banks in the sample were present in time periods where returns on loans were lower. However, this interpretation is excluded by the use of year dummies as controls for general macroeconomic, macro-financial and regulatory conditions.

It is crucial to note that, if a multi-equation framework had not been used and tested in sections 4.4 to 4.6, I would have reached the erroneous conclusion that state majority ownership also has a negative effect on loan impairments. Faced with the combination of this erroneous result and the reliable results of section 5.4, I would have concluded that state ownership leads to less-risky lending and, in the classical risk-return trade-off, lower returns from lending. The distinction between my actual conclusions and this potential error is crucial in that it shows that empirical work must, if it is to consistently confirm the hypothesis that state ownership makes banks less financially efficient, take account of simultaneity between risk and return.

It is also interesting to note that, for most of the indicators of risk and return I consider, state majority ownership has no robust effect. Earlier studies report positive effects on risk and negative effects on return using such dependent variables as profitability, stock returns, solvency and agency ratings. For indicators similar to these, I do not find such effects.

Why might this difference exist? It cannot be that state-owned banks in the UK do not offer any soft loans; this is contradicted by the effect I find on loan interest income. Likewise, it cannot be that the UK government is better at running banks than other sovereigns; this is excluded by the fact that the state-owned banks in my sample were owned by a range of governments (UK, European and Middle Eastern). The remaining interpretation is that the operating context in the UK is somehow different, such that granting of soft loans does not lead to adverse effects on ROA, ROE or loan impairments. It may be that the institutional framework in the UK is such that soft loans do not necessarily lead to higher credit losses, perhaps because of better governance, while lost interest income can be offset in some way. Some support for this conclusion is provided by Lensink *et al* (2008) who argue that differences in national institutions can modulate the effects of ownership type.

My finding that state ownership is not inefficient on every measure contrasts with wider literature which suggests that government involvement in business is universally inefficient. For instance Pack and Saggi (2006) suggest that industrial policy[4] is always considered to be inefficient on the grounds that governments lack the right information or incentives to do it well, while Gonzales-Garcia and Grigoli (2013) suggest that this financial inefficiency includes banks, because of the granting of soft loans to political supporters of the incumbent government.

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[4] The term is used in this context to mean any state involvement in business, including ownership of companies or other policies targeted at specific sectors and firms. This often includes banks, with the goal being to direct credit to favoured sectors of the economy.

My findings suggest a more nuanced conclusion: that state ownership of banks is financially inefficient on some measures but not others. This is consistent with arguments that industrial policy can be effective (Esteban *et al,* 2013) and that it works well when there are effective information flows between the state and firms (Rodrik, 2007).

In conclusion, I accept hypothesis H5.1: there is indeed robust evidence of a negative effect of state majority ownership on bank returns (and, in section 5.6 I also find the predicted effect on risk). However, it should be noted that I find an impact only on certain measures of returns and no adverse effect on impairments. Implications of these finding for economic policy are discussed in section 5.7.

5.5 Mutual and Foreign Ownership – Similarity in Effects

My analysis below shows that mutual ownership and a foreign parent have a negative effect on ROE in single-equation models. These effects are robust to variations in model specification. The effect of mutual ownership is consistent with predictions of agency theory reported in the literature, while that of a foreign parent suggests that information asymmetries dominate over the effects of diversification in this setting. This is the first time the effects of foreign ownership have been found to mirror those of mutuality in this way.

Models used to test hypotheses are estimated using the following equations (Table 5.3) with equation numbers used for cross-reference in regression tables.

Table 5.3 Dependent and explanatory variables in models for testing hypotheses that ownership types affect ROE.

Dependent Variable: return_on_equity			
All equations (5.5 to 5.8)	Equation (5.6)	Equation (5.7)	Equation (5.8)
L.state_majority_owner	L.joint_ceo_chairman	L.board_size	L.board_size
L.mutual_ownership	L.cro_present_onboard	L.director_ratio	L.director_ratio
L.foreign_parent	L.comm_dir_board	L.rem_co	L.rem_co
L.growth_total_assets	L.female_ratio	L.exec_rem_disclosed	L.exec_rem_disclosed
L.loan_impairments	L.no_exp_ratio	L.average_pay	L.average_pay
L.loan_interest_income	L.irb_permission	L.joint_ceo_chairman	L.joint_ceo_chairman
L.exposure_to_banks		L.cro_present_onboard	L.cro_present_onboard
L.securities_holdings		L.comm_dir_board	L.comm_dir_board
L.advisory_activity		L.female_ratio	L.female_ratio
L.equity_ratio		L.no_exp_ratio	L.no_exp_ratio
L.curr_dep_over_liabs		L.irb_permission	L.irb_permission
L.size_over_gdp			
Year dummies			

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Return on equity is used as a dependent variable because it is an important measure of bank performance that one would expect to be affected by characteristics which affect the appetite for profit or the ability to achieve it (given that it is likely to be the principal objective of shareholders as argued in section 3.4) and results are complemented by consistent results for ROA and loan impairments later in this section.

Amongst the explanatory variables, the only difference between these equations and the basic model specification stated in Table 3.1 is that variables that are used elsewhere in this study as dependent variables are included here as lagged explanatory variables (not simultaneous terms) for the same reasons as stated at the outset of section 5.4 and in section 3.4.

Although my objective here is to test hypotheses relating to the effects of ownership, I include governance variables and balance sheet characteristics also. This is because, as explained in section 6.4, there are reasons to believe that these governance characteristics affect bank risk and return, while it is likely that difference balance sheet compositions reflect different business models with different levels of risk and return, as discussed in section 3.4. Thus, omission of either of these sets of characteristics could lead to mis-specification and bias, so they are retained in the model. Model specifications are varied across the four equations in order to conduct robustness testing.

Models are estimated in linear form because there is no reason to believe in any particular nonlinear relationship and because this format is sufficient to test the significance of one relationship while treating covariates as held constant. Equations 5.5 to 5.7 are estimated by OLS while 5.8 is estimated by random effects. This is to show that my results are not specific to any one estimation method and not biased by the particular vulnerabilities of each method. Results are as follows.

Table 5.4 Single-equation estimation results for effects of mutuality and a foreign parent on return on equity.

	OLS	OLS	OLS	Random Effects
	(5.5) return_on_ equity	(5.6) return_on_ equity	(5.7) return_on_ equity	(5.8) return_on_ equity
L.state_majority_owner	-3.895	-7.947*	-6.429	-5.361
	(5.005)	(4.614)	(4.235)	(4.402)
L.mutual_ownership	**-1.212**	**-7.458****	**-7.303***	**-7.352***
	(4.039)	**(3.658)**	**(3.721)**	**(3.932)**
L.foreign_parent	**-6.410***	**-9.124****	**-13.44*****	**-12.66*****
	(3.711)	**(3.617)**	**(4.160)**	**(4.430)**
L.growth_total_assets	0.0445*	0.0179	0.00540	0.0182
	(0.0244)	(0.0229)	(0.0255)	(0.0225)
L.loan_impairments	-0.711	-1.333*	-1.450	-1.029
	(0.863)	(0.798)	(0.873)	(0.855)
L.loan_interest_income	-0.0567	-0.0906*	-0.105**	-0.0832*
	(0.0543)	(0.0455)	(0.0481)	(0.0505)
L.board_size			0.681*	0.784*
			(0.402)	(0.418)
L.director_ratio			-4.398	-2.809
			(8.042)	(8.428)
L.rem_co			1.247	0.472
			(3.016)	(3.586)
L.exec_rem_disclosed			-2.969	-2.348
			(1.939)	(2.078)
L.average_pay			20.54	24.91*
			(13.34)	(14.63)
L.joint_ceo_chairman		-20.55	-21.22	-22.63
		(15.39)	(14.79)	(15.91)
L.cro_present_onboard		0.230	-1.678	-1.582
		(2.120)	(2.472)	(2.379)
L.comm_dir_board		0.825	0.0887	0.444
		(1.561)	(1.551)	(1.595)
L.female_ratio		-19.54***	-14.45**	-7.806
		(6.705)	(5.677)	(6.240)
L.no_exp_ratio		10.44**	7.301*	7.047*
		(4.292)	(3.953)	(4.238)
L.irb_permission		-3.338	-4.623	-5.223
		(3.096)	(3.494)	(3.489)
L.exposure_to_banks	2.131	-3.703	-2.960	-5.737
	(7.790)	(9.205)	(10.13)	(11.62)

L.securities_holdings	6.577	3.860	-6.680	-10.51
	(6.178)	(5.052)	(9.217)	(10.33)
L.advisory_activity	132.7***	118.7*	104.2	95.10
	(41.58)	(60.41)	(69.01)	(69.87)
L.equity_ratio	10.05	23.17	20.25	14.67
	(31.81)	(24.78)	(24.46)	(24.83)
L.curr_dep_over_liabs	4.477	4.125	4.392	5.988
	(2.919)	(3.434)	(3.789)	(4.059)
L.size_over_gdp	2.822	4.365	4.157	4.130
	(2.649)	(3.427)	(3.638)	(3.564)
Constant	3.598	7.811	4.872	1.986
	(5.948)	(4.888)	(8.436)	(8.610)
Observations	349	305	304	304
R-squared	0.180	0.339	0.373	0.366
VIFs	1.13-4.45	1.12-6.69	1.29-7.08	1.29-7.08
F statistic	11.6	16.5	12.3	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				382.6
Pr > Chi^2				<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 5.3. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 4.5 to 4.7 are estimated using OLS, while 4.8 is estimated as a panel model with random effects, for comparison purposes. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.13 to 7.08, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, as was expected for this set of regressors. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as large as that obtained under the null hypothesis of spherical error variance.

These results (Table 5.4) show clear negative effects of mutual ownership and a foreign parent on return on equity. In mutual banks, ROE is 7.3% to 7.5% (of total equity) lower compared to non-mutuals *ceteris paribus*. In banks with a foreign parent, ROE is 6.4% to 13.4% lower compared to other banks *ceteris paribus*. Given that the average value of ROE in the sample is 4.4%, these are very large effects. However, it is important to note that the full scale of an effect such as this measured using a regression will never be evident in practice; this is because it will obviously be offset by the other causal effects such that smaller variation in the outcome variable is observed.

The effects of mutual ownership are as predicted by theory and shown in earlier empirical studies (e.g. Iannotta *et al* 2007). Those for a foreign parent also add to knowledge. In particular, it has not been previously shown that a foreign parent has the combination of effects I report in this Chapter, or that it has effects mirroring those of mutuality. The significance of these findings is discussed in more detail at the end of the section.

In order to validate this result I show that it holds in a framework where risk and return are treated as simultaneous. This analysis using simultaneous equation models shows that mutual ownership has negative effects on loan impairments and ROA. A foreign parent also has negative effects on loan impairments and ROA. This is the first time that such effects have been demonstrated using a simultaneous equation model. The effects are robust, including to switching estimation method and adjustment for non-spherical error variance in the second table below.

Models used to test hypotheses in a simultaneous equations framework are estimated using the following equations (Table 5.5) with equation numbers used for cross-reference in regression tables.

Table 5.5 Dependent and explanatory variables in models for testing hypotheses that ownership types affect ROA and loan impairments.

Dependent variable: loan_impairments	
All equations (5.9 and 5.11)	Equation (5.11)
L.state_majority_owner	L.board_size
L.mutual_ownership	L.director_ratio
L.foreign_parent	L.rem_co
return_on_assets	L.exec_rem_disclosed
L.return_on_assets	L.average_pay
L.growth_total_assets	
L.loan_interest_income	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_dep_over_liabs	
L.size_over_gdp	
Year dummies	

Table 5.5 (contd.) Dependent and explanatory variables in models for testing hypotheses that ownership types affect ROA and loan impairments

Dependent variable: return_on_assets	
All equations (5.10 and 5.12)	Equation (5.12)
L.state_majority_owner	L.board_size
L.mutual_ownership	L.director_ratio
L.foreign_parent	L.rem_co
loan_impairments	L.exec_rem_disclosed
L.loan_impairments	L.average_pay
L.growth_total_assets	
L.loan_interest_income	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_dep_over_liabs	
L.size_over_gdp	
Year dummies	

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

These models use the same basic specification as Table 3.1, with the only exception being that simultaneous effects between loan impairments and return on assets (and also lagged effects of these variables on one another) are introduced. This is done because Chapter 4 confirmed that these variables have simultaneous and lagged effects on one another and showed that omission of such effects can cause bias. Robustness testing is conducted by varying the specification across models to show that results are not dependent on one specification. Additional robustness testing is carried out in section 5.6 below, this time by changing estimation method entirely to show that results are not dependent on one estimation method.

Although the objective is to test hypotheses relevant to the effects of ownership types on risk and return, and to estimate the parameters necessary to do so, characteristics relating to governance and balance sheet structure are retained in the model. This is because, as explained in section 6.4, there are reasons to expect governance structures to have effects, while it is also plausible that risk and return vary with business model, which is reflected in balance sheet structure (as per discussion in section 3.4). Omission of either set of variables could cause mis-specification and bias, so they are retained.

Models are estimated in linear form because there is no theory which suggests any particular nonlinear form which should be used. In addition, a linear form is sufficient to determine if hypothesised relationships are significant while treating co-variates as if they were held constant. These models are estimated by 2SLS because this is a method of estimating multi-equation systems that is unbiased and consistent under reasonable assumptions. The effects of switching to GMM as an estimation method are evaluated in the next section.

Table 5.6 Multi-equation 2SLS estimation results for effects of bank ownership in models with simultaneity of risk and return.

	Model 1		Model 2	
	(5.9) loan_ impairments	(5.10) return_on_ assets	(5.11) loan_ impairments	(5.12) return_on_ assets
L.state_majority_owner	**0.173**	**-2.418***	**0.167**	**-1.613***
	(0.891)	**(1.320)**	**(0.855)**	**(0.828)**
L.mutual_ownership	**-2.805*****	**-0.778**	**-2.580*****	**-0.886***
	(0.932)	**(0.605)**	**(0.856)**	**(0.470)**
L.foreign_parent	**-1.324****	**-1.189***	**-1.733****	**-1.120****
	(0.653)	**(0.626)**	**(0.714)**	**(0.502)**
return_on_assets	-5.301***		-4.846***	
	(1.592)		(1.564)	
L.return_on_assets	2.849**		2.469**	
	(1.145)		(1.104)	
loan_impairments		-2.210**		-1.754***
		(1.020)		(0.643)
L.loan_impairments		1.289*		0.877*
		(0.751)		(0.451)
L.growth_total_assets	0.00526	0.00258	0.00305	0.000530
	(0.00668)	(0.00539)	(0.00610)	(0.00406)
L.loan_interest_income	0.0277	-0.0244	0.0232	-0.0216
	(0.0218)	(0.0181)	(0.0213)	(0.0133)
L.board_size			0.0697	0.102**
			(0.0578)	(0.0486)
L.director_ratio			-0.767	0.391
			(1.509)	(1.050)
L.rem_co			0.0644	0.857*
			(0.617)	(0.497)
L.exec_rem_disclosed			-0.494	-0.144
			(0.412)	(0.282)
L.average_pay			1.108	-2.031
			(2.109)	(1.710)
L.joint_ceo_chairman	-4.003***	-0.405	-3.685***	-0.485
	(1.449)	(0.806)	(1.401)	(0.617)
L.cro_present_onboard	0.226	-0.734	-0.241	-0.364
	(0.715)	(0.665)	(0.692)	(0.494)
L.comm_dir_board	-0.421	0.258	-0.448	0.107
	(0.354)	(0.304)	(0.341)	(0.221)
L.female_ratio	-1.964	1.469	-1.267	0.395
	(2.108)	(2.026)	(1.860)	(1.340)
L.no_exp_ratio	0.662	1.364	0.461	0.921
	(0.862)	(0.858)	(0.860)	(0.653)

L.irb_permission	-1.844**	-0.416	-1.808**	-0.492
	(0.790)	(0.497)	(0.755)	(0.382)
L.exposure_to_banks	-2.058	3.731	-1.721	3.202*
	(2.058)	(2.503)	(2.083)	(1.817)
L.securities_holdings	-1.414	2.568	-1.803	2.695
	(1.466)	(1.774)	(1.888)	(1.712)
L.advisory_activity	92.32***	-32.00	83.58**	-23.97
	(34.32)	(34.81)	(34.83)	(24.74)
L.equity_ratio	-37.22*	46.22*	-32.65	34.78*
	(21.06)	(27.79)	(20.85)	(18.03)
L.curr_dep_over_liabs	2.000*	-1.725	1.687	-1.072
	(1.157)	(1.227)	(1.064)	(0.758)
L.size_over_gdp	0.807	0.396	0.687	-0.249
	(0.690)	(0.584)	(0.726)	(0.482)
Constant	4.274**	-1.662	4.288	-2.789
	(1.851)	(1.789)	(2.631)	(1.971)
Observations	298	298	297	297
VIFs	1.12-6.77	1.12-6.91	1.28-7.23	1.28-7.35
F statistic	8.20	2.68	9.55	3.96
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Hall-Pagan	<0.001	<0.001	0.007	<0.001
Pr > Breusch-Pagan	<0.001		<0.001	

Year dummies included but not shown
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 5.5. Where two equations are estimated simultaneously they are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using two-stage least squares. Estimated parameter values are shown along with star symbols for statistical significance. Classical standard errors are in parentheses. Diagnostic testing using using Hall-Pagan, Breusch-Pagan and system tests shows the presence of non-spherical error variance in each equation and the system overall, such that this analysis is followed up with GMM estimation using clustered standard errors. VIFs for this set of regressors vary from 1.12 to 7.35, but this has not prevented the detection of significant associations or caused sign reversal (as shown with smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

This analysis (Table 5.6) appears to show negative effects of mutual ownership and a foreign parent on loan impairments and ROA. However, since the 2SLS estimation employed does not support calculation of robust standard errors, and since it is necessary to show robustness to a change in estimation method, a GMM estimator with clustered standard errors was used as a complement. Models are estimated using equations 4.11 and 4.12 above, albeit with GMM in place of 2SLS as the estimator. Results are as follows.

Table 5.7 Multi-equation GMM estimation results for effects of ownership in models with simultaneity of risk and return.

	Model 2	
	(5.11) loan_ impairments	(5.12) return_on_ assets
L.state_majority_owner	-0.732	-0.334
	(0.461)	(0.246)
L.mutual_ownership	**-1.471*** **	**-0.849*** **
	(0.387)	**(0.218)**
L.foreign_parent	**-1.254*** **	**-0.751*** **
	(0.477)	**(0.256)**
return_on_assets	-1.841***	
	(0.134)	
L.return_on_assets	0.322***	
	(0.0984)	
loan_impairments		-0.506***
		(0.0297)
L.loan_impairments		0.0265
		(0.0445)
L.growth_total_assets	-0.00124	-8.08e-05
	(0.00342)	(0.00185)
L.loan_interest_income	-0.0118*	-0.00188
	(0.00625)	(0.00291)
L.board_size	0.0773***	0.0438**
	(0.0270)	(0.0178)
L.director_ratio	-0.213	-0.206
	(0.643)	(0.343)
L.rem_co	0.609**	0.269**
	(0.255)	(0.126)
L.exec_rem_disclosed	-0.298	-0.169*
	(0.188)	(0.0993)
L.average_pay	-0.668	-0.135
	(1.039)	(0.575)
L.joint_ceo_chairman	-1.461**	-0.909*
	(0.660)	(0.469)
L.cro_present_onboard	-0.387	-0.219
	(0.252)	(0.153)
L.comm_dir_board	-0.104	-0.0756
	(0.0946)	(0.0661)
L.female_ratio	-0.527	-0.567*
	(0.492)	(0.305)

L.no_exp_ratio	0.847***	0.485***
	(0.264)	(0.165)
L.irb_permission	-0.696***	-0.437***
	(0.248)	(0.149)
L.exposure_to_banks	1.344*	0.318
	(0.802)	(0.469)
L.securities_holdings	0.629	0.170
	(0.752)	(0.381)
L.advisory_activity	25.85***	20.20***
	(6.744)	(3.216)
L.equity_ratio	6.402**	0.370
	(2.577)	(1.280)
L.current_deposits_over_liabs	-0.0952	0.152
	(0.289)	(0.177)
L.size_over_gdp	0.0879	0.0251
	(0.258)	(0.143)
Constant	0.322	0.439
	(0.729)	(0.402)
Observations	299	299
VIFs	1.28-7.23	1.28-7.35
GMM criterion Q(b)	$1.01 \times e^{-17}$	$1.94 \times e^{-19}$
Pr > F endo reg	>0.999	>0.999

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 5.5. The two equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses because non-spherical error variance is assumed. VIFs for this set of regressors vary from 1.28 to 7.35, but this has not prevented the detection of significant associations, or caused sign reversals. Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.)

These results (Table 5.7) show clear negative effects of mutual ownership and a foreign parent on loan impairments and ROA. Importantly, the use of both 2SLS and GMM estimation reveals that the effects reported are robust to a change of estimation framework and the use of clustered standard errors. It also allows assessment of whether the estimated magnitude of effects varies with estimation framework.

Taking GMM estimates as definitive because of greater efficiency and less vulnerability to bias, mutual ownership lowers loan impairments by 1.5% (of gross loans) and ROA by 0.8% (of total assets) *ceteris paribus*. A foreign parent lowers loan impairments by 1.2% and ROA by 0.8% *ceteris paribus*. Given that the average in the sample of the loan impairments ratio is 0.3% and that of ROA is 0.4%, these are large effects (although they will be offset in practice by variation in other causal variables). For mutual ownership, the results are as predicted by theoretical studies in the literature and earlier empirical studies. However, my results lend essential support to pre-existing studies in a number of ways. Firstly, they lend support to a literature that relied on relatively few papers, with the main results being in Iannotta *et al* (2007) and Marco and Fernandez (2007).

Secondly, they show that mutual ownership has a negative effect on risk and return in an institutional setting where this was not established before: a data set where the great majority of mutuals are UK building societies. This is important because, although UK building societies are owned by depositors and are thus mutual organisations in the standard international sense of the word, they differ from mutual banks overseas in terms of the range of activities in which they are permitted to undertake. The UK Building Societies Act, 1986 (legislation.gov.uk) was, as part of wider financial deregulation, designed specifically to widen the range of services building societies could offer and thereby intensify the competition between them and shareholder-owned banks. After the Act was passed, building societies were allowed to offer unsecured loans and cheque accounts, and even to engage in foreign exchange activities, provide stock-broking services, manage retail investment funds and arrange and advise in respect of insurance.

The key point is that, while mutual banks overseas are heterogeneous in nature, UK legislation makes building societies more homogenous as a group and more similar to banks in their commercial activities. Thus, they offer an opportunity to test, a very pure way that is not confounded by correlation of mutuality with restrictions on business model, the effects of mutual ownership. The fact that I find results for building societies in the UK consistent with theoretical predictions represents a more robust confirmation than any earlier study that the effects detected are due to mutual status and not any restrictions on business model that are correlated with mutuality.

Thirdly, it is clear from the results of section 4.6 that, if I had not used a simultaneous equations model allowing for effects of risk and return on one another, the fact that UK building societies provide a very robust confirmation of the effects of mutuality would have been entirely overlooked. Omitting simultaneity would create the erroneous impression that mutuality has no effects on risk or return.

The results for a foreign parent must be understood in the context of the contradictory literature on this subject. Choi and Hasan (2005) report a negative effect of foreign ownership on bank risk, Angkinand and Whilborg (2010) report the exact opposite, and Forssbaeck (2011) finds no impact. Havrylchyk and Jurzyk (2011) suggest that bank privatisation improves performance while Chen and Liao (2011) suggest that the implications of having a foreign parent entity may be largely context-specific.

My findings support the side of the debate that suggests a negative impact on risk and are contrary to earlier studies that suggest a positive impact on performance. Indeed, my result runs contrary to a general literature on economic globalisation that suggests cross-border ownership and other international linkages are always performance-boosting because they arose to exploit opportunities to increase efficiency by expanding overseas. For instance, Hanousek *et al* (2012) argue that the relevant literature almost universally argues that foreign ownership increases efficiency compared to domestic ownership, and they find further evidence to support this in data for central Europe.

My result for a foreign parent is credible, and likely more credible than earlier empirical studies, because it is consistent with two bodies of theoretical literature. One is the literature summarised in section 4.2 which suggests that risk and return are correlated. The second is the literature on information asymmetries. For instance, Bebczuk (2003) argues that firm insiders have an informational advantage over outsiders (including investors) and that this manifests in various ways, including principal-agent conflict and difficulty raising equity finance. It is reasonable to assume that this information asymmetry is intensified if the owners are in a different country, with fewer personal interactions and differences in personal networks and culture. It is informative here that my findings for foreign ownership are similar to those for mutuality, given that the theoretical literature (for instance Schliefer and Vishny, 1997) suggests the effects of mutuality are due to managers being able to pursue their own interests – which is arguably equivalent to how managers can behave when owners are based overseas. This is the first time the effects of foreign ownership have been found to mirror those of mutuality in this way.

A few other studies support the view that foreign ownership is not always performance-boosting. For instance, in stochastic frontier analysis of European corporations, Hanousek *et al* (2015) show that foreign majority owners detract from profitability.

The literature relating to ownership concentrations surveyed in section 2.5.4 is also relevant here. The findings of Kim *et al* (2007) and Auvray and Brossard (2012) suggest that owners who control large blocks are better able to monitor banks and, assuming they are diversified with other holdings, will force more aggressive pursuit of profit and greater risk-taking. Since mutuality implies the absence of any block holdings, and since foreign ownership entails the absence of any block holders geographically nearby, my findings are consistent with the view that mutuality and foreign ownership have the effects they do because they both involve lack of strong oversight by profit-oriented shareholders.

Overall, it seems that the effects I observe for foreign ownership of banks arise from cross-border information asymmetries and that these predominate over diversification and any other effects of foreign ownership. The conclusion that the effects of a foreign parent are due to information asymmetries, while cross-border diversification is not important, is supported by my finding in Chapter 8 that diversification effects are not important at all in my sample.

Importantly, neither mutual ownership nor a foreign parent has any measurable effect on the growth rate of total assets (results not shown but can be provided upon request), suggesting that, while they adversely affect bank performance in the sense of profitability, they do not affect the provision of finance to the wider economy.

I find in section 5.6 that a foreign parent entity increases the probability of bank failure. As well as being a novel finding, this difference from mutual ownership likely arises because foreign ownership has a larger negative effect on ROE (which is important for solvency) than mutual ownership. It also supports the conclusion that foreign ownership acts primarily through cross-border information asymmetries and suggests that the financial inefficiencies associated with foreign ownership can have seriously adverse social consequences.

State majority ownership appears to have robust effects on ROA and loan impairments in initial analysis, but these disappear when I adjust for non-spherical error variance and so should be disregarded.

In summary, mutual ownership has negative effects on bank risk and return I therefore accept hypothesis H5.2. I also accept hypothesis H5.3: foreign ownership does indeed have effects on bank risk and return, and these effects are negative in both cases.

5.6 Ownership and Bank Failure

Logically, one would expect the effects of ownership and governance on bank risk and performance to exist alongside effects of the same regressors on bank failure. There are likely to be direct and indirect effects involved here. In terms of indirect effects, *ceteris paribus* we would expect any characteristic which increases performance to reduce the probability of failure, and any characteristic which increases asset risk to increase the probability of failure. If something reduces both performance and risk, then it would be expected that the larger of these two effects would be dominant in terms of effects on the probability of failure

Ownership and governance are likely to affect many aspects of banks beyond those measured here, possibly including effects that have not been, or cannot easily be, measured effectively. Success or failure is the result of a combination of all of these effects. As a consequence, it is simpler from a modelling perspective if I test hypotheses relating to effects on bank failure using reduced-form models in which effects are treated as direct even if they include a complex and hard-to-specify mix of direct and indirect components.

To determine if ownership and governance have effects on bank failure, I take the same regressors as used in sections 5.4 and 5.5 and use them in probit models with the dependent variable being a combined indicator of failure (combined_failure) that takes the value 1 if the bank fails (in the sense of becoming insolvent, bankrupt or a defaulter) or receives government assistance (such as a capital injection or asset guarantee) designed to prevent failure. Defining the dependent variable in this way ensures that I capture cases in which the business model of the bank has, in effect, failed, but an actual insolvency has not occured purely because of government intervention.

Models used to test hypotheses are estimated using the following equations (Table 5.8) with equation numbers used for cross-reference in regression tables.

Table 5.8 Dependent and explanatory variables included in models for testing hypotheses that ownership types affect bank failure.

Dependent Variable: combined_failure		
All equations (5.13 to 5.15)	Equation (5.14)	Equation (5.15)
L.state_majority_owner	L.exposure_to_banks	L.growth_gross_loans
L.mutual_ownership	L.securities_holdings	L.growth_total_assets
L.foreign_parent	L.advisory_activity	L.loan_impairments
L.board_size	L.equity_ratio	L.return_on_assets
L.director_ratio	L.current_deposits_over_liabs	L.return_on_equity
L.rem_co	L.size_over_gdp	L.exposure_to_banks
L.exec_rem_disclosed		L.securities_holdings
L.average_pay		L.advisory_activity
L.joint_ceo_chairman		L.equity_ratio
L.cro_present_onboard		L.current_deposits_over_liabs
L.comm_dir_board		L.size_over_gdp
L.female_ratio		
L.no_exp_ratio		
L.irb_permission		
Year Dummies		

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Characteristics relating to ownership are retained in these models because the aim is to test, using an indicator of bank failure as a measure of risk, the hypotheses stated in section 5.3. Characteristics relating to governance are retained as controls because, for the reasons stated in section 6.4, there is reason to expect these to affect bank risk. (The converse logic applies when equations 5.13 to 5.15 are re-used in section 6.11: there I am testing hypotheses relating to governance variables and retaining ownership variables as controls in order to avoid mis-specification.)

The only difference in the set of explanatory variables compared to the baseline model specification stated in Table 3.1 is the inclusion as regressors of variables included elsewhere in my study as outcome variables. The rationale for this is simple: financial outcomes have direct impacts on bank failure (e.g. low ROE directly erodes solvency and increases the chances of failure) and may be influenced by unknown factors not included in these models. The only way to control for these potentially omitted influences is to include the relevant outcome variables as regressors. In particular, various studies in the literature identify periods of rapid growth or speculative behaviour in banking as causes or predictors of subsequent bank distress (e.g. Gorton, 2012 and Allen and Gale, 1997).

Balance sheet characteristics are included as controls because these are reflective of business model and it is plausible that bank risk could vary depending on the risk level of different business models, as explained in section 3.4.

Probit models are used because they are suitable for testing significance with co-variates treated as held constant in settings with binary dependent variables, and the choice between logit and probit is arbitrary. Linear probability models are not used because they can predict meaningless probabilities greater than 1 or less than zero. Results obtained are as follows (Table 5.9).

Table 5.9 Probit estimation results for ownership as a determinant of bank failure.

	(5.13) combined_ failure	(5.14) combined_ failure	(5.15) combined_ failure
L.growth_gross_loans			0.00714
			(0.00550)
L.growth_total_assets			0.0233***
			(0.00853)
L.loan_impairments			-0.111
			(0.435)
L.return_on_assets			0.0560
			(0.303)
L.return_on_equity			-0.0221***
			(0.00610)
L.state_majority_owner	**1.172*** **	**2.061*** **	**8.760*** **
	(0.407)	**(0.694)**	**(1.827)**
L.mutual_ownership	**0.192**	**-0.736**	**0.998**
	(0.478)	**(0.639)**	**(1.349)**
L.foreign_parent	**0.913** **	**1.176** **	**5.887*** **
	(0.425)	**(0.592)**	**(1.579)**
L.board_size	0.0178	0.0422	0.0832
	(0.0498)	(0.0694)	(0.103)
L.director_ratio	-1.118	-3.317	-9.247***
	(1.280)	(2.136)	(3.522)
L.rem_co	-0.737**	-0.985**	-2.808***
	(0.329)	(0.497)	(0.743)
L.exec_rem_disclosed	0.577	0.808	3.731***
	(0.397)	(0.559)	(0.910)
L.average_pay	0.0313	-3.572	-5.424
	(0.0694)	(2.739)	(4.198)
L.joint_ceo_chairman	-0.0881	0.889	0.398
	(0.417)	(0.547)	(0.828)
L.cro_present_onboard	0.460	-0.284	-0.349
	(0.593)	(0.565)	(0.874)
L.comm_dir_board	-0.109	-0.505*	-0.842**
	(0.272)	(0.300)	(0.360)
L.female_ratio	-0.822	-1.148	2.664
	(1.914)	(2.394)	(3.035)
L.no_exp_ratio	0.478	2.211**	5.794***
	(0.709)	(0.985)	(1.609)
L.irb_permission	0.0678	0.268	-5.956***
	(0.425)	(0.492)	(1.602)

L.exposure_to_banks		-2.188*	-5.784***
		(1.217)	(1.436)
L.securities_holdings		-4.444**	-7.575***
		(1.982)	(2.462)
L.advisory_activity		-83.80**	-73.17
		(34.92)	(52.53)
L.equity_ratio		2.362	5.221
		(1.710)	(10.08)
L.current_deposits_over_liabs		-0.818	0.138
		(0.553)	(0.851)
L.size_over_gdp		0.0362	1.718*
		(0.683)	(0.894)
Constant	-1.063	2.264	0.941
	(0.803)	(1.428)	(2.042)
Observations	406	384	294
Pseudo-R-squared	0.235	0.376	0.591
VIFs (these regressors)	1.18 – 3.15	1.27 – 6.23	1.28 – 7.3
Wald Chi^2	422.0	463.7	2225.7
Pr > Chi^2	<0.001	<0.001	<0.001
Pr < Smith-Blundell	<0.001	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 5.8. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using maximum likelihood with numerical optimisation. Estimated parameter values are shown along with star symbols for statistical significance. The presence of non-spherical error variance is assumed, such that clustered standard errors are used (shown in parentheses). Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr<Smith-Blundell is the probability of obtaining a Smith-Blundell statistic at least as small as was obtained under the null that regressors are endogenous.

This analysis (Table 5.9) reveals that state majority ownership is associated with an increased likelihood of failure. However, this is not as causally interesting as might first appear. It is present probably because state ownership arises in this sample often due to government takeover following severe distress. Such stress does not stop immediately at the point of government takeover, and on-going stress raises the probability of further failure events for the kind I define above.

More interestingly, the presence of a foreign parent raises the probability of bank failure. This is consistent with the earlier finding that a foreign parent has large negative effects on ROE, which is directly important for bank solvency (a negative ROE entails erosion of equity capital and thus movement towards insolvency). It is also consistent with the fact that a foreign parent lowers loan impairments by 1.2% of gross loans (0.7% of gross loans) but nevertheless lowers overall ROA by 0.8% of total assets – indicating that its other effects on performance overwhelm the beneficial effect on performance that occurs indirectly through lower impairments.

Since the effects of a foreign parent on bank risk and return can be attributed to cross-border information asymmetries dominating over diversification effects and greater resources, the knock-on effects for bank failure can also be attributed to information asymmetries. In essence foreign-owned banks are more likely to fail because their foreign shareholders face greater difficulty in monitoring and controlling local management.

The parameter values estimated cannot be directly interpreted as partial effects because they relate to a model that involves a nonlinear transformation. It can be observed that they vary substantially in magnitude across different specifications included for reasons of robustness testing. However, the values are significant in all cases and are larger in those models where more controls are added.

In conclusion, the results shown here lend support to hypotheses H5.1 and H5.3, which were already accepted on other grounds in sections 5.5 and 5.5.

Please note that the effects detected above for governance variables are not discussed because they are dealt with in the penultimate section of Chapter 6.

5.7 Conclusions

The main conclusions of Chapter 5 are that hypotheses H5.1, 5.2 and 5.3 are all accepted. There is robust evidence that state ownership reduces performance (albeit not on all measures) and perhaps increases risk, that mutuality lowers risk and performance, and that a foreign parent reduces performance and financial risk, while increasing the probability of failure.

My work demonstrates that, when a framework is used in which bank risk and return are treated as simultaneous (the first time this has been done in the literature on bank ownership and governance), interesting effects of ownership types are evident. Mutual ownership and the presence of a foreign parent have very similar effects to one another: they each lower bank risk and bank performance.

The effects of mutuality are in accordance with theory (Schleifer and Vishny, 1997) and earlier empirical work (Iannotta *et al,* 2007). They are present because the managers of mutuals *ceteris paribus* have weaker incentives to pursue profits and take risk compared to the managers of other banks. Although they have been seen before, these results are nevertheless interesting. They show that the findings remain robust in a framework where risk and return are treated as simultaneous – a relationship that is important in theory and which I show is present in this empirical setting. They also extend and support the relatively limited number of empirical papers showing the effects of mutual ownership of banks.

The effects of a foreign parent are something that can only be understood empirically. In theory, cross-border banks are subject to greater information asymmetries between owners and managers, but also benefit from greater diversification and resources. Which of these is dominant in any given setting is a matter that can only be settled empirically.

My results show that, in this data set, the effects of information asymmetry must be dominant over the other potential effects of a foreign parent that I considered. Managers of banks with a foreign parent are not motivated as strongly as in other banks to pursue the objectives of shareholders – who are generally assumed to be more profit-seeking and more risk-tolerant than managers, all else being equal (e.g. Sullivan and Spong, 2007).

The effects of a foreign parent on bank performance have a knock-on effect: they make banks more susceptible to failure. This effect is not evident for mutual banks, most likely because the effects of mutuality on ROE (which is of vital importance for solvency) are half the size of the effects of a foreign parent.

It is also important to note that neither mutual ownership nor the presence of a foreign parent has any detectable effect on growth in bank assets or growth in gross loans. This suggests that, although effects on bank performance may be present, there is no sign of an effect on provision of credit or other forms of investment to the wider economy.

State majority ownership is found to lead to lower loan interest income. This is a novel result and is likely due to the propensity of state-owned banks to pursue other objectives alongside financial objectives, and thus to do less-well financially (Gonzales-Garcia and Grigoli, 2013 and Schleifer and Vishny, 1997). State-owned banks are also more likely to fail than other banks, but this is likely because many banks in this sample became state-owned as a result of on-going stress, which makes failure events more likely.

In policy terms, all these results have interesting implications (drawn using normative assumptions stated in section 9.3). The possible benefits of mutual ownership have been discussed by a number of authors (e.g. Guadano, 2009). If mutual ownership lowers bank risk, has no effect on provision of investment to the economy and has its only adverse effects on private profits (which could be the result of efficiency or rent-seeking, albeit earned for small depositor-owners) then it appears, on balance, beneficial. This is especially so when we consider that the incentives which make the managers of such banks less profit-seeking and less risk-tolerant may also make them less likely to mistreat customers.

This suggests that mutual ownership of banks should be widespread and that incentives to encourage it should be created, perhaps through the corporate tax system or by helping the creation of new mutuals. We cannot argue on the basis of the results shown here that mutuality in bank ownership should be universal because going this far could have adverse general equilibrium effects that cannot be foreseen using my data. However, it is clear that increasing the prevalence of mutuals from its current level would be beneficial.

The policy recommendation for a foreign parent is different. If it increases the probability of bank failure, with all the systemic disruption this can entail, it cannot be seen as beneficial. Although current international agreements on bank regulation and treaties designed to prevent trade barriers would preclude it, there is an argument for imposing higher regulatory capital requirements on foreign-owned banks as a means to protect their solvency and the stability of the system.

The finding that state ownership of banks has adverse effects on performance suggests inefficiency due to granting soft loans and indicates, in the absence of any other measurable effects, that it would be undesirable to have an economy with many state-owned banks. However, a limited number of state-owned banks in an economy could be beneficial as a means to mobilise capital into innovative sectors that have been subject to market failures affecting investment levels[5] (e.g. Lin et al 2015). Bank nationalisation may also be necessary in cases where banks are failing and there are no credible systems of bank resolution to ensure orderly liquidation.

In conclusion, the data suggest that mutual ownership of banks should be encouraged, though not necessarily to the exclusion of other ownership types,

[5] In making this observation I should note, to avoid any appearance of a conflict of interest, that I currently work for a state-owned bank, the UK Green Investment Bank plc, that was created to address a market failure in provision of investment to renewable energy projects.

while foreign ownership should be limited and state majority ownership should be used only in selective cases.

Chapter 6: Roles of Governance and Information Processing

6.1 Introduction

In this chapter, I test hypotheses that aspects of bank governance affect risk and return. The aspects of bank governance in question include features which relate to the ability of banks to make use of information on risk and return. I make use of the approach set out in Chapter 3 and the models with simultaneity developed in Chapter 4. The main dependent variables are ROE, ROA, loan impairments and combined failure, because these are indicators of risk and return. Growth in total assets was also used as a dependent variable, to determine if effects on banks are accompanied by effects on credit provision to the economy (the conclusion was that they are not, so these results are not shown, although they can be provided on request).

One key hypothesis I confirm is that IRB, because it entails better detection of risk and therefore empowers risk-averse agents within banks, leads to lower risk-taking and lower return. This is tested using another novel framework in which risk, return and leverage are endogenous, with IRB permission allowed to affect the equity ratio because regulators may permit IRB banks to hold less equity capital. Using this framework, I accept the hypothesis that IRB lowers risk and performance, which is a novel result not previously reported in the literature. Specifically, I find that regulatory permission to use Internal Ratings Based (IRB) models leads to lower impairments and lower ROA. This is an important finding in that it contradicts recent studies such as Aikman *et al* (2014) and Haldane (2013) which have questioned the ability of IRB to affect risk-taking.

I also confirm another novel hypothesis relating to information-processing capability: that a higher proportion of Directors without financial services experience positively affects return but also leads to higher risk (in the form of a higher rate of bank failure) because the consequences of pursuing returns are not fully understood by Directors in this setting.

Using the same novel multi-equation framework as Chapters 4 and 5, I confirm the related hypothesis that Board Size positively affects return on assets due to having access to a wider set of skills and experience and thus better processing of information relating to risk and return. Supporting work using a single-equation model with ROE as the dependent variable also confirms the hypothesis.

Surprisingly, I find that the proportion of NEDs on the Board has no measurable effect on financial outcomes, even though having a sufficient number of NEDs on the Board is considered a core element of good corporate governance (UK Corporate Governance Code 2014). However, I do confirm the hypothesis that NEDs reduce bank risk in that I show a higher proportion of NEDs leading to a lower rate of bank failure. Likewise, I confirm the hypothesis that strong governance of remuneration leads to lower bank risk by showing the presence of a remuneration committee leading to a lower rate of bank failure. Taken together, these findings have the practical importance of showing that banks should have large Boards with many NEDs with experience in financial services and a remuneration committee.

I also confirm the novel hypothesis that an independent Chairman and an independent CRO each lead to higher risk because they dilute the personal accountability of the CEO and confuse decision making at the most senior levels. This is of great practical importance because it runs contrary to the guidance in the UK Corporate Governance Code (2014) and Financial Conduct Authority Handbook that firms should have an independent Chairman and independent CRO for reasons of risk mitigation. More surprisingly, I find that the presence of a Commercial Director as a full Board member has no robust effects.

Subsequent sections of this chapter deal with relevant literature and development of hypotheses from this literature (sections 6.2 to 6.4), empirical results relating to how specific aspects of governance and information processing ability affect risk and return (sections 6.5 to 6.11) and overall synthesis of results and policy implications (section 6.12).

6.2 Key Results in the Literature

As discussed in Chapter 2, the literature on agency theory suggests outcomes across firms are affected by variations in levels of control by individuals with different incentives. This applies to banks as much as other firms.

The incentives of, and levels of control held by individuals are, in turn, determined by corporate governance arrangements. The literature defines corporate governance as structures for overseeing a firm, often designed to manage agency conflicts. This again applies to banks as much as other firms.

Corporate governance differs across banks. Therefore agency theory predicts different outcomes at the bank level.

The empirical literature validates this prediction. It shows that the presence of more independent directors and a larger Board both lead to less risk, as does (more surprisingly) the presence of a joint CEO-Chairman. The presence of a CRO on the Board is reported to lead to increased performance and reduced risk.

The presence of independent directors on a bank's Board appears to lead to reduced risk and performance. Analysis from the International Monetary Fund (Brandão-Marques *et al* 2014) finds that independence at Board level leads to reduced risk, a result that is also found by Pathan (2009). Aebi *et al* (2012) finds that director independence leads to reduced profitability in a crisis period. A dissenting result is found in a study by the World Bank (Anginer *et a*l, 2014), which reports that independence in the governance structure at Board level leads to increased bank risk-taking, but I dismiss this on the basis that it is contrary to theory and the rest of the empirical literature.

Results for board size are clearer, but are based on few papers. Pathan (2009) and Aebi *et al* (2012) both find that Board size has a negative impact on risk. This suggests that the availability of a greater set of skills and experience at a senior level leads to better decision-making and lower risk. In the case of non-financial firms Huang and Wang (2015) also report that larger Boards are associated with reduced risk. Meanwhile, results in Liang *et al* (2013) indicate that larger Board size in banks has a negative impact on financial performance. This is consistent with a situation in which larger Boards lead to a lower risk appetite at the firm level and the classical risk-return correlation discussed in section 4.2 is present. A single study, Pathan (2009), examines the effects of combining the CEO and Chairman roles and finds that a dual CEO-Chairman has a negative effect on bank risk. This is can be understood in light of a study by Yang and Zhao (2014) suggesting that separation of these roles confuses decision-making and a study from Rus *et al* (2011) suggesting that anything which weakens the personal accountability of a CEO increases risk.

Results in the literature relating to the presence of a CRO as a full Board Director appear clear-cut. Aebi *et al* (2012) find that a CRO on the Board has a positive impact on returns, while Dong *et al* (2014) find that it has a negative impact on risk. However, these are based on narrow research contexts (a crisis period for the former and Chinese banks for the latter) and represent the opposite effect of senior-level monitoring from that reported for the Chairman. So, on balance, it is more likely that an independent Chairman or an independent CRO each increase risk because the division of responsibilities involved confuses decision-making and weakens the personal accountability (for risk management) of the CEO.

The literature attempts to understand how the personal-level incentives of individuals within banks differ, potentially providing a behavioural micro-foundation for work that considers the effects of empowering different agents. Šilingienė *et al* (2015) summarise the relevant literature and report that firm performance is a major factor in determining CEO remuneration.

By contrast, Goh and Gupta (2015) report that firm performance is not a determinant of NED or Chairman Remuneration in the UK. Mallin *et al* (2015) report the same for firms in the UK and Italy. This is consistent with the UK Corporate Governance Code 2014, which states that NED's pay should not involve share options or other performance-related elements. There are no similar studies for the CRO, but regulation in the UK requires that remuneration of control functions is appropriately aligned to risk-taking incentives and that control functions are not subject to remuneration-based incentives that could undermine their motivation to limit risk (Financial Conduct Authority Handbook, Systems and Controls Sourcebook, Chapter 19).

On the basis of these sources, it appears that the CEO has strong incentives to seek profit and tolerate risk, while the Chairman, NEDs and CRO have incentives to minimise risk. However, these personal incentives are not likely to be what determines the effects of an independent Chairman or CRO. The CEO is the most powerful role in a bank, being responsible for its overall executive direction so, since the presence an independent CRO or Chairman makes it harder for the CEO to execute decisions immediately and limits the personal accountability for risk he or she perceives (Yang and Zhao, 2014 and Rus *et al,* 2011) then we can expect an independent CRO or Chairman to cause increased risk. This is clearly contrary to what regulators assume, but it is a more plausible synthesis of the various studies on the roles of the Chairman and CRO and on decision-making and accountability that I cite here.

In the case of Non-Executive Directors, these individuals form a more diffuse group with no clear personal roles, so they are less likely to confuse the CEO's decisions or dilute his or her personal accountability. Therefore, more NEDs can be expected to cause less risk and less return, in the way their personal incentives would suggest.

In summary, based on the literature one would expect a larger Board to entail better use of information and thus better outcomes in terms of risk and / or return. One would expect the effects of having an independent Chairman or independent CRO to be determined by dilution of CEO accountability and confusion of decisions while, by contrast, we would expect the effects of having more NEDs on the Board to be determined by the risk-averse preferences of NEDs.

6.3 The Economics of Information

Shannon (1948) shows that information is a fundamental physical quantity that can be quantified and modelled. The quantity of information present, the quantity that can be present, and processes through which more information is generated has implications for system stability, pattern formation, evolution and economic growth.

Theoretical work since the 1970s has recognised the importance of information asymmetries in a range of economic settings. Such asymmetries can, for instance, cause a form of market failure in which trading volume drops because buyers assume that sellers are withholding information (Akerlof, 1970).

More recent studies have applied the theory of information assymetries in a range of settings (Bircher and Butler, 2007) including financial services (Bebczuk, 2003). For instance, because investors are aware that share issuers have an informational advantage, capital-raising through equity markets is lower than it would otherwise be if this asymmetry of information did not exist. Similarly, because of limited information, banks may charge borrowers with different characteristics the same interest rate, with the results that a) credit is rationed and b) strong, honest borrowers subsidise less desirable borrowers.

This body of theory implies that anything which affects the ability of banks to process information will have important effects on risk and return. Specifically, if some banks have better information-processing capabilities than others, and the other banks are unable to perfectly mimic their decisions, then they may be able to achieve lower risk at the same level or return (or greater return at the same level of risk). This could perhaps be the case if banks have more experienced Directors or if they use the Internal Ratings Based (IRB) approach to credit risk analysis permitted under Basel regulation, which is a direct indicator of the ability to process information on the credit quality of borrowers.

Hakenes and Schnabel (2011) have explored the effects of IRB in a theoretical model. They argued that IRB improves capital adequacy (relative to risk) at IRB banks, but that banks' right to choose between IRB and simpler regulator-prescribed formulae for determining capital requirements may put smaller, non-IRB banks at a competitive disadvantage, leading them to take greater risk and magnifying aggregate risk. These conclusions have not been tested empirically.

While some studies show that IRB is considered relation to loan pricing (e.g. Ruthenberg and Landskroner, 2008) none show that banks seek to use it to identify attractive risk-return pairings. Rather than leading to a better risk-return trade-off, it may therefore be more likely that IRB permission simply leads to lower risk and return because it empowers risk-averse decision-makers, reflecting the manner in which different kinds of agents can be empowered by information (Ashraf, 2008).

In the case of Board size, one can construct an argument in which greater Board size entails a greater set of skills and experience to draw upon, leading to greater information-processing power and a better risk-return trade-off. This is contrary to the empirical studies summarised in section 6.2, which suggest that larger Boards have negative effects on both risk and performance. However, evidence of a negative effect on performance is based on one study (Liang *et al*, 2013) from a particular setting (China) and it is more plausible that larger Boards benefit either risk or performance – because they entail greater experience, they do not affect risk aversion, and it should not be hard to coordinate a Board of less than 30 people when firms routinely coordinate thousands of staff. My results (see section 6.5) are consistent with the hypothesis that larger Board size does improve the risk-return trade-off.

In conclusion, there is a strong basis for expecting that information-processing capabilities should affect bank risk and return. However, there have been no empirical studies to validate this. I address this gap in this Chapter.

6.4 Literature Gaps and Hypotheses

The empirical literature has not sought to determine if the predicted effects of governance variables hold true in a setting where risk and return are treated as simultaneous. This is an important omission because I have shown in Chapter 4 that risk and return are, in practice, simultaneous and that overlooking this can lead to bias in model estimates. Empirical studies have also omitted certain important indicators of the balance of power within firms, such as the presence of commercial directors who are likely to have strong risk-taking incentives. Other omitted variables relate to features which affect the information-processing capacities of banks, including the presence or not of permission from regulators to use IRB models to analyse credit risk.

Therefore, in this Chapter I seek to test the following hypotheses:

> **H6.1:** Board size is associated with higher return or lower risk, because it entails a greater set of skills and experience on which to draw, hence a greater ability to process information, and hence lower risk at the same return (compared to other banks) or greater return at the same risk.

H6.2: The presence of a Joint CEO-Chairman leads to lower risk and/or higher return because it increases the personal accountability of the CEO and permits clearer decision-making.

H6.3: The presence of a CRO who is a full Board member entails higher risk and/or lower performance because it lowers the personal accountability of the CEO and confuses decision-making.

H6.4: The presence of a Commercial Director who is a full Board member entails higher risk and higher return because it empowers an individual (the Commercial Director) with strong incentives to pursue profit and take risk.

H6.5: A higher ratio of Non-Executive Directors compared to executives entails lower risk and lower returns because it empowers individuals (NEDs) with weak incentives to pursue profit and take risk.

H6.6: A higher proportion of directors with no previous financial services experience is associated with higher return and higher risk because it leads to simple pursuit of profit without understanding risk.

H6.7: Permission from regulators to use IRB models for credit risk analysis is associated with lower return and/or lower risk, because it empowers individuals with risk-averse preferences within banks.

H6.8: The presence of more female Directors leads to higher return or lower risk, because it reflects a situation in which banks have not overlooked skills through irrational gender discrimination, meaning that they can use information better.

H6.9: The presence of a Remuneration Committee leads to lower risk and lower return because it ensures that outcomes related to risk are taken into account in setting pay, whereas pay would otherwise tend to be based only on profitability.

H6.10: The presence of Executive Remuneration Disclosures leads to lower risk and lower return because it discourages the setting of pay that incentivises high levels of profit-seeking and high risk tolerance.

Note that, in the case of hypothesis H6.4, I am not assuming that the presence of a Commercial Director weakens the incentives of the CEO to control risk (this is clearly not the case) or that it leads to confused decision-making (because, under Corporate Governance Codes, a Commercial Director does not have the same rights to monitor the CEO as the Chairman or CRO). Therefore I am assuming that, because Commercial Directors have profit-oriented incentives, their presence on the Board leads to higher risk and higher return.

In hypothesis H6.7, I am assuming that IRB permission empowers risk-averse decision makers within banks, rather than improving the risk-return trade-off. This is for the reasons discussed in section 6.3.

In hypothesis H6.8, one could make reference to biological and sociological factors which have been reported to cause risk preferences to differ between genders (Sapienza *et al,* 2008). These are not my starting point, because the literature in this respect is more uncertain than the simple, practical considerations that inform H6.8. However, such factors are considered in section 6.10 when I interpret some unexpected results relating to this explanatory variable.

6.5 Effects of Board Size and a Joint CEO-Chairman

My analysis below shows that Board Size positively affects ROA, which is likely due to having a greater set of skills and experience on which to draw. It also shows that the presence of a joint CEO-Chairman reduces impairments, which is consistent with the hypothesis that splitting the roles of CEO and Chairman leads to dilution of the personal accountability of the CEO and confused decision-making. This is the first time a simultaneous equations model has been used in this way to analyse the effects of bank governance, making the results more credible than earlier findings in the literature in that they are robust to simultaneity between risk and return.

Models used to test hypotheses are estimated using the following equations (Table 6.1) with equation numbers used for cross-reference in regression tables.

Table 6.1 Dependent and explanatory variables in models for testing hypotheses that governance variables affect loan impairments and ROA.

Dependent Variable: loan_impairments	
All equations (6.1 and 6.3)	Equation (6.3)
return_on_assets	L.director_ratio_sq
L.return_on_assets	L.director_ratio_cu
L.board_size	
L.director_ratio	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.low_ned	
L.growth_total_assets	
L.loan_interest_income	
L.state_majority_owner	
L.mutual_ownership	
L.foreign_parent	
L.rem_co	
L.exec_rem_disclosed	
L.average_pay	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_dep_over_liabs	
L.size_over_gdp	
Year dummies	

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Table 6.1 (contd.) Dependent and explanatory variables in models for testing hypotheses that governance variables affect loan impairments and ROA.

Dependent Variable: return_on_assets	
All equations (6.2 and 6.4)	Equation (6.4)
loan_impairments	L.director_ratio_sq
L.loan_impairments	L.director_ratio_cu
L.board_size	
L.director_ratio	
L.joint_ceo_chairman	
L.cro_present_onboard	
L.comm_dir_board	
L.female_ratio	
L.no_exp_ratio	
L.low_ned	
L.growth_total_assets	
L.loan_interest_income	
L.state_majority_owner	
L.mutual_ownership	
L.foreign_parent	
L.rem_co	
L.exec_rem_disclosed	
L.average_pay	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_dep_over_liabs	
L.size_over_gdp	
Year dummies	

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Loan impairments and ROA are used as dependent variables because they are the principal measures of risk and return in my study and one would expect them to be affected by any attributes which affect appetite for profit and ability to achieve it, or tolerance for risk and ability to minimise it.

Compared to Table 3.1, these model specifications introduce two important changes. First, terms for the square and cube of the variable director ratio are introduced. This is to test the possibility that this variable has nonlinear effects and that omission of these nonlinear effects could bias estimates for other effects of governance variables. Initially, as the number of NEDs increases from zero it may have increasing effects on governance as the size of voting block they can create increases. However, as the number becomes large, effects may diminish again as NEDs each assume that other NEDs will exercise oversight and that credit and blame will be diluted. So the square and cube of the variable director ratio are included as a robustness test to allow for the possibility of this kind of nonlinearity, being additional in equations 6.2 and 6.4 to the shorter specifications in 6.1 and 6.2.

Second, the dummy variable Low NED is included. This takes a value of 1 if NEDs are less than half of the Board, meaning that they can be out-voted by executives who may have different incentives in respect of risk and profit. This is included because it is a natural complement to regressors involving powers of the director ratio.

The model specifications here are slightly different from those used in section 5.5, in that metrics of financial performance used as dependent variables elsewhere in my study were included as explanatory variables in section 5.5

but are not included here. The reason for the difference is that it serves as a form of robustness testing. I see that, despite slight differences in specification, a) all of the results reported in section 5.5 (negative effects of mutuality and a foreign parent on ROA and loan impairments) are evident in section 6.5 and b) all of the results reported in section 6.5 (positive effect of Board size on ROA and negative effect of Joint CEO-Chairman on impairments) are evident in section 5.5. In all cases, this includes results being evident in both 2SLS and GMM specifications, showing that a complete change of estimation method does not undermine the results. This is one example of how different sections of my thesis act as robustness tests for one another.

Models are estimated in linear form because there is no basis for suspecting any specific nonlinearities and a linear form is sufficient to test significance while controlling for co-variates. Results obtained are as follows.

Table 6.2 2SLS estimation results for effects of governance in models with simultaneity of risk and return.

	Model 1		Model 2	
	(6.1) loan_ impairments	(6.2) return_on_ assets	(6.3) loan_ impairments	(6.4) return_on_ assets
return_on_assets	-5.443**		-4.568***	
	(2.315)		(1.499)	
L.return_on_assets	2.864*		2.164**	
	(1.604)		(1.005)	
loan_impairments		-1.605***		-1.721***
		(0.514)		(0.664)
L.loan_impairments		0.724**		0.796*
		(0.345)		(0.442)
L.board_size	**0.0591**	**0.105****	**0.0330**	**0.115****
	(0.0688)	**(0.0443)**	**(0.0590)**	**(0.0565)**
L.director_ratio	0.470	-0.995	141.4	-107.8
	(2.107)	(1.128)	(113.1)	(87.87)
L.director_ratio_sq			-231.2	155.5
			(166.7)	(127.9)
L.director_ratio_cu			121.5	-74.00
			(80.95)	(61.29)
L.joint_ceo_chairman	**-4.200****	**-0.474**	**-3.992*****	**-0.341**
	(1.997)	**(0.553)**	**(1.518)**	**(0.669)**
L.cro_present_onboard	-0.271	-0.310	-0.574	-0.276
	(0.793)	(0.438)	(0.641)	(0.475)
L.comm_dir_board	-0.378	-0.0480	-0.512	0.0524
	(0.371)	(0.190)	(0.333)	(0.230)
L.female_ratio	-1.121	-0.0116	-1.543	0.0207
	(2.113)	(1.157)	(1.721)	(1.293)
L.no_exp_ratio	0.779	0.525	0.812	0.556
	(1.035)	(0.561)	(0.823)	(0.610)
L.low_ned	**1.485**	**-1.439***	**1.202**	**-2.433***
	(1.841)	**(0.842)**	**(1.819)**	**(1.460)**
L.growth_total_assets	0.00197	0.00196	0.000432	0.00256
	(0.00680)	(0.00380)	(0.00529)	(0.00427)
L.loan_interest_income	0.0321	-0.0228*	0.0256	-0.0265*
	(0.0315)	(0.0123)	(0.0230)	(0.0157)
L.state_majority_owner	0.260	-1.396**	-1.077	-1.227*
	(1.024)	(0.674)	(0.715)	(0.654)
L.mutual_ownership	-2.816**	-0.904**	-2.700***	-0.806*
	(1.125)	(0.420)	(0.880)	(0.462)
L.foreign_parent	-2.087**	-0.852*	-2.001**	-0.845*
	(0.998)	(0.437)	(0.774)	(0.473)
L.rem_co	0.0102	0.771*	-0.114	0.889*
	(0.729)	(0.424)	(0.609)	(0.531)

L.exec_rem_disclosed	-0.536	-0.156	-0.290	-0.204
	(0.483)	(0.252)	(0.368)	(0.278)
L.average_pay	1.384	-1.774	-1.321	-1.293
	(2.521)	(1.467)	(1.871)	(1.468)
L.irb_permission	-2.019**	-0.482	-1.692**	-0.491
	(1.004)	(0.342)	(0.703)	(0.370)
L.exposure_to_banks	-2.625	3.254**	-2.585	3.758*
	(3.062)	(1.642)	(2.431)	(2.197)
L.securities_holdings	-2.390	2.516*	-1.565	2.677
	(2.528)	(1.471)	(1.773)	(1.732)
L.advisory_activity	92.68**	-15.65	73.11**	-17.53
	(47.01)	(19.17)	(30.33)	(22.52)
L.equity_ratio	-40.97	31.72**	-30.40	35.28*
	(31.12)	(14.87)	(20.73)	(19.21)
L.curr_dep_over_liabs	1.916	-0.846	1.649	-1.058
	(1.387)	(0.603)	(1.033)	(0.791)
L.size_over_gdp	0.794	-0.202	0.898	-0.271
	(0.876)	(0.426)	(0.717)	(0.492)
Constant	4.152	-1.507	-23.31	22.01
	(2.939)	(1.425)	(23.97)	(18.75)
Observations	297	297	297	297
VIFs	1.30-7.23	1.30-7.35	1.32-7.36	1.32-7.47
F statistic	7.07	4.83	9.49	3.94
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Hall-Pagan	<0.001	<0.001	0.011	<0.001
Pr > Breusch-Pagan	<0.001		<0.001	

Year dummies included but not shown
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.1. Where two equations are estimated simultaneously they are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using two-stage least squares. Estimated parameter values are shown along with star symbols for statistical significance. Classical standard errors are in parentheses. Diagnostic testing using Hall-Pagan, Breusch-Pagan and system tests shows the presence of non-spherical error variance, such that this work is complemented by GMM estimation with clustered standard errors (next results table). VIFs vary from 1.30 to 7.47 but this has not prevented detection of significant relationships or caused sign reversal (shown using smaller sets of regressors). VIF estimates exclude powers of the director ratio. Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr> Breusch-Pagan and Pr>Hall-Pagan are probabilities of obtaining test statistics at least as extreme as those obtained under the null hypothesis of spherical error variance.

This analysis (Table 6.2) suggests that Board Size positively affects returns and that the presence of a Joint CEO-Chairman negatively affects impairments. However, since the 2SLS estimation employed does not support calculation of clustered standard errors, and because it was necessary to show robustness to a change in estimation method, a GMM estimator with standard errors clustered by bank was used as a complement. Results are as follows. Models are estimated using the same equations 6.3 and 6.4 as in the preceding table.

Table 6.3 GMM estimation results for effects of governance in models with simultaneity of risk and return.

	Model 2	
	(6.3) loan_ impairments	(6.4) return_on_ assets
return_on_assets	-1.838***	
	(0.132)	
L.return_on_assets	0.300***	
	(0.0841)	
loan_impairments		-0.512***
		(0.0274)
L.loan_impairments		0.0162
		(0.0417)
L.board_size	**0.0692*** **	**0.0385*** **
	(0.0239)	**(0.0147)**
L.director_ratio	1.844	8.455
	(43.05)	(23.71)
L.director_ratio_sq	-15.71	-19.75
	(63.18)	(34.56)
L.director_ratio_cu	12.68	12.41
	(30.75)	(16.71)
L.joint_ceo_chairman	**-1.569** **	**-0.976** **
	(0.719)	**(0.482)**
L.cro_present_onboard	**-0.451* **	**-0.266* **
	(0.232)	**(0.145)**
L.comm_dir_board	**-0.215* **	**-0.129* **
	(0.114)	**(0.0740)**
L.female_ratio	-0.968**	-0.758**
	(0.491)	(0.306)
L.no_exp_ratio	0.669**	0.422**
	(0.272)	(0.175)
L.low_ned	**-1.253** **	**-0.509**
	(0.595)	**(0.360)**
L.growth_total_assets	-0.000273	0.000116
	(0.00256)	(0.00142)
L.loan_interest_income	-0.0118*	-0.00235
	(0.00652)	(0.00308)
L.state_majority_owner	-1.019*	-0.541*
	(0.585)	(0.293)
L.mutual_ownership	-1.485***	-0.869***
	(0.384)	(0.209)
L.foreign_parent	-1.142**	-0.715***
	(0.494)	(0.257)

L.rem_co	0.499**	0.219*
	(0.240)	(0.129)
L.exec_rem_disclosed	-0.240	-0.133
	(0.165)	(0.0879)
L.average_pay	-1.302	-0.578
	(0.953)	(0.488)
L.irb_permission	-0.687***	-0.428***
	(0.242)	(0.145)
L.exposure_to_banks	1.203	0.259
	(0.907)	(0.537)
L.securities_holdings	0.714	0.232
	(0.747)	(0.400)
L.advisory_activity	26.70***	19.71***
	(5.738)	(2.617)
L.equity_ratio	6.473**	0.775
	(2.784)	(1.230)
L.current_deposits_over_liabs	0.00385	0.176
	(0.307)	(0.178)
L.size_over_gdp	0.192	0.0907
	(0.265)	(0.145)
Constant	2.423	-0.106
	(9.474)	(5.260)
Observations	299	299
VIFs	1.29-7.36	1.32-7.47
GMM criterion Q(b)	1.02 x e^{-17}	1.97 x e^{-19}
Pr > F endo reg	>0.999	>0.999

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.1. The two equations are estimated simultaneously and so are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses, as a means to address the assumed presence of non-spherical error variance. VIFs for this set of regressors vary from 1.29 to 7.47, but this has not prevented the detection of significant associations or caused sign reversals (shown using shorter equations). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.)

Looking across all of the above results (Tables 6.2 and 6.3) it is clear that Board Size positively affects returns. This conclusion is bolstered by the finding, shown in section 6.7, that a larger Board also boosts ROE. It is consistent with the hypothesis (H6.1) that a larger Board entails greater expertise on which to draw and thus better use of information in respect of risk and return.

The magnitude of the effect I find is material. Adding one extra Board member increases ROA by an amount equal to between 0.04% and 0.12% of total assets, compared to an average bank ROA in the sample of 0.4% of total assets. The lower end of this range is more credible because it is derived from more-robust GMM estimation, but it nevertheless seems that adding five extra Board members could increase ROA by at least half of its baseline value (making an assumption that they are of comparable ability to those members already present). Results for ROE in section 6.7 similarly suggest that adding one extra Board member increases ROE by an amount equal to 0.7% to 0.8% of total equity, compared to an average of 4.4%.

In some estimations, I also find a positive effect on risk arising from a larger Board size, but this is not consistently-significant and so must be discounted. Similarly, if I had omitted risk-return simultaneity in the manner of section 4.6, I would then find that a larger Board size appeared to lead to greater risk and greater return. This would have forced me to conclude that larger Boards encourage greater profit-seeking and greater risk-tolerance, possibly because of stronger shareholder representation. This erroneous conclusion would be very different from the one I eventually reached and shows the importance of accommodating simultaneity in my models.

A potential objection to my conclusions is that Boards could become less effective as they get bigger, for various reasons. Directors might assume that oversight responsibilities are being exercised by other Directors, or communication amongst Directors might become more difficult. However, this is refuted in my data by the empirical finding that larger Boards boost profitability. In addition, when I add powers of the Board size variable to my models, to allow for possible nonlinear effects (such as reversal of effect at very large values of the regressor) no additional significant relationships are found.

These results are very interesting in the context of the relevant theoretical and empirical literature. Empirical studies summarised in section 6.2 (Pathan 2009, Aebi *et al* 2013 and Liang *et al* 2013) suggest that larger Boards lower risk and return. However, the only consistently-significant effect I find is a positive effect on bank returns.

I am therefore led to a very different conclusion from the pre-existing empirical literature. The empirical literature appears to suggest that larger Boards entail lower risk appetite (presumably because there are more NEDs – a variable which I test separately) and a classical risk-return correlation. My results suggest instead a picture in which larger Boards entail greater skills and experience, hence greater information-processing capabilities, hence a better risk-return trade-off. It is clear that the greater ability to use information that arises overwhelms any effects of disagreement within a larger group or delays in making decisions. In any case, it is not clear that a Board group of less than 30 individuals would experience significant coordination problems when firms can coordinate many thousands of staff.

Why exactly do my results differ from earlier empirical studies? The negative effect on performance reported by Liang *et al*, 2013 came from a study that did not have any obvious empirical deficiencies, but it was derived from a single setting (China) that is institutionally different from other economies in which bank risk and return have been analysed. My results may be more indicative of what occurs in a Western-style economy.

The negative effects of Board size on bank risk reported by Pathan (2009) and Aebi *et al* (2013) came from an economy (the US) where there is no obvious reason to expect Director incentives to be fundamentally different from my sample (the UK). However, these studies did select different measures of risk from my work, including financial losses during a crisis period, the Altman Z-score and measures related to stock price volatility, and they are anyway not as contradictory with my results as those of Liang *et al* (2013).

In any case, taking my results together with those in the literature, I conclude that larger Board size does indeed improve the risk-return trade-off (by lowering risk and increasing performance) because it improves information-processing capability.

In addition to the result for Board size, I also find in Tables 6.2 and 6.3 above that the presence of a Joint CEO-Chairman negatively affects loan impairments. This result would be surprising if we based our thinking entirely on personal incentives and believed, as regulators appear to, that independent Chairmen have weaker profit-seeking and risk-taking incentives than CEOs, such that they cause lower risk.

This result is not specific to my data – the same finding is reported by Pathan (2009) using data for the US. Pathan employed an extensive multi-year data set and a well-controlled panel model specification, so the result is reliable. The dependent variables used were entirely different from mine, but were still meaningful indicators of risk. Taking these results together with my own, it seems that having the same person hold the CEO and Chairman roles does indeed lead to lower bank risk.

One way to dismiss my result would be to argue that that independent Chairmen force better recognition of impairments, whereas unhindered CEOs are able to conceal them. This would create the appearance that a Joint CEO-Chairman lowers risk. However, it could equally be argued that a higher ratio of NEDs on the Board would lead to better recognition of impairments since ensuring 'true and fair' public accounting is a major function of Boards (UK Financial Reporting Council, 2014), and that this could create the appearance of an effect on risk contrary to theoretical expectations. But this effect is not evident, so the 'impairments recognition' argument is not plausible.

Another interpretation that could be advanced is that Joint CEO-Chairmen are remunerated differently from CEOs who are not also Chairmen. Shareholders and Boards might give the former less profit-seeking, risk-tolerant incentives. However, Dey *et al* (2011) report the opposite: that CEO remuneration has a higher profit-linked component when the role is combined with that of Chairman. This study used data for US corporates in general (not just banks) but it nevertheless suggests that pay does not explain my result.

A more useful guide is provided by Yang and Zhao (2014). They report that separating the roles of CEO and Chairman leads to lower bank performance. They also report that this negative effect is greater in firms with greater complexity and higher information costs (as indicated by expenditures on marketing and R&D, the level of intangible assets and investment analysts' forecasting errors). They suggest that this means that separation of the roles of CEO and Chairman has negative effects because of slower and more difficult decision-making.

Another useful study is Rus *et al* (2011). They find that the self-serving behaviour of leaders is moderated by individual accountability. It is possible that, when the roles of CEO and Chairman are combined, there is no-one else the CEO can assume is exercising oversight, and no-one else they can blame in the event of adverse outcomes, so they are more motivated to be prudent. This effect can exist alongside that identified by Yang and Zhao (2014) and, indeed, is complementary to it. So I can conclude that having a Joint CEO-Chairman leads to lower risk because it permits clearer decision-making and places greater accountability for risk management on the CEO.

It is important to note at this point that, had I omitted risk-return simultaneity in the manner of section 4.6, I would have mistakenly concluded that a Joint CEO-Chairman leads to lower risk and lower return. This would have been contrary to hypothesis H6.2. It would have suggested an interpretation of lower risk tolerance, rather than the beneficial effects for the bank in terms of risk and/or return envisaged in hypothesis H6.2.

My results suggest a number of other findings, but these are not robust and so are not relied upon. A low NED ratio (NEDs being less than 50% of the Board) may lead to lower returns and / or lower impairments. However, this is not consistent across the two estimation approaches (2SLS and GMM) and it is the opposite of what would be expected: that NEDs lacking power would allow executives to pursue returns more aggressively and take more risk. So it is not relied upon.

There is also unreliable evidence that the presence of a Chief Risk Officer as a full Board Director leads to lower risk and lower return, and that the presence of a Commercial Director as a full Board member has the same effect. However, these results are not consistent across the two estimation approaches and it is very surprising that the presence of Directors on the Board who would be expected to have opposing incentives (one to lower risk and one to pursue returns) appear to have the same effects. So these results are again not relied upon – although more interesting conclusions relating to the CRO role are reached when its interactions are considered, in the next section.

In conclusion, I accept hypothesis H6.1 and H6.2 based on the evidence of this section. Policy implications of this are discussed further in section 6.12.

6.6 The Interactions of the Chairman and CRO

A surprising feature of the above results is that governance variables do not have as many effects on bank risk and return as expected. The Director Ratio appears to have no effects at all, even though having a sufficient number of NEDs on the Board is considered a core principle of good corporate governance (UK Corporate Governance Code 2014). Meanwhile, estimates of the effects of a low NED ratio (NEDs being less than half of the Board) are inconsistent and unreliable. There is credible evidence in section 6.11 that a higher Director Ratio leads to a lower probability of bank failure, but even here the robustness of the result is not fully complete.

Having a CRO as a full Board member likewise does not appear to have any robustly-detectable effects. This is again surprising as I expected that an independent CRO would have the same effects on risk and/or return as an independent Chairman.

One possible technical interpretation is that these explanatory variables are affected by multicollinearity that prevents the detection of significant results. Variance Inflation Factors for the regressors in question are: Low NED: 4.07, CRO Present on Board: 3.41, Director Ratio: 2.95, Commercial Director Present on Board: 1.52. These values are not extreme, and are no larger than for other regressors where I detect significant effects, so it is not likely that they caused an otherwise highly-significant result to become insignificant.

To further test the possibility that significant associations are overlooked because of multicollinearity, the four regressors mentioned above were used in models with no other regressors, other than year dummies as controls. These models used loan impairments, ROA, ROE, loan interest income and growth in total assets as dependent variables. The first two dependent variables above were treated as simultaneous, as per the relationship uncovered in Chapter 4, while the others were analysed using single-equation models. In this setting VIFs for the regressors were: Director Ratio: 1.92, Low NED: 1.60, Commercial Director on Board: 1.26 and CRO Present on Board: 1.02. However, once again, no significant relationship of these regressors with any dependent variable was found (results not shown but available upon request). Thus, because of the stripped-down models used, it is unlikely that multicollinearity is the reason no significant relationships are detected.

Another possible reason that, in section 6.5, I do not find some of the effects expected relates to a further gap in the relevant empirical literature. The empirical literature ignores the possibility that internal agents with similar incentives to one another (such as the Chairman, NEDs and the CRO) may act as complements or substitutes for one another. For instance, an independent Chairman may be more effective in a setting where there are a large number of NEDs on the Board to support his or her decisions. Alternatively, an independent Chairman and a CRO may each have such powers to influence decisions that they are redundant, with the presence of either having the same effect as the presence of both.

I address this possibility by using interaction terms. Specifically I use the term cumulative governance (cumul_gov) which takes the value 3 if a bank has all three of an independent Chairman, CRO on the Board and NEDs being over 50% of the Board. It takes the value 2 if two of these are the case, 1 if only one of them is true and zero if none of them are true. I also use the term CRO or Chair (cro_or_chair), which takes the value 1 if either an independent Chairman or CRO (or both) is present. Taken together, these test the possibilities that features of corporate governance which empower agents with similar preferences and effects are either substitutes or complements for one another. Interaction terms are computed after missing-value replacement so that the interaction values are consistent with the post-replacement values of the underlying terms.

Furthermore, it is possible that effects of the Director Ratio are not detected because important nonlinearities are omitted. It is conceivable that, as the numbers of NEDs increase from very low levels, to average levels, to very high levels, their authorities and incentives change in nonlinear ways. At very low numbers of NEDs relative to executives, they may lack the collective power to do anything. At average numbers they may have the power and incentive to act. At very high numbers, they may each assume that some other NEDs are exercising oversight, or that blame may be diluted in the event of failure, such that they each have limited incentive to intervene. I test these possibilities by adding squares and cubes of the director ratio to models as a means to allow for nonlinearity.

Models used to test hypotheses are estimated using the following equations (Table 6.4) with equation numbers used for cross-reference in regression tables.

Table 6.4 Dependent and explanatory variables in models for testing hypotheses that interactions between governance structures affect loan impairments and ROA.

Dependent Variable: loan_impairments	
All equations (6.5 and 6.7)	Equation (6.5)
return_on_assets L.return_on_assets L.board_size L.director_ratio L.low_ned L.cumul_gov L.cro_or_chair L.female_ratio L.no_exp_ratio L.growth_total_assets L.loan_interest_income L.state_majority_owner L.mutual_ownership L.foreign_parent L.rem_co L.exec_rem_disclosed L.average_pay L.irb_permission L.exposure_to_banks L.securities_holdings L.advisory_activity L.equity_ratio L.curr_dep_over_liab L.size_over_gdp Year Dummies	L.director_ratio_sq L.director_ratio_cu

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

Table 6.4 (contd.) Dependent and explanatory variables in models for testing hypotheses that interactions between governance structures affect loan impairments and ROA.

Dependent Variable: return_on_assets	
All equations (6.6 and 6.8)	Equation (6.6)
loan_impairments	L.director_ratio_sq
L.loan_impairments	L.director_ratio_cu
L.board_size	
L.director_ratio	
L.low_ned	
L.cumul_gov	
L.cro_or_chair	
L.female_ratio	
L.no_exp_ratio	
L.growth_total_assets	
L.loan_interest_income	
L.state_majority_owner	
L.mutual_ownership	
L.foreign_parent	
L.rem_co	
L.exec_rem_disclosed	
L.average_pay	
L.irb_permission	
L.exposure_to_banks	
L.securities_holdings	
L.advisory_activity	
L.equity_ratio	
L.curr_dep_over_liab	
L.size_over_gdp	
Year Dummies	

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

These equations differ from the baseline model specification in section 3.1 in three respects. First, the interaction terms discussed above the table are introduced, for the reasons explained. Second, governance terms without interactions (specifically Joint CEO-Chairman and CRO Present on Board) are dropped to avoid multicollinearity with the interaction terms. Third, powers of the Director Ratio are included as a form of robustness testing for the same reasons as in section 6.5.

Please note that the changes in specification introduced here do not imply that models in earlier sections were mis-specified. As I do throughout this thesis, I am simply introducing small variations to the baseline model specification stated in Table 3.1 because this is an effective means of testing many hypotheses. It is also an effective means of showing that results are robust across many variations of model specification (for instance, the results reported in earlier sections for mutuality, a foreign parent and Board size still hold true in Tables 6.5 and 6.6 below). Results obtained are as follows.

Table 6.5 2SLS estimation results for interactions amongst governance terms in models with simultaneity of risk and return.

	Model 1		Model 2	
	(6.5) loan_ impairments	(6.6) return_on_ assets	(6.7) loan_ impairments	(6.8) return_on_ assets
return_on_assets	-4.828***		-5.662**	
	(1.711)		(2.519)	
L.return_on_assets	2.359**		3.026*	
	(1.153)		(1.748)	
loan_impairments		-1.706***		-1.615***
		(0.631)		(0.514)
L.loan_impairments		0.785*		0.732**
		(0.419)		(0.345)
L.board_size	0.0113	0.116**	0.0435	0.104**
	(0.0664)	(0.0564)	(0.0730)	(0.0444)
L.director_ratio	**121.0**	**-103.2**	**1.366**	**-0.900**
	(114.7)	**(80.34)**	**(2.224)**	**(1.074)**
L.director_ratio_sq	**-201.7**	**148.6**		
	(168.9)	**(116.4)**		
L.director_ratio_cu	**108.3**	**-70.74**		
	(82.25)	**(55.68)**		
L.low_ned	**1.239**	**-2.722***	**1.886**	**-1.694***
	(2.154)	**(1.544)**	**(2.249)**	**(0.958)**
L.cumul_gov	**-0.410**	**-0.292**	**-0.140**	**-0.295**
	(0.674)	**(0.466)**	**(0.826)**	**(0.437)**
L.cro_or_chair	**4.594****	**0.644**	**4.499****	**0.764**
	(1.864)	**(0.792)**	**(2.244)**	**(0.692)**
L.female_ratio	-1.804	0.0317	-1.291	-0.0247
	(1.870)	(1.281)	(2.224)	(1.163)
L.no_exp_ratio	1.112	0.527	1.002	0.552
	(0.898)	(0.587)	(1.087)	(0.553)
L.growth_total_assets	-0.000214	0.00259	0.00145	0.00190
	(0.00563)	(0.00423)	(0.00706)	(0.00381)
L.loan_interest_income	0.0281	-0.0261*	0.0343	-0.0230*
	(0.0255)	(0.0151)	(0.0339)	(0.0123)
L.state_majority_owner	-1.225	-1.205*	0.151	-1.426**
	(0.767)	(0.623)	(1.039)	(0.664)
L.mutual_ownership	-2.681***	-0.819*	-2.824**	-0.895**
	(0.938)	(0.452)	(1.182)	(0.421)
L.foreign_parent	-2.093**	-0.841*	-2.163**	-0.856*
	(0.851)	(0.467)	(1.064)	(0.440)
L.rem_co	-0.126	0.877*	-0.000684	0.778*
	(0.655)	(0.511)	(0.767)	(0.425)
L.exec_rem_disclosed	-0.356	-0.198	-0.587	-0.160
	(0.396)	(0.272)	(0.512)	(0.253)

L.average_pay	-1.404	-1.279	1.315	-1.810
	(2.008)	(1.443)	(2.627)	(1.465)
L.irb_permission	-1.779**	-0.491	-2.093*	-0.482
	(0.779)	(0.366)	(1.077)	(0.343)
L.exposure_to_banks	-2.666	3.692*	-2.705	3.297**
	(2.635)	(2.072)	(3.241)	(1.637)
L.securities_holdings	-1.403	2.612	-2.270	2.574*
	(1.855)	(1.618)	(2.606)	(1.454)
L.advisory_activity	74.35**	-16.80	93.93*	-16.30
	(32.98)	(21.12)	(49.79)	(19.01)
L.equity_ratio	-33.22	34.79*	-43.43	32.04**
	(23.35)	(18.22)	(33.67)	(14.85)
L.curr_dep_over_liab	1.789	-1.043	2.049	-0.852
	(1.157)	(0.760)	(1.503)	(0.606)
L.size_over_gdp	1.056	-0.274	0.911	-0.196
	(0.802)	(0.488)	(0.940)	(0.428)
Constant	-22.71	21.05	-0.656	-1.798
	(25.40)	(17.65)	(2.420)	(1.435)
Observations	297	297	297	297
VIFs	1.33-7.30	1.32-7.51	1.33-7.18	1.32-7.29
F statistic	8.44	4.08	6.59	4.83
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Hall-Pagan	<0.001	<0.001	<0.001	<0.001
Pr > Breusch-Pagan	<0.001		<0.001	

Year dummies included but not shown

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.4. Where two equations are estimated simultaneously they are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using two-stage least squares. Estimated parameter values are shown along with star symbols for statistical significance. Classical standard errors are in parentheses. Diagnostic testing using Hall-Pagan, Breusch-Pagan and system tests shows the presence of non-spherical error variance, such that the next results table uses GMM with clustered standard errors as a complement. VIFs for this set of regressors vary from 1.32 to 7.51, but this has not prevented the detection of significant associations or caused any reversals of sign (shown using shorter equations). VIFs for powers of the director ratio were excluded. Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity;

results not shown.) Pr>Breusch-Pagan and Pr>Hall-Pagan are probabilities of obtaining test statistics at least as extreme as those obtained under the null hypothesis of spherical error variance.

As in previous sections, because the specific 2SLS estimation command employed does not support calculation of clustered standard errors, and because it is necessary to show robustness to a change in estimation procedure, a GMM estimator with clustered standard errors was used as a complement. Results are as follows. Models are estimated using the same equations 6.5 and 6.6 as in the preceding table.

Table 6.6 GMM estimation results for effects of governance interactions in models with simultaneity of risk and return.

	Model 2	
	(6.5) loan_ impairments	(6.6) return_on_ assets
return_on_assets	-1.832***	
	(0.133)	
L.return_on_assets	0.307***	
	(0.0867)	
loan_impairments		-0.512***
		(0.0274)
L.loan_impairments		0.0185
		(0.0421)
L.board_size	0.0620***	0.0342**
	(0.0234)	(0.0140)
L.director_ratio	-11.82	0.565
	(40.37)	(21.93)
L.director_ratio_sq	4.610	-8.020
	(59.23)	(31.88)
L.director_ratio_cu	3.086	6.888
	(28.94)	(15.46)
L.low_ned	-1.550**	-0.674
	(0.727)	(0.455)
L.cumul_gov	**-0.376***	**-0.222**
	(0.215)	**(0.135)**
L.cro_or_chair	**1.920****	**1.189****
	(0.790)	**(0.533)**
L.female_ratio	-1.034**	-0.807**
	(0.500)	(0.322)
L.no_exp_ratio	0.775***	0.489***
	(0.273)	(0.186)
L.growth_total_assets	-0.000555	-3.30e-05
	(0.00250)	(0.00139)
L.loan_interest_income	-0.0123*	-0.00245
	(0.00633)	(0.00297)
L.state_majority_owner	-1.070*	-0.572*
	(0.608)	(0.305)
L.mutual_ownership	-1.423***	-0.835***
	(0.385)	(0.208)
L.foreign_parent	-1.137**	-0.717***
	(0.504)	(0.264)

L.rem_co	0.515**	0.226*
	(0.229)	(0.125)
L.exec_rem_disclosed	-0.262	-0.146
	(0.171)	(0.0943)
L.average_pay	-1.320	-0.585
	(0.985)	(0.504)
L.irb_permission	-0.680***	-0.427***
	(0.245)	(0.148)
L.exposure_to_banks	1.327	0.315
	(0.886)	(0.524)
L.securities_holdings	0.864	0.316
	(0.760)	(0.403)
L.advisory_activity	25.33***	19.10***
	(5.698)	(2.735)
L.equity_ratio	6.863**	0.884
	(2.753)	(1.210)
L.current_deposits_over_liabs	-0.00952	0.176
	(0.307)	(0.181)
L.size_over_gdp	0.228	0.112
	(0.276)	(0.154)
Constant	4.006	0.740
	(9.294)	(5.139)
Observations	299	299
VIFs	1.33-7.18	1.32-7.29
GMM criterion Q(b)	2.00 x e^{-17}	3.24 x e^{-19}
Pr > F endo reg	>0.999	>0.999

Year dummies included but not shown

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.4. The two equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. The presence of non-sphericity is assumed, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.33 to 7.29, but this has not prevented the detection of significant associations or caused sign reversals (shown using shorter equations with less multicollinearity). VIFs for powers of the director ratio are excluded. Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.)

These results (Tables 6.5 and 6.6) point to one new finding. There is evidence that the variable CRO or Chair has a positive effect on loan impairments. This is not what we would expect if, contrary to hypothesis H6.3, we believed that only personal incentives matter in determining the effects of a given role, such that empowering risk-averse agents would lead to lower impairments. For anyone who does hold this view (as regulators appear to) my result cannot be dismissed as sign reversal due to multicollinearity with the other indicators of governance interactions, because I investigated this possibility using shorter equations and excluded any material impact of multicollinearity.

Crucially, the effect reported here is not simply the same effect as that detected for the variable Joint CEO-Chairman in section 6.5 (given that having an independent Chairman is simply the negation of having a Joint CEO-Chairman). If the effect of having an independent Chairman were the only one present, diluting this variable with a supposedly irrelevant term (the presence of an independent CRO) in the interaction variable CRO or Chair would substantially reduce the absolute value of parameter magnitudes compared to section 6.5. Instead, in section 6.6 I find magnitudes of 1.9, 4.5 and 4.6 (compared to 1.5, 2.9 and 4.2 in section 6.5). The parameter values actually increase – indicating that the presence of a CRO on the Board has a similar effect to an independent Chairman, although the interaction term is required for the effect to be detectable due to substitution effects.

In section 6.5 I concluded that CEOs behave in a more risk-averse manner when they also hold the role of Chairman, because of greater personal accountability and clearer decision-making. Here I conclude that two senior-level agents that are both monitors of the CEO (the Chairman and an independent CRO) act as substitutes for one another and do so in ways that lead to increased risk.

This should not be over-interpreted as meaning that all risk governance structures are without value. First, the result relates only to an *independent* CRO who is a full Board member. Nearly all of the banks in my sample had a CRO, but in most cases they were not a full Board member and reported to the CEO instead. Because this is the counterfactual to having a CRO on the Board, it is clear that it cannot have the same adverse effects as having a CRO on the Board. In short, it is better for the CRO to report to the CEO than to be an independent Board member.

Second, other independent risk structures clearly do have value: I find in section 6.9 that IRB framework lowers risk and in section 6.11 that NEDs lower the probability of bank failure. Third, it is likely that a CRO is helpful in running an IRB framework, whether or not they are a Board member. So we can conclude that an independent Chairman and an independent CRO do not have the beneficial effects assumed by regulators, and indeed are counter-productive, but not that the principle of oversight of risk management is misguided.

There is also some evidence that the variable Cumulative Governance leads to reduced impairments. However, this is not robust across estimation methods (2SLS and GMM) and therefore cannot be relied upon.

Overall, the parts of my models on governance produce fewer significant parameter estimates than those on ownership. It seems that governance, while it does have important effects, does not matter as much as ownership in determining financial outcomes for banks. It may be that the governance structures are not always strong in practice, whereas ownership is a hard fact that can never be ignored by agents within banks.

In addition, there is evidence that structures which are considered to represent good corporate governance (a high number of NEDs, an independent Chairman and a CRO as a full Board member) do not have the effects on financial outcomes that regulators rely on in guidance such as the UK Corporate Governance Code (2014). A higher director ratio has no apparent financial effects, although it does have the very important effect of reducing the probability of bank failure (see section 6.11). An independent Chairman and an independent CRO, by contrast, appear to have the opposite effects from those intended: increasing risk because they weaken the accountability of the CEO and complicate decision-making.

The fact that the variable CRO or Chair yields significant results, while Cumulative Governance does not, suggests that a CRO and Chairman can act as substitutes for one another but that there is no sense in which those structures that are considered good governance (independent Chairman, independent CRO and many NEDs) are complements of one another. The latter is consistent with the finding that CRO and Chairman are substitutes (rather than complements) and the finding that NEDs have different effects from either of these.

In conclusion, I accept hypothesis H6.3 based on the evidence shown in this section. Given that hypothesis H6.2 was also accepted, this implies a need for substantial revision to Corporate Governance Codes. The implications are discussed more in section 6.12.

6.7 Limited Effects of Non-Executive Directors

No significant effects for the Director Ratio were detected in the previous sections. It appears that the proportion of NEDs on the Board has no effect on banks' financial outcomes. Can this be true when my results are considered in the context of the wider literature? If it is true, what does that imply for regulators and policymakers?

The lack of any financial effect of the Director Ratio must be understood in the context of a literature where there is a consensus on the role of Directors who are independent from management, but at least one major study that dissents from the consensus. Analysis from the International Monetary Fund (Brandão-Marques *et al,* 2014) finds that independence at Board level leads to reduced risk. Likewise, Pathan (2009) reports that director independence has a negative impact on bank risk. By contrast, a study by the World Bank (Anginer *et al*, 2014) reports that independence in the governance structure at Board level leads to increased bank risk-taking

These studies have important weaknesses. The World Bank study relied on composite measures of independence at the Board level and is thus hard to interpret in terms of the effects of any one, clearly-defined governance structure. Meanwhile, the IMF study relied on controls at the country level in a way that leaves it particularly vulnerable to bias at the level of bank observational units.

The study by Pathan (2009) used a different setting from me (the United States) and dependent variables relating to stock prices and composite measures of bank risk. However, Pathan's work was most similar to my own in terms of methodology. It used panel models with clearly-defined variables and sufficient controls. So it is the most reliable comparator.

Comparing my results to those of Pathan (2009) forces me to the conclusion that the effects of having more NEDs on the Board are context-specific. The effects are evident for certain indicators and settings but not evident for others. Crucially, one of the ways in which an effect is evident is a higher rate of bank failure when NEDs are fewer in number, as reported in section 6.11 below. So NEDs are effective, just not as effective as the literature and corporate governance guidelines would suggest.

In conclusion, hypothesis H6.5 is accepted based on the evidence of section 6.11 which considers bank failure as a dependent variable, but the evidence suggests that effects on financial outcomes only occur in certain contexts.

6.8 Director Experience and Bank Performance

Information asymmetries and the implications of limited and imperfect information may be more important in banks than in other firms. This is because banking is especially complex and opaque (Boot, 2011) with the intangible nature of certain key issues likely increasing opacity because they make understanding more difficult. In this setting, if some banks can use information better than their competitors, they may be able to find lower-risk assets without returns being priced-away.

The empirical literature has not addressed this hypothesis. I can test it using IRB permission and the number of Directors with previous financial services experience as regressors. IRB is a regulatory framework designed explicitly to improve information processing in respect of risk, while financial services experience is likely to affect the ability of Directors to identify and assess risk.

My analysis below shows that the proportion of Directors with no financial services experience has a positive effect on ROE. This is consistent with the hypothesis (H6.6) that Directors lacking FS experience may pursue returns more aggressively because they do not understand the eventual consequences in terms of risk as fully as directors who do have FS experience. In manually collecting governance data, I noted that many directors without FS experience came from the retail sector (which is focused on sales) so it is possible that they brought sales-oriented habits with them to the banking sector.

Models used to test hypotheses are estimated using the following equations (Table 6.7) with equation numbers used for cross-reference in regression tables.

Table 6.7 Dependent and explanatory variables in models for testing the hypothesis that director experience affects returns.

Dependent Variable: return_on_equity			
All equations (6.9 t0 6.12)	Equation (6.10)	Equation (6.11)	Equation (6.12)
L.no_exp_ratio	L.joint_ceo_chairman	L.state_majority_owner	L.state_majority_owner
L.growth_total_assets	L.cro_present_onboard	L.mutual_ownership	L.mutual_ownership
L.loan_impairments	L.comm_dir_board	L.foreign_parent	L.foreign_parent
L.loan_interest_income	L.female_ratio	L.board_size	L.board_size
L.irb_permission		L.director_ratio	L.director_ratio
L.exposure_to_banks		L.rem_co	L.rem_co
L.securities_holdings		L.exec_rem_disclosed	L.exec_rem_disclosed
L.advisory_activity		L.average_pay	L.average_pay
L.equity_ratio		L.joint_ceo_chairman	L.joint_ceo_chairman
L.curr_dep_over_liab		L.cro_present_onboard	L.cro_present_onboard
L.size_over_gdp		L.comm_dir_board	L.comm_dir_board
Year Dummies		L.female_ratio	L.female_ratio

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Return on equity is used as a dependent variable because this is assumed to be the outcome of greatest interest to shareholders (see section 3.4 for discussion) and, in an environment where Directors (who are in large part representative of shareholders) have better or worse ability to use information, this is the outcome one would most expect to be affected.

These models use the baseline specification as shown in Table 3.1. Unlike models for ROE reported in section 5.5, I do not introduce as extra controls financial outcomes used as dependent variables elsewhere in the thesis. This difference is introduced because it allows the two sections to act as robustness tests for one another and I can confirm that the same key results are evident in each (negative effect of mutual and foreign ownership on ROE and positive effect of Board size and no experience ratio on ROE). Across equations 6.9 to 6.12 above further robustness testing is carried out by varying specification (using a different pattern of regressor-dropping from section 5.5) and by using OLS to estimate 6.9 to 6.11 and random effects to estimate 6.12.

As noted previously, even though I am testing effects of governance, ownership and balance sheet characteristics are retained in the model. This is because there are reasons to believe that governance characteristics have effects on risk and performance (see Chapter 5) and reason to believe that different business models (as reflected by different balance sheet structures) also have such effects (discussed in section 3.4). Omitting either could lead to bias due to mis-specification. Models are estimated in linear form because there is no literature which points to any specific non-linear relationship that should be used and linear models are sufficient to test the hypothesis of a significant relationship under the *ceteris paribus* condition that other regressors are effectively held constant. Results are as follows.

Table 6.8 Estimation results for effects of director experience.

	OLS	OLS	OLS	Random Effects
	(6.9) return_on_ equity	(6.10) return_on_ equity	(6.11) return_on_ equity	(6.12) return_on_ equity
L.no_exp_ratio	**3.617**	**10.41****	**7.301***	**7.047***
	(3.554)	**(4.386)**	**(3.953)**	**(4.238)**
L.growth_total_assets	0.0507**	0.0421*	0.00540	0.0182
	(0.0234)	(0.0234)	(0.0255)	(0.0225)
L.loan_impairments	-1.011	-1.367	-1.450	-1.029
	(0.961)	(0.824)	(0.873)	(0.855)
L.loan_interest_income	-0.0616	-0.0839	-0.105**	-0.0832*
	(0.0603)	(0.0533)	(0.0481)	(0.0505)
L.state_majority_owner			-6.429	-5.361
			(4.235)	(4.402)
L.mutual_ownership			-7.303*	-7.352*
			(3.721)	(3.932)
L.foreign_parent			-13.44***	-12.66***
			(4.160)	(4.430)
L.board_size			0.681*	0.784*
			(0.402)	(0.418)
L.director_ratio			-4.398	-2.809
			(8.042)	(8.428)
L.rem_co			1.247	0.472
			(3.016)	(3.586)
L.exec_rem_disclosed			-2.969	-2.348
			(1.939)	(2.078)
L.average_pay			20.54	24.91*
			(13.34)	(14.63)
L.joint_ceo_chairman		-22.05	-21.22	-22.63
		(14.97)	(14.79)	(15.91)
L.cro_present_onboard		-0.0796	-1.678	-1.582
		(1.620)	(2.472)	(2.379)
L.comm_dir_board		1.322	0.0887	0.444
		(1.567)	(1.551)	(1.595)
L.female_ratio		-12.48	-14.45**	-7.806
		(7.518)	(5.677)	(6.240)
L.irb_permission	0.474	-3.304	-4.623	-5.223
	(2.875)	(3.051)	(3.494)	(3.489)
L.exposure_to_banks	-3.306	-6.213	-2.960	-5.737
	(7.160)	(8.446)	(10.13)	(11.62)
L.securities_holdings	2.712	-0.466	-6.680	-10.51
	(5.494)	(4.289)	(9.217)	(10.33)
L.advisory_activity	157.4***	198.5***	104.2	95.10
	(26.42)	(52.47)	(69.01)	(69.87)

L.equity_ratio	26.64	38.58	20.25	14.67
	(34.31)	(23.92)	(24.46)	(24.83)
L.curr_dep_over_liab	5.716**	3.696	4.392	5.988
	(2.829)	(2.699)	(3.789)	(4.059)
L.size_over_gdp	4.547**	9.614***	4.157	4.130
	(2.232)	(3.301)	(3.638)	(3.564)
Constant	-3.528	-3.269	4.872	1.986
	(4.508)	(3.303)	(8.436)	(8.610)
Observations	354	310	304	304
R-squared	0.149	0.294	0.373	0.366
VIFs	1.13-3.92	1.10-4.70	1.29-7.08	1.29-7.08
F statistic	11.0	12.1	12.3	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				382.6
Pr > Chi^2				<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.7. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 6.9 to 6.11 are estimated using OLS, while 6.12 is estimated as a panel model with random effects. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.13 to 7.08, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, as was expected for this set of regressors. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability at least as extreme as that obtained under the null hypothesis of spherical error variance.

These results (Table 6.8) indicate that the proportion of directors with no previous financial services experience has a positive effect on bank performance. This suggests either that diversity of experience leads to better outcome because it makes it possible to draw on insights from a greater range of previous situations, or that Directors from non-financial-services backgrounds engage in more aggressive marketing because they do not understand the risk this may eventually bring. In section 6.11 I find evidence that the proportion of directors with no previous financial services experience has a positive association with the probability of bank failure. This makes it very unlikely that the 'diversity of experience' interpretation above is correct, and instead supports the argument that lack of previous financial services experience on the Board leads to more aggressive pursuit of profit, with positive implications for returns but also a heightened risk of bank failure.

There are no other studies which specifically consider the role of Director experience in determining bank outcomes in this way. However, it is clear that regulators, from their experience, note the importance of Director suitability. The UK regulator operates an 'approved persons' regime for financial services, designed to ensure that senior individuals are 'fit and proper' (Financial Conduct Authority Handbook, Approved Persons Sourcebook) and the UK Corporate Governance Code (2014) likewise requires that Boards should include a suitable range of skills, knowledge and experience. The investigation by the UK authorities into the failure of Royal Bank of Scotland in 2008 (Financial Services Authority, 2011) similarly points out that, while the Board of RBS met formal corporate governance standards, it may not have included a sufficient level of experience in banking and investment. These publications support the view that previous Director experience in relevant sectors is important.

My results above also show a positive effect of Board Size on ROE. This supports the conclusions of section 6.5 in that it suggests a wider set if skills leads to better use of information and stronger performance (see section 6.5 for further discussion).

In conclusion, hypothesis H6.6 is accepted. Having a higher proportion of directors with no previous experience in financial services leads to increased profit, and a higher probability of bank failure. This underlines the need to ensure that the right individuals are selected as bank Directors. Policy implications are discussed further in section 6.12.

6.9 IRB Permission: Effects on Risk and Return

In this section, I use a novel simultaneous equations framework to show a clear negative effect of IRB permission on loan impairments and ROA. The Internal Ratings Based (IRB) approach to credit risk measurement in banks, as created in the 2004 Basel II international capital accord (Bank for International Settlements, 2006) and continued under the 2009 Basel III accord (Bank for International Settlements, 2009), permits banks to employ statistical models developed internally within the bank to quantify credit risk and the amount of regulatory capital required to mitigate this risk.

Banks must obtain regulatory permission to adopt the IRB approach, after regulators apply stringent scrutiny to their governance, risk management, data management and modelling capabilities in order to decide if such permission should be granted. Banks which to not meet the required standard must instead adopt the Standardised approach to credit risk measurement, in which regulatory capital requirements are quantified using relatively simple formulae prescribed by the regulator (and are typically higher than under IRB). In addition, on a model-by-model basis, regulators must be satisfied that the internal governance and analytical processes employed in developing, validating and approving a particular credit risk model are adequate before it may be used.

IRB permission, because it reflects a generally superior framework for measuring and managing credit risk, and because it entails the presence of robust statistical models for quantifying such risk, is expected to enable banks to make better credit decisions than banks lacking such permission.

Taking this as the starting point, one could argue that IRB banks achieve higher return at the same level of risk, or lower risk at the same level of return, because they can discriminate attractive risk-return pairings in individual loans better than other banks. However, while some studies show that IRB is considered in relation to loan pricing (Ruthenberg and Landskroner, 2008) none show that banks seek to use it to identify attractive risk-return pairings. Therefore, I hypothesise that IRB leads to lower risk and lower return simply because it provides information to risk-averse agents within banks and information can be empowering (Ashraf, 2008).

I use a three-equation model below to show that IRB permission lowers both loan impairments and ROA. This finding is consistent with the hypothesis that IRB permission permits better detection of risk, empowers risk averse agents by providing them with information and thus leads to less risk-taking and lower returns. However it should be noted that there is no effect of IRB on growth in total assets (results not shown), suggesting that there is no effect on investment provided to the wider economy, which is more important in a social sense than the profits of individual banks.

Interestingly, I also find some evidence that IRB permission leads to lower equity ratios (higher leverage), which is consistent with the view that regulators permitted IRB banks in my sample to be more leveraged. Since higher leverage normally leads to higher ROE, this finding vindicates the decision to control for effects of IRB on leverage when examining the effects of IRB on returns.

Models used to test hypotheses are estimated using the following equations (Table 6.9) with equation numbers used for cross-reference in regression tables.

Table 6.9 Dependent and explanatory variables included in models for testing the hypothesis that IRB permission affects loan impairments and ROA.

Dependent Variable: loan_impairments
Equation (6.13)
L.irb_permission
L.big_and_irb
securities_holdings
return_on_assets
L.return_on_assets
L.growth_total_assets
L.loan_interest_income
L.state_majority_owner
L.mutual_ownership
L.foreign_parent
L.board_size
L.director_ratio
L.rem_co
L.exec_rem_disclosed
L.average_pay
L.joint_ceo_chairman
L.cro_present_onboard
L.comm_dir_board
L.female_ratio
L.no_exp_ratio
L.exposure_to_banks
L.advisory_activity
L.equity_ratio
L.current_deposits_over_liabs
L.size_over_gdp
Year dummies

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Table 6.9 (contd.) Dependent and explanatory variables included in models for testing the hypothesis that IRB permission affects loan impairments and ROA.

Dependent Variable: return_on_assets
Equation (6.14)
L.irb_permission
L.big_and_irb
securities_holdings
loan_impairments
L. loan_impairments
L.growth_total_assets
L.loan_interest_income
L.state_majority_owner
L.mutual_ownership
L.foreign_parent
L.board_size
L.director_ratio
L.rem_co
L.exec_rem_disclosed
L.average_pay
L.joint_ceo_chairman
L.cro_present_onboard
L.comm_dir_board
L.female_ratio
L.no_exp_ratio
L.exposure_to_banks
L.advisory_activity
L.equity_ratio
L.current_deposits_over_liabs
L.size_over_gdp
Year dummies

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Table 6.9 (contd.) Dependent and explanatory variables included in models for testing the hypothesis that IRB permission affects loan impairments and ROA.

Dependent variable: L.equity_ratio
Equation (6.15)
L.irb_permission L.securities_holdings Year Dummies

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Loan impairments and ROA are used as dependent variables, because these are my principal measures of risk and return, and because using ROE could lead to confounding as IRB may directly affect the equity ratio. Effects of IRB on leverage are controlled for, but it is still prudent not to rely on a dependent variable that contains equity in its definition when IRB permission may directly affect the equity ratio.

In terms of explanatory framework, the three-equation formulation shown above in Table 6.9 is necessary because it is suggested in the literature (Cathcart *et al,* 2015) that UK regulators have allowed IRB banks to hold less capital than other banks, such that they had lower equity ratios (higher leverage ratios). By allowing IRB permission to affect equity ratio in my models, and equity ratio to then affect the outcomes of interest, I capture this effect.

In terms of regressors contained in equations 6.13 and 6.14, the only significant departure from the baseline model specification stated in Table 3.1 is that I test the interaction of IRB permission with an indicator variable for large size (which takes a value of 1 if total assets are greater than 10% of GDP). This is intended to control for the fact that IRB imposes significant burdens in terms of organisational structures (Chorafas, 2004) and it seems clear that these burdens involve thresholds that are more easily met by large banks. Thus, there could be confounding between IRB and size that should be controlled for. The threshold of 10% of GDP was chosen because the empirical distribution of the variable size over GDP is dense below this level and long and sparse above it. Interaction terms were computed after missing-value replacement so that the interaction values are consistent with the post-replacement values of the underlying terms (although this is of limited relevance in this case as the relevant missing-rates are very low).

The variable securities holdings is used as a regressor in equation 6.15, but not 6.13 or 6.14. This is intended to reflect the tendency of investment bank status (as indicated by securities holdings) to lead to higher leverage (Ozcan *et al* 2012). It also serves to ensure that the system of equations is identified by placing a regressor (securities holdings) in the equation for equity ratio that is not present in any other equation. Such identification is necessary in order for any estimator to yield a unique set of parameter estimates for a given model specification and data set.

Robustness testing involving holding out of subsets of regressors was carried out and showed the results to be robust. This is not shown for reasons of space but can be shared upon request.

Models are estimated in linear form because there is no reason to believe in any specific form of nonlinearity and because this format is sufficient to test hypotheses while controlling for covariates. Estimation is by both 2SLS and GMM. Results are as follows.

Table 6.10 2SLS estimation results for effects of IRB permission in models with simultaneity of risk and return.

	Model 1		
	(6.13) loan_ impairments	(6.14) return_on_ assets	(6.15) L_equity_ ratio
L.irb_permission	**-2.013***	**-0.833****	**-0.0216****
	(1.192)	**(0.415)**	**(0.00973)**
L.big_and_irb	**0.749**	**0.0707**	
	(0.998)	**(0.513)**	
L.securities_holdings			-0.00967
			(0.0183)
return_on_assets	-4.342**		
	(1.683)		
L.return_on_assets	2.244**		
	(0.976)		
loan_impairments		-0.744***	
		(0.265)	
L.loan_impairments		0.637***	
		(0.236)	
L.growth_total_assets	0.00344	0.00100	
	(0.00550)	(0.00275)	
L.loan_interest_income	0.0105	0.0422**	
	(0.0396)	(0.0201)	
L.state_majority_owner	0.0512	-0.763*	
	(0.713)	(0.410)	
L.mutual_ownership	-1.999	-1.537***	
	(1.267)	(0.390)	
L.foreign_parent	-1.255	-1.803***	
	(1.176)	(0.473)	
L.board_size	0.0728	0.0407	
	(0.0523)	(0.0321)	
L.director_ratio	-0.904	0.771	
	(1.348)	(0.734)	
L.rem_co	0.102	0.612**	
	(0.548)	(0.289)	
L.exec_rem_disclosed	-0.402	-0.644**	
	(0.619)	(0.268)	
L.average_pay	-0.488	-0.418	
	(1.406)	(0.713)	
L.joint_ceo_chairman	-2.998**	-0.924**	
	(1.377)	(0.369)	
L.cro_present_onboard	-0.237	-0.152	
	(0.613)	(0.329)	
L.comm_dir_board	-0.356	-0.235	
	(0.365)	(0.151)	

L.female_ratio	-0.895	-1.261	
	(2.064)	(0.951)	
L.no_exp_ratio	0.753	-0.363	
	(0.813)	(0.513)	
L.exposure_to_banks	-0.855	0.359	
	(1.772)	(0.838)	
L.advisory_activity	67.41	25.03**	
	(46.98)	(12.03)	
L.equity_ratio	-21.18	-19.20	
	(33.78)	(13.38)	
L.current_deposits_over_liabs	1.366	0.430	
	(1.310)	(0.447)	
L.size_over_gdp	0.380	-0.691*	
	(0.721)	(0.409)	
Constant	2.803	1.805	0.0682***
	(3.352)	(1.254)	(0.00435)
Observations	295	295	295
VIFs	1.29-7.26	1.30-7.42	1.05
F statistic	9.29	7.73	3.77
Pr > F	<0.001	<0.001	0.023
Pr > F endo reg	>0.999	0.999	0.985
Pr > Hall-Pagan	<0.001	<0.001	<0.001
Pr > Breusch-Pagan	<0.001		

Year dummies included but not shown
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.9. The three equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using two-stage least squares. Estimated parameter values are shown along with star symbols for statistical significance. Classical standard errors are in parentheses. Diagnostic testing using Hall-Pagan, Breusch-Pagan and system tests shows the presence of non-spherical error variance, such that the next results table uses generalised method of moments with clustered standard errors, as a comparator. VIFs for this set of regressors vary from 1.05 to 7.42, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller equations). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity, other than possibly in equation 6.15, which is present for control purposes only, not empirical testing. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan and Pr>Hall-Pagan are probabilities of obtaining test statistics at least as extreme as those obtained under the null hypothesis of spherical error variance.

These results (Table 6.10) suggest very clearly that IRB permission leads to lower loan impairments and lower ROA. However, since the specific 2SLS estimation employed does not support calculation of robust standard errors, and to test for robustness to a change in estimator, a GMM estimator with clustered standard errors was used as a complement. Results are as follows. Models are estimated using the same equations 6.13 to 6.15 as above, albeit with GMM as the estimator in place of 2SLS.

Table 6.11 GMM estimation results for effects of IRB permission in models with simultaneity of risk and return.

	Model 1		
	6.13 loan_ impairments	6.14 return_on_ assets	6.15 L.equity_ ratio
L.irb_permission	**-0.872** (0.370)**	**-0.561*** (0.207)**	**-0.0214*** (0.00825)**
L.big_and_irb	**0.259 (0.544)**	**0.200 (0.309)**	
securities_holdings			-0.00957 (0.0248)
return_on_assets	-1.880*** (0.123)		
L.return_on_assets	0.332*** (0.0960)		
loan_impairments		-0.502*** (0.0273)	
L.loan_impairments		0.0251 (0.0414)	
L.growth_total_assets	-0.000896 (0.00370)	0.000128 (0.00195)	
L.loan_interest_income	-0.0111* (0.00616)	-0.00170 (0.00292)	
L.state_majority_owner	-0.677 (0.471)	-0.314 (0.252)	
L.mutual_ownership	-1.505*** (0.412)	-0.839*** (0.236)	
L.foreign_parent	-1.276*** (0.483)	-0.742*** (0.263)	
L.board_size	0.0825*** (0.0302)	0.0465** (0.0186)	
L.director_ratio	-0.171 (0.648)	-0.189 (0.334)	
L.rem_co	0.570** (0.250)	0.256** (0.126)	
L.exec_rem_disclosed	-0.285 (0.191)	-0.166 (0.103)	
L.average_pay	-0.180 (0.661)	-0.0327 (0.382)	
L.joint_ceo_chairman	-1.559** (0.652)	-0.917** (0.450)	
L.cro_present_onboard	-0.417 (0.263)	-0.231 (0.156)	
L.comm_dir_board	-0.144 (0.0984)	-0.0929 (0.0664)	

L.female_ratio	-0.501	-0.550*	
	(0.488)	(0.302)	
L.no_exp_ratio	0.814***	0.480***	
	(0.273)	(0.172)	
L.exposure_to_banks	1.190	0.295	
	(0.842)	(0.472)	
L.advisory_activity	28.68***	21.05***	
	(6.788)	(3.284)	
L.equity_ratio	5.680**	0.216	
	(2.320)	(1.236)	
L.current_deposits_over_liabs	-0.0605	0.165	
	(0.294)	(0.174)	
L.size_over_gdp	0.120	0.00536	
	(0.271)	(0.145)	
Constant	0.416	0.423	0.0680***
	(0.786)	(0.445)	(0.00556)
Observations	297	297	297
VIFs	1.29-7.26	1.30-7.42	1.05
GMM criterion Q(b)	2.58 x e^{-17}	4.05 x e^{-19}	2.22 x e^{-12}
Pr > F endo reg	>0.999	>0.999	0.940

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.9. The three equations are estimated simultaneously and are shown under the heading of the same model. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using the generalised method of moments. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses and are used to address the assumed presence of non-spherical error variance. VIFs for this set of regressors vary from 1.05 to 7.42, but this has not prevented the detection of significant associations or caused sign reversals (shown using shorter equations). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.)

These results (Tables 6.10 and 6.11) allow us to conclude that the effects of IRB are robust. IRB permission leads to lower loan impairments and also lower ROA. Taking the GMM estimates as definitive, on the basis that they are expected to be more efficient and less vulnerable to bias, suggests that IRB permission lowers loan impairments by 0.9% (of gross loans) and lowers ROA by 0.6% (of total assets). Given that the average values in the sample of these dependent variables are 0.3% and 0.4% respectively, these are substantial effects (although they will obviously be offset in practice by variation in the other explanatory variables).

The only consistent interpretation of these results is that IRB permission is reflective of greater competence in risk analysis and management, which lead to better detection of risk, which in turn empowers agents who are risk averse and leads to less risk-taking, which leads to lower returns. The other possiblities outlined at the start of this section are not tenable; in particular, because IRB permission lowers both risk and return it cannot be argued that it improves the risk-return trade-off.

It is important to interpret this finding in the context of literature which has questioned the value of the IRB framework. The major critique of the IRB framework is found in Aikman *et al* (2014) and Haldane (2013) and other papers and comments by the same authors, who are senior regulators at the Bank of England. Their fundamental argument is that back-testing shows that simple heuristics out-perform IRB as a predictor of bank risk, in part because of the difficulties inherent in predictive modelling, and in part because bankers have an incentive to deliberately mis-estimate IRB models, which they can do in an environment of complexity and opacity. When model builders in the risk management function are not sufficiently independent from the front-line business, bankers may be able to distort models to obtain lower estimates of risk so that they can do more deals and earn more bonus, irrespective of the eventual consequences for the bank as a whole.

The arguments in Aikman *et al* (2014) and Haldane (2013) confuse and confound governance problems with analytical problems. Even if models governance within banks is frequently weak, it does not imply that predictive analytics *per se* are not effective. However, if the issues these authors describe are severe for every bank that has IRB permission (and they do point to clear evidence that they arise within banks) then the usefulness of IRB may be undermined.

My results show that problems with IRB are not this severe. I find clear, robust evidence that the IRB framework lowers bank risk and, as implied by the classical risk-return trade-off in finance theory, also lowers return. So, while the operation of IRB frameworks may be subject to governance problems, it is very clear that these problems have not entirely undermined the effectiveness of the system.

Why does the IRB framework lower both risk and return? If it improves the availability of information, by converting raw data into a format usable for decisions in a way that other banks cannot match, then should we not expect it to have a beneficial effect on one of risk or return, without affecting the other? Why does it not lead to this kind of improvement in the risk-return trade-off?

It cannot be because other banks can mimic the decisions of IRB banks so that benefits are priced-away; this would simply cause all significant effects of IRB to disappear because it would make outcomes the same across all banks irrespective of IRB status. Likewise, it cannot be because other banks have non-IRB risk-scoring systems that are equally effective; this would again cause all significant effects of IRB to disappear. What we are left with is the argument that the information generated by IRB may be used in a debate between agents who care chiefly about return (bankers) or risk (risk managers) and is not used to identify cases where return is anomalously high given the level of risk. As noted already, there is no robust evidence that IRB is used by banks to identify loans where the risk-return trade-off is anomalously good, even though it would be in their interest to do so.

However, there is evidence that information empowers agents in settings where they are in debate with other agents who have differing incentives. This has been found, for instance, in the case of providing information to poor citizens who must negotiate with potentially-corrupt bureaucracies in low-income countries (Ashraf, 2008). Within banks, it is likely that risk officers can better curtail excessive risk-taking by profit-incentivised bankers when that can point to specific quantification of the risk involved. So IRB likely empowers risk-averse agents.

This suggests that IRB is a useful tool for achieving the policy goal of lowering risk in the banking system. It also suggests that there is an unexploited opportunity for banks and their regulators to improve the risk-return trade-off in the banking system by using IRB to identify loans where the risk-return mix is anomalously good.

I therefore accept hypothesis H6.7 on the basis that IRB is found to lower both risk and return. The policy implications of this are discussed in section 6.12.

6.10 No Effects of Gender Imbalance

Like IRB permission and the proportion of Directors with previous financial services experience, the gender balance on a bank's Board may also impact its information-processing capability and the decisions made. If the reason for gender imbalance is discrimination, then the bank has ignored suitable candidates for Board membership and has likely lowered its ability to process information effectively. This hypothesis has not previously been tested in the literature on bank governance.

As shown in section 3.8, the average bank in my sample has a Board which is 13% female. The literature on gender imbalance on Boards is divided over the cause of this. In a discussion of the literature, Mishra and Jhunjhunwala (2013) identify causes on the demand side (subtle discrimination from men that tends to keep women out of the most senior roles) and the supply side (insufficient numbers of female candidates reaching senior levels because of such structural factors as unbalanced childcare responsibilities between men and women coupled with working environments not accommodative of childcare).

So, while it cannot necessarily be said that the gender imbalance of Boards is purely due to irrational discrimination, it appears clear that it may be at least part of the cause. In addition, given that all banks face the same structural conditions in the economy that may cause some women to drop back earlier in their careers and not reach Board level as a result, any differential between banks in terms of gender imbalance on the Board must represent differing levels of discrimination. Therefore, the proportion of the Board which is female represents a good indicator of comparative levels of discrimination. This could conceivably be positive discrimination (banks putting more women on their Boards in order to appear socially conscious) but, given the literature, negative discrimination appears more likely.

My analysis below initially suggests that a higher proportion of female directors is associated with lower ROE. However, this result disappears when we take account of structurally lower performance in certain banks. We can therefore conclude that gender imbalance, although undesirable on other grounds, has no measureable adverse effects on bank financial outcomes in this sample.

Models used to test hypotheses are estimated using the following equations (Table 6.12) with equation numbers used for cross-reference in regression tables.

Table 6.12 Dependent and explanatory variables in models for testing the hypothesis that the proportion of female directors affects returns.

Dependent Variable: return_on_equity			
All equations (6.16 to 6.19)	Equation (6.17)	Equation (6.18)	Equation (6.19)
L.female_ratio	L.state_majority_owner	L.state_majority_owner	L.state_majority_owner
L.growth_total_assets	L.mutual_ownership	L.mutual_ownership	L.mutual_ownership
L.loan_impairments	L.foreign_parent	L.foreign_parent	L.foreign_parent
L.loan_interest_income	L.irb_permission	L.board_size	L.board_size
L.exposure_to_banks		L.director_ratio	L.director_ratio
L.securities_holdings		L.rem_co	L.rem_co
L.advisory_activity		L.exec_rem_disclosed	L.exec_rem_disclosed
L.equity_ratio		L.average_pay	L.average_pay
L.curr_dep_over_liab		L.joint_ceo_chairman	L.joint_ceo_chairman
L.size_over_gdp		L.cro_present_onboard	L.cro_present_onboard
Year Dummies		L.comm_dir_board	L.comm_dir_board
		L.no_exp_ratio	L.no_exp_ratio
		L.irb_permission	L.irb_permission

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Return on equity is used as dependent variable because this is most appropriate in a setting where one is considering an attribute of a bank that may entail different abilities to use information at the Director level. This is because, as argued in section 3.4, shareholders care primarily about ROE as an outcome because it represents the efficiency of their equity stake in generating returns, and Directors are in large part representatives of shareholders in a UK corporate governance context.

On the other sides of the equations, models use the baseline specification shown in Section 3.1, with specification varied across the four equations for reasons of robustness testing. Ownership, other governance and balance sheet characteristics are retained and linear functional forms are used, for the same reasons in earlier sections of this Chapter. Estimation is by OLS (equations 6.16 to 6.18) and random effects (equation 6.19) in order to avoid dependence of results on one estimation method. This turns out to be important in that the presence of a significant association in OLS, with the opposite sign expected, can be explained *via* the absence of such an association in random effects (see below).

Table 6.13 Estimation results for effects of the proportion of female directors.

	OLS	OLS	OLS	Random Effects
	(6.16) return_on_ equity	(6.17) return_on_ equity	(6.18) return_on_ equity	(6.19) return_on_ equity
L.female_ratio	**-8.688**	**-20.99****	**-14.45****	**-7.806**
	(9.222)	**(9.404)**	**(5.677)**	**(6.240)**
L.growth_total_assets	0.0527**	0.0370	0.00540	0.0182
	(0.0256)	(0.0222)	(0.0255)	(0.0225)
L.loan_impairments	-0.959	-0.635	-1.450	-1.029
	(0.952)	(0.841)	(0.873)	(0.855)
L.loan_interest_income	-0.0591	-0.0543	-0.105**	-0.0832*
	(0.0585)	(0.0539)	(0.0481)	(0.0505)
L.state_majority_owner		-5.192	-6.429	-5.361
		(4.724)	(4.235)	(4.402)
L.mutual_ownership		-1.223	-7.303*	-7.352*
		(4.066)	(3.721)	(3.932)
L.foreign_parent		-6.676*	-13.44***	-12.66***
		(3.660)	(4.160)	(4.430)
L.board_size			0.681*	0.784*
			(0.402)	(0.418)
L.director_ratio			-4.398	-2.809
			(8.042)	(8.428)
L.rem_co			1.247	0.472
			(3.016)	(3.586)
L.exec_rem_disclosed			-2.969	-2.348
			(1.939)	(2.078)
L.average_pay			20.54	24.91*
			(13.34)	(14.63)
L.joint_ceo_chairman			-21.22	-22.63
			(14.79)	(15.91)
L.cro_present_onboard			-1.678	-1.582
			(2.472)	(2.379)
L.comm_dir_board			0.0887	0.444
			(1.551)	(1.595)
L.no_exp_ratio			7.301*	7.047*
			(3.953)	(4.238)
L.irb_permission		1.735	-4.623	-5.223
		(3.045)	(3.494)	(3.489)
L.exposure_to_banks	-2.811	0.404	-2.960	-5.737
	(7.302)	(7.916)	(10.13)	(11.62)
L.securities_holdings	1.920	5.417	-6.680	-10.51
	(5.335)	(5.687)	(9.217)	(10.33)

L.advisory_activity	165.8***	139.8***	104.2	95.10
	(25.21)	(41.53)	(69.01)	(69.87)
L.equity_ratio	20.93	5.441	20.25	14.67
	(31.84)	(30.89)	(24.46)	(24.83)
L.curr_dep_over_liab	6.042**	4.765*	4.392	5.988
	(2.922)	(2.833)	(3.789)	(4.059)
L.size_over_gdp	4.940**	2.153	4.157	4.130
	(1.981)	(2.893)	(3.638)	(3.564)
Constant	-0.851	6.784	4.872	1.986
	(3.868)	(5.682)	(8.436)	(8.610)
Observations	354	349	304	304
R-squared	0.150	0.195	0.373	0.369
VIFs	1.08-3.77	1.17-4.47	1.29-7.08	1.29-7.08
F statistic	12.5	11.5	12.3	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				382.7
Pr > Chi^2				<0.001
F stat endo reg	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 6.12. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 6.16 to 6.18 are estimated using OLS, while 6.19 is estimated as a panel model with random effects. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.08 to 7.08, but this has not prevented the detection of significant associations or caused sign reversals (shown using shorter equations). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

These results (Table 6.13) initially appear surprising. There is (incompletely robust) evidence that the ratio of female directors in my sample is negatively associated with ROE. One possible interpretation of the above result is that the biomedical and sociological literature (e.g. Sapienza *et al,* 2008) suggests that women have a lower risk tolerance than men. It may therefore be that Boards with a higher proportion of female Directors decide on lower leverage ratios (or lower risk in other ways) and this leads to lower ROE (but also *ceteris paribus* less danger of insolvency).

I attempt to test this hypothesis using a two-equation model (not shown for reasons of space) in which the ratio of female directors determines equity ratio (alongside a covariate – securities holdings – that is indicative of high-leverage investment banking activities) while female ratio and equity ratio determine ROE (alongside covariates). However, in this analysis, all significant relationships disappear, indicating that the model is mis-specified. This suggests that the interpretation that female ratio affects leverage ratio is incorrect.

The estimation results in Table 6.13 suggest an alternative interpretation. The relationship detected ceases to be significant when panel estimation is used, whereas other relationships remain significant under panel estimation. This suggests that banks which have structurally lower performance appoint more female directors. This could be because they wish to be seen to do well on other fronts because they are doing poorly financially (making their commitment to gender equality insincere). Or, conversely, it could be that they have social priorities alongside financial ones, reflected in greater gender equality, a lower emphasis on earning profits and probably other outcomes.

Further research could possibly test this conclusion further (see section 9.5 for discussion). However, this would be beyond the scope of the hypothesis considered here (H6.8), which involves the proposition that irrational gender discrimination has adverse effects on bank risk and return. We must conclude, from the evidence available, that such discrimination does not have adverse financial effects (although it is clearly undesirable on other grounds). Hypothesis H6.8 is rejected.

6.11 Governance and Bank Failure

As discussed in section 5.6, one would expect effects of ownership and governance on bank risk and performance to exist alongside effects of the same regressors on bank failure. *Ceteris paribus* we would expect any characteristic which increases performance to reduce the probability of failure, and any characteristic which increases asset risk to increase the probability of failure. If something reduces performance and risk, then it would be expected that the larger of these two effects would be dominant in terms of effects on the probability of failure.

The argument that governance is likely to be important in determining the probability of bank failure is reinforced by the work of Liang *et al* (2016). In a study using data mining techniques and a data set from Taiwan, they show that corporate governance indicators are useful in bankruptcy prediction.

To determine if governance affects the likelihood of bank failure in the ways I suggest above, I use the same models 5.13 to 5.15 as in section 5.6. Please refer to section 5.6 for the rationale for the specification of these models. Results are as follows.

Table 6.14 Probit estimation results for governance as a determinant of bank failure.

	(5.13) combined_ failure	(5.14) combined_ failure	(5.15) combined_ failure
L.growth_gross_loans			0.00714
			(0.00550)
L.growth_total_assets			0.0233***
			(0.00853)
L.loan_impairments			-0.111
			(0.435)
L.return_on_assets			0.0560
			(0.303)
L.return_on_equity			-0.0221***
			(0.00610)
L.state_majority_owner	1.172***	2.061***	8.760***
	(0.407)	(0.694)	(1.827)
L.mutual_ownership	0.192	-0.736	0.998
	(0.478)	(0.639)	(1.349)
L.foreign_parent	0.913**	1.176**	5.887***
	(0.425)	(0.592)	(1.579)
L.board_size	0.0178	0.0422	0.0832
	(0.0498)	(0.0694)	(0.103)
L.director_ratio	**-1.118**	**-3.317**	**-9.247*** **
	(1.280)	**(2.136)**	**(3.522)**
L.rem_co	**-0.737** **	**-0.985** **	**-2.808*** **
	(0.329)	**(0.497)**	**(0.743)**
L.exec_rem_disclosed	**0.577**	**0.808**	**3.731*** **
	(0.397)	**(0.559)**	**(0.910)**
L.average_pay	0.0313	-3.572	-5.424
	(0.0694)	(2.739)	(4.198)
L.joint_ceo_chairman	-0.0881	0.889	0.398
	(0.417)	(0.547)	(0.828)
L.cro_present_onboard	0.460	-0.284	-0.349
	(0.593)	(0.565)	(0.874)
L.comm_dir_board	-0.109	-0.505*	-0.842**
	(0.272)	(0.300)	(0.360)
L.female_ratio	-0.822	-1.148	2.664
	(1.914)	(2.394)	(3.035)
L.no_exp_ratio	**0.478**	**2.211** **	**5.794*** **
	(0.709)	**(0.985)**	**(1.609)**
L.irb_permission	0.0678	0.268	-5.956***
	(0.425)	(0.492)	(1.602)
L.exposure_to_banks		-2.188*	-5.784***
		(1.217)	(1.436)

L.securities_holdings		-4.444**	-7.575***
		(1.982)	(2.462)
L.advisory_activity		-83.80**	-73.17
		(34.92)	(52.53)
L.equity_ratio		2.362	5.221
		(1.710)	(10.08)
L.current_deposits_over_liabs		-0.818	0.138
		(0.553)	(0.851)
L.size_over_gdp		0.0362	1.718*
		(0.683)	(0.894)
Constant	-1.063	2.264	0.941
	(0.803)	(1.428)	(2.042)
Observations	406	384	294
Pseudo-R-squared	0.235	0.376	0.591
VIFs (these regressors)	1.18 – 3.15	1.27 – 6.23	1.28 – 7.3
Wald Chi^2	422.0	463.7	2225.7
Pr > Chi^2	<0.001	<0.001	<0.001
Pr < Smith-Blundell	<0.001	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as in section 5.6. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using maximum likelihood with numerical optimisation. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses and are used to address the presumed presence of non-spherical error variance. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr<Smith-Blundell is the probability of obtaining a Smith-Blundell statistic at least as small as was obtained under the null that regressors are endogenous.

In Table 6.14, a higher ratio of NEDs and the presence of a remuneration committee both lower the probability of failure – suggesting that these structures work as intended: ensuring better oversight of risk-taking and ensuring that remuneration policy is better aligned with risk-management, respectively. On this basis, I accept hypothesis H6.5 (relating to the director ratio) and hypothesis H6.9 (relating to the remuneration committee).

It is important to note that, if I had not used a simultaneous equations framework for estimating effects on ROA and loan impairments, then the results of section 4.6 show that I would have been misled into thinking that the presence of a Remuneration Committee has a positive effect on ROA and impairments. This would have completely obscured the proper conclusion that it lowers risk only, in a way that lowers the rate of bank failure.

In addition, the proportion of directors with no previous financial services experience has a positive effect on the probability of failure. This must be interpreted alongside my earlier finding that this variable leads to higher ROE. Taken together, the best interpretation of these two findings is that having Directors drawn from non-financial-services backgrounds leads to more aggressive pursuit of returns, with later consequences for the probability of bank failure. (These consequences are clearly mediated by some mechanism other than through low ROE eroding equity – a different pattern from how a foreign parent increases the probability of failure). I therefore accept hypothesis H6.6, as already stated.

IRB permission also lowers the probability of bank failure. This leads to an interesting comparison between three variables that all lower both ROA and loan impairments – IRB permission, mutuality and having a foreign parent. Of these, a foreign parent increases the probability of bank failure while mutuality has no effect on the failure rate and IRB lowers it. The key to understanding why this is not contradictory lies in different effects on ROE, which has a vital effect on bank solvency. A foreign parent has a large negative effect on ROE, mutuality has a smaller negative effect and IRB has no effect at all. It is clear that the effect of a foreign parent on ROE is big enough to sometimes affect bank solvency, that this is not the case for mutual ownership and that the lack of a direct effect of IRB on ROE allows it to have beneficial effects on bank survival by other mechanisms. In conclusion, IRB permission lowers the rate of bank failure, thus providing further support for my earlier conclusion that hypothesis H6.7 should be accepted.

The presence of a Commercial Director on the Board appears to be negatively associated with the probability of failure. This is the opposite of my expectation. A possible explanation is that the presence of such a role entails greater use of front-line knowledge in Board decisions. However, it is not clear why this effect would not be evident in other outcomes I have analysed. In any case, hypothesis H6.4 (that a Commercial Director has a positive effect on risk) is rejected.

Disclosure of executive remuneration appears to be positively associated with the probability of failure, which is the opposite of my expectation. One possible interpretation is simply that banks which engage in high levels of risk-taking use high levels of transparency as a means to justify their actions. However, this is too speculative, and hypothesis H6.10 is rejected.

6.12 Conclusions

This chapter uses novel simultaneous equations frameworks and other supporting models to reach a number of interesting conclusions on the roles of governance and information-processing capacity in banks.

Hypotheses H6.1 to 6.3, H6.5 to 6.7 and H6.9 are all accepted. Only hypotheses H6.4, H6.8 and H6.10 are rejected, on grounds of insufficient or contradictory evidence. All these findings represent important contributions to the literature.

Specifically, the presence of a Joint CEO-Chairman leads to lower loan impairments. This is likely due to greater personal accountability for risk perceived by the CEO and clearer decision-making when these two roles are combined.

Similarly, the presence of an independent CRO has the effect of increasing loan impairments. This is consistent with the preceding conclusion and with the view that having Board-level individuals responsible for monitoring the CEO weakens the accountability perceived by the CEO and impedes clear decision-making. The results for Chairman and CRO are lent credibility by being consistent with one another. This is a radical conclusion in that it implies that guidance on corporate governance which supports having an independent Chairman and an independent CRO is essentially misguided. Although the proportion of NEDs on the Board has no financial effects (which is surprising), I find that the proportion of NEDs on the Board and the presence of a remuneration committee each lower the probability of bank failure. This suggests that these structures work as intended – lowering the danger of bank instability by ensuring appropriate oversight and incentives, respectively. The finding relating to the remuneration committee is particularly striking – it is fully robust and it suggests that setting risk-aligned incentives can have powerful effects.

Characteristics related to the ability of banks to process information have clear effects. Larger Board size is found to have positive effects on performance and, taking my results in conjunction with the literature, may also reduce risk. This can be attributed to better information processing and, consequently, a better risk-return trade-off. IRB permission – which is a direct indicator of ability to process information relating to credit risk – leads to lower ROA, lower loan impairments, and a lower rate of bank failure, compared to other banks. This suggests that IRB permission, because it leads to better detection of risk, empowers risk-averse agents, leading to less risk-taking and consequently less return. This, in turn, suggests that someone in the marketplace has sufficient information to price the relevant assets such that they earn lower return. It is also notable that IRB does not affect growth in bank assets, indicating that it does not affect credit provision to the wider economy.

A higher proportion of Directors without previous financial services experience leads to higher performance and a higher probability of failure – which is consistent with the hypothesis that Directors from non-FS backgrounds (such as retail) pursue profits more aggressively, leading eventually to a greater probability of failure.

The proportion of Directors on the Board who are female was also hypothesised to indicate better information processing. Specifically, if the reason for gender imbalance is irrational discrimination then banks will have overlooked skilled persons and their ability to make good decisions may be impaired. However, the empirical evidence does not support this hypothesis. So, while discrimination is clearly undesirable on other grounds, we cannot say that it has adverse financial impacts in this sample.

Similarly, the expected effects for Commercial Director on the Board and Executive Remuneration Disclosed were not evident. In these cases, the parameter sign was the opposite of that anticipated. The only possible interpretations of these results are speculative, so the hypotheses are simply rejected.

A number of more general themes are evident in these findings. One is that characteristics relating to information-processing capability are generally important. Board size, IRB permission and the number of Directors with previous financial services experience all have effects that can all be attributed to differences in the ability of banks to use information relating to risk and return.

A second theme is that governance has fewer significant effects than ownership. It may be that governance structures are not as strong in practice as claimed (i.e. informal behaviour partially overcomes formal governance) while ownership types are hard facts that cannot easily be ignored by agents within banks. Some aspects of governance either lack the effects that regulators clearly assume or have the opposite effects.

In particular, an independent Chairman and an independent CRO each appear to have impacts opposite to what financial services regulators desire in that they increase risk, rather than lowering it. Having high numbers of NEDs, meanwhile, has some of the effects expected (reducing bank failure rates) but not all of them (no detectable effects on financial outcomes). On balance, governance appears less effective than ownership in affecting bank behaviour.

A third theme is that, taking my results together with the literature, there are indications that some aspects of ownership and governance have effects which are context-dependent. This may be the case for foreign ownership, the proportion of NEDs on the Board and the presence of a CRO as a full Board member. It is not surprising to find context-dependence in a social science setting where comparable units may have unobserved differences between settings that may cause them to act in different ways. This is consistent with the literature on managerial ownership and ownership concentrations (see sections 2.5.2 and 2.5.4), where different studies using different contexts and methods report opposite effects on risk-taking of managerial ownership and block-holdings.

A fourth and final theme is that different governance structures are not complements for one another and only the CRO and Chairman are substitutes for one another. NEDs have different effects that are subject to neither substitution nor complementarity with the other indicators of governance considered.

In terms of economic policy and prudential regulation of banks, these results have interesting implications (drawn using normative assumptions stated in section 9.3). Larger Boards appear to be desirable, on the basis that they increase return and may also reduce risk. The IRB framework also appears to be useful, despite arguments in the literature implying the contrary (Aikman *et al*, 2014 and Haldane, 2013), on the grounds that its effects on risk and lack of effects on provision of credit to the economy have clearer social significance than its effects on returns (profit can be due to efficiency or rent-seeking). There is also reason to believe that the risk-return trade-off in the banking system could be improved if IRB banks made better use of their IRB models to identify cases where the return is anomalously high given the level of risk.

Having a sufficient number of NEDs on the Board, although it does not have as many effects as expected, is beneficial in that it lowers the probability of bank failure. Likewise, a remuneration committee appears to be highly effective in setting incentives that reduce the probability of bank failure.

By contrast, other features of what is considered to be 'good governance' (UK Corporate Governance Code 2014) do not have the effects expected, or are even counter-productive. Specifically, an independent Chairman and an independent CRO each cause higher impairments because they weaken the personal accountability of the CEO and complicate decision-making. This may not be true in all settings as Aebi *et al* (2012) and Dong *et al* (2014) find different results in narrower contexts. Nevertheless, it is clear that there are material circumstances in which independent Chairmen and independent

CROs have the exact opposite consequences from those intended by policymakers.

Taking all of this together, it is clear that official guidance relating to corporate governance needs to be kept as it is in some respects and reconsidered in others. Regulators should retain guidance requiring large numbers of NEDs (and by extension large Boards) and should focus on ensuring that the individuals on Boards have financial services experience. They should also retain a focus on having a strong Remuneration Committee. IRB should be strengthened and embedded deeper into bank decision-making (a move contrary to the direction of current regulatory thinking, as discussed in section 6.9). By contrast, the requirements for an independent Chairman and independent CRO should be abolished and replaced with alternative structures that ensure there is scrutiny of CEO's choices, without taking away personal accountability or confusing decision-making. The latter would represent a radical shift in governance standards.

Given that all of the characteristics relating to information processing proved to have important effects, it seems clear that regulators should focus on improving information systems within banks. This is especially so since banks' ways of using information are reported to have important weaknesses and to be out-dated in some respects (Eastburn and Boland, 2015).

On a broader level, it is clear from the limitations that are evident in the effects of corporate governance that it cannot be relied upon in isolation as a means to reform banking. The results of Chapter 5 suggest that mutual ownership has clear effectiveness as a means of reducing bank risk. This suggests that reforms to banking, if they aim to limit risk without affecting credit provision to the wider economy, should focus on combining greater prevalence of mutuals with the changes to governance codes I recommend here.

Chapter 7: Bank Pay and its Consequences

7.1 Introduction

In this Chapter, I test hypotheses relating to the determinants of bank pay (at all levels in the organisation) and the consequences of such pay for bank risk and return. I use each of average pay, growth in total assets, returns and combined failure as dependent variables because these match the specific hypotheses I test. For the latter three I use the methodology described in Chapter 3 (because this is my general approach for testing the effect of any feature of bank ownership and governance on risk and return). For determinants of average pay I use a different methodology described in section 7.4.

It is important to understand pay at all levels in banks because the pre-existing literature on bank remuneration has focused narrowly on the remuneration of the CEO and other very senior levels. It has neglected the causes and consequences of pay at more junior levels which could, in aggregate, be equally important.

I address this gap by testing a series of novel hypotheses relating to the determinants of bank pay and the effects of bank pay on risk and performance, focusing on pay at all levels, not just that of the CEO. In analysing the determinants of average pay at all levels within banks, I test the novel hypothesis that there is a positive effect on bank pay from the positive component of return on assets (that is the component of ROA obtained setting any negative ROA values to zero) but no effect from negative components of ROA. This hypothesis is derived from the literature on downwards nominal wage rigidity, as explained in section 7.3. However, the hypothesis is rejected and I find no evidence at all that bank returns affect bank pay.

I also reject the hypothesis that loan impairments have a negative effect on average pay in banks. Taken together with the findings on returns, this suggests that financial outcomes at the bank level have surprisingly little effect on bank pay, which is a novel and important insight. It suggests that banks are able to set their pay with no dependence on how well they do financially.

I test and accept other novel hypotheses that the presence of a remuneration committee and large numbers of non-executive directors lead to higher average pay, while the disclosure of executive remuneration leads to lower average pay. These effects occur because structures which regulators intend to control pay are used instead to justify high pay, while the effect of pay disclosure is to discourage high pay, for reputational reasons.

These results must be interpreted alongside the finding in the previous chapter that the presence of a Remuneration Committee robustly lowers the probability of bank failure. It is clear that a Remuneration Committee is, in some way, able to structure incentives so as to reduce the risk of bank failure, but these effects are not mediated through the average level of pay, and may instead occur through effects on the detailed structure of executive and Board pay.

I also show that mutual banks have lower average pay while investment banks have higher average pay. This is hardly surprising, but it is the first time the comparison has been formally demonstrated.

In examining the consequences of bank pay, I accept the novel hypotheses that higher average pay leads to faster growth of bank assets and a lower rate of bank failure, both due to efficiency-wage effects. I also accept the hypotheses that excess pay (beyond that which can be explained by variables which are important across banks) leads to slower growth of bank assets and a higher rate of bank failure, both due to unresolved agency problems (Carter *et al*, 2016).

These are original contributions that significantly extend the existing literature.

In what follows, sections 7.2 and 7.3 respectively review the existing literature and use it to develop hypotheses, section 7.4 tests hypotheses relating to the causes of bank pay, sections 7.5 to 7.8 test hypotheses relating to its consequences and 7.9 synthesises results and discusses policy implications.

7.2 Key Results in the Literature

Any consideration of the role of bank governance in risk and performance inevitably includes discussion of remuneration. As discussed in Chapter 2, this is because agency theory holds that the incentives of individuals with control over firms have implications for outcomes at the corporate level, and remuneration must be central amongst those incentives. It is important to understand whether the determinants of remuneration are as assumed in theory and whether remuneration itself has the effects it is assumed to have on corporate behaviour.

Empirical studies relating to the role of remuneration in banks have generally focused on the CEO, with a few studies focused on senior executives more generally. The results of these studies are generally clear-cut and aligned with the predictions of agency theory. Higher variable and performance-based remuneration is found to lead to increased risk-taking. For instance, Bai and Elyasiani (2013) and Hagendorff and Vallascas (2011) each find that the performance-sensitivity of CEO pay has a positive effect on risk. And Uhde (2015) and Efing *et al* (2015) each find that high bonuses amongst executives and traders leads to increased risk-taking. The dissenting results are Acrey *et al* (2011) and Fahlenbrach and Stulz (2011), who find an insignificant or negative association of CEO bonuses with bank risk – but this is a minority conclusion that can probably be dismissed on the basis of being relevant only in certain contexts.

In order to develop hypotheses on bank remuneration more generally, not just the remuneration of the most senior individuals within banks, it is necessary to consider a wider literature beyond banking and relate it back to banks. I first consider the determinants of bank pay. An important phenomenon in this regard is that of downward nominal wage rigidity. This concept is important in New Keynesian macroeconomics (Romer, 2006) and serves to explain why wages do not drop rapidly to restore aggregate equilibrium after a negative output gap has arisen. On a micro-economic level, Fehr and Goette (2005) show that downward nominal wage rigidity exists regardless of the level of inflation and suggest that it arises because of the long-term nature of employment contracts, along with the behavioural heuristic of money illusion (Wilkinson, 2008). Radowski and Bonin (2010) provide further empirical evidence that the phenomenon actually exists, in a different applied setting.

In the case of banks, these results imply that we cannot expect a simple correlation between bank profitability and average pay. There is evidence that bonuses are a larger component of pay at the most senior levels compared to all other levels (Flabbi and Ichino, 2001) so increases in fixed base salary may be more important than bonuses in understanding the effects of bank performance on average pay across the bank. Given downward nominal wage rigidity, base salary may move up after a year in which the bank has performed well (because banks have the financial ability to pay more and a desire to set incentives by rewarding desired outcomes) but not move down after a year in which it has performed badly. So, as well as including simple measures of bank performance, models of the determinants of average pay in banks should also contain measures of the positive component of bank returns (setting negative performance to zero). In addition, since performance in the preceding year will determine wage increases that persist indefinitely, lagged effects should be taken into account.

There are no studies which consider the effects of bank loan impairments on remuneration, at senior levels or any other level. However, it is reasonable to expect that large impairments would lead *ceteris paribus* to negative impacts on pay (or at least an absence of pay increases). Indeed, regulation in the United Kingdom requires that risk is taken into account in pay settlements (Financial Conduct Authority Handbook, Systems and Controls Sourcebook, Chapter 19). So it appears reasonable to include loan impairments as a realised risk in models of bank pay.

Similarly, the UK Corporate Governance Code (2014) requires that Remuneration Committees ensure pay is reasonable, aligned with risk and not excessive, and encourages banks to disclose executive remuneration as a means to discourage excessive pay through public scrutiny and reputational risk. So the presence of Remuneration Committees and Executive Remuneration Disclosures should be considered as factors which may affect bank remuneration.

There is evidence that the extent and nature of Board-member oversight influences CEO remuneration (Renneboog and Zhao, 2011), suggesting that it could also be important for the remuneration of other senior individuals and the average level of pay. Specifically, Renneboog and Zhao (2011) argue that inter-personal networks between Directors and CEOs at different firms may strongly affect corporate wage-setting. This suggests that, although regulators view Remuneration Committees and oversight by Non-Executive Directors as means to restrict pay, it may actually be the case that these institutions are used as justification for higher remuneration.

There is also evidence that Directors' desire to protect their future reputation may affect decisions they make in respect of remuneration. For instance, there is some evidence from Lin *et al* (2016) that Director reputation can be important in securing future business and, thus, that there is an incentive to act in ways that preserve reputation. This suggests that pay awards will be lower in cases where they must be publicly disclosed, because Directors do not wish to become known as persons who permit managers to take an excessive share of corporate income.

Finally, although there is no rigorous evidence available, salary surveys conducted by recruitment firms (in particular the Robert Walters Salary Survey 2016) suggest that salaries are higher in certain parts of the banking sector, such as investment banks, and lower in other banks, such as mutuals. This seems unsurprising and suggests that indicators of bank business model should be included in models of remuneration.

Moving beyond the determinants of bank pay, it is of interest to consider what wider literature, beyond banking, suggests might be the effects of higher pay on bank risk and return.

One could argue that higher pay at all levels in a bank would have the same effects as higher performance-related pay at the executive level, as reported by Bai and Elyasiani (2013), Hagendorff and Vallascas (2011), Uhde (2015) and Efing *et al* (2015). However, individuals below the executive level are unlikely to have much (or any) control over broad policy decisions regarding balance sheet structure, lending criteria, financing choices, risk limits and so on.

Furthermore, performance-related remuneration contracts within banks tend to focus on growth and returns, much more than risk, and bankers below the most senior levels do not necessarily take a portfolio-level view, but may rather be focused on their own deals. So it cannot be meaningful to interpret effects of pay at all levels in the organisation in terms of a risk-return trade-off.

Pay at all levels in the organisation is therefore likely to have different kinds of effects from pay at the most senior levels. Specifically, the comparative generosity of pay may have large effects on motivation through impacts encapsulated in the theory of efficiency wages, which is of fundamental importance in microeconomics. Akerlof and Yellen (1986) argue that efficiency wages arise when managers, being aware that they cannot always detect shirking, offer wages higher than the market-clearing wage so that employees have an incentive not to take the risk of losing this privileged position. In a distinct argument that supports the same conclusion (that pay motivates performance) Kahneman *et al* (1986) find that perceptions of fairness are important in wage-labour exchanges and that perceptions of unfairly low wages lead to less effort and lower motivation.

If this is so, one would expect higher average pay to lead to faster growth, higher profitability and lower risk – on the grounds that all are likely results of getting more work and better-quality work from employees.

One would also expect any component of pay which is insensitive to characteristics that are relevant across banks in determining pay to have different effects from average pay. In particular, if a component of pay is insensitive to generally-relevant bank characteristics, then it is likely to be reflective of unresolved agency issues (Carter, 2016). This indicates an environment in which employees perceive that their rewards are unconnected to outcomes for the firm. One would therefore expect higher excess pay to lead to slower growth, lower profitability and higher risk – on the grounds that all are the likely results of getting less work and lower-quality work from employees.

In summary, the literature suggests a range of financial outcomes and institutional factors that should determine average pay within banks. It suggests that higher average pay will increase returns and reduce risk due to efficiency wage effects, while excess pay beyond that explained by systemic factors should reduce return and increase risk because it reflects unresolved agency problems.

7.3 Literature Gaps and Hypotheses

There are no studies in the literature which examine any of the following as determinants of bank pay: the positive component of returns, loan impairments, the presence of a Remuneration Committee and Executive Remuneration Disclosures, Director Ratio, a Joint CEO-Chairman, mutual ownership and securities holdings (the latter being an indicator for investment banking activity). Given the literature in the preceding section pointing to each of these as potentially important factors, this is an important set of omissions.

In addition, there are no studies which consider the effects on risk and return of remuneration at all levels in a bank. This is an important omission since it is unlikely that management at the most senior levels could ever have complete control over all aspects of a banking organisation, implying that the aggregation of actions at all levels could be as important for overall risk and return as decisions at the most senior levels.

Therefore, in this Chapter I seek to test the following hypotheses:

H7.1: Return on assets has a positive effect on bank average pay, immediately and/or at a lag, because of incentive schemes in which higher performance leads to bonuses or increases in base salaries.

H7.2: The positive component of ROA (treating any negative ROA as zero) has a positive effect on bank average pay, immediately and/or at a lag, because there are upward movements in base salaries following strong bank performance but not the converse following weak performance.

H7.3: The loan impairments ratio has a negative effect on average pay because such measures of realised risk are taken into account in pay awards.

H7.4: The presence of a Remuneration Committee has a positive effect on average pay because it is used to justify high pay awards.

H7.5: A high Director Ratio has a positive effect on average pay because it is used to justify high pay awards.

H7.6: The presence of Executive Remuneration Disclosures leads to lower average pay because Directors have a reputational incentive not to be seen to give away an excess portion of corporate income.

H7.7: A Joint CEO-Chairman has a positive effect on average pay because it gives the CEO more freedom to award higher pay to managers.

H7.8: Mutual banks have lower pay than other banks while banks with high securities holdings (indicative of investment banking activity) have higher pay than other banks.

H7.9: Higher average pay leads to faster growth of bank assets because it leads to more motivated work.

H7.10: Higher average pay leads to higher bank returns because it leads to more motivated work.

H7.11: Higher average pay leads to lower bank risk because it leads to more motivated work.

H7.12: Higher excess pay (beyond that which can be explained by systematic factors[6]) leads to slower growth of bank assets because it reflects unresolved agency problems.

H7.13: Higher excess pay leads to lower bank returns because it reflects unresolved agency problems.

H7.14: Higher excess pay leads to higher bank risk because it reflects unresolved agency problems.

A minor limitation in testing these hypotheses is that I do not have data on remuneration at all levels in banks. However, I do have data on banks' total numbers of employees and their total remuneration expenditure. This makes it possible to directly calculate average pay (as the latter divided by the former) and to econometrically estimate excess pay in the way explained in section 7.4.

[6] In this context "systematic" means factors that are shown to be significant at the level of my sample of banks. Components of pay not determined by such systematic factors clearly must have determinants of some kind, but these determinants are not systematically important across banks.

7.4 Explaining Average Pay

Bank pay is expected to depend to some extent on returns, risk and institutional factors in the manner described in the preceding sections. I use these factors here to construct a model to test hypotheses H7.1 to H7.8. In addition, the model is used to extract a measure of excess pay for use in subsequent sections. The rationale for this is that pay which is not determined by systemic factors is likely to be specific to a particular institution in a particular year and can be deemed 'excess' pay that is earned irrespective of bank financial outcomes or governance structures.

Models used to test hypotheses are estimated using the following equations (Table 7.1) with equation numbers used for cross-reference in regression tables.

Table 7.1 Dependent and explanatory variables included in models for testing hypotheses relating to the determinants of average pay.

Dependent Variable: average_pay		
All equations (7.1 to 7.3)	Equation (7.2)	Equation (7.3)
pos_roa	return_on_assets	return_on_assets
L.pos_roa	L.return_on_assets	L.return_on_assets
loan_impairments	director_ratio	director_ratio
rem_co		joint_ceo_chairman
exec_rem_disclosed		
mutual_ownership		
securities_holdings		
Year Dummies		

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

The regressor choice is based on hypotheses H7.1 to 7.8 above, which constitute a systematic set of factors proposed to explain bank pay. Year dummies are included as controls on the basis that pay levels can be expected to vary through time as economic conditions change. Models are estimated in linear form because there is no literature suggesting a non-linear relationship and linear functions are sufficient to test hypotheses while treating confounding factors as constant. Results are as follows.

Table 7.2 Estimation results for models explaining average pay in banks.

	OLS	OLS	OLS
	(7.1)	(7.2)	(7.3)
VARIABLES	average_pay	average_pay	average_pay
return_on_assets		-18.42	-14.82
		(18.65)	(19.66)
L.return_on_assets		-17.28	-19.31
		(12.43)	(12.19)
pos_roa	14.74	54.52	51.46
	(20.85)	(41.25)	(41.33)
L.pos_roa	-66.80**	-34.10	-32.08
	(30.15)	(27.02)	(27.25)
loan_impairments	-7.627	-18.54*	-17.09
	(5.675)	(10.85)	(11.17)
rem_co	64.35***	76.42***	73.63***
	(22.38)	(26.38)	(26.38)
exec_rem_disclosed	-67.89*	-66.13*	-66.89*
	(34.70)	(35.80)	(35.70)
director_ratio		225.9*	228.0*
		(120.3)	(119.1)
joint_ceo_chairman			28.20
			(26.50)
mutual_ownership	-74.79**	-65.34**	-59.03*
	(33.82)	(32.67)	(33.95)
securities_holdings	374.1***	331.3***	332.3***
	(108.1)	(113.2)	(114.3)
Constant	90.58***	-107.1	-112.7
	(26.94)	(87.23)	(87.07)
Observations	432	413	413
R-squared	0.431	0.475	0.477
VIFs	1.21-3.70	1.40-7.14	1.20-7.47
F statistic	4.7	5.0	9.3
P(F=0)	<0.001	<0.001	<0.001
F (endo reg)	0.00	0.00	0.00
Pr > F endo reg	<0.001	<0.001	<0.001
Pr > Breusch-Pagan	<0.001	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 7.1. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using OLS. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.21 to 7.47, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller sets of regressors). Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

These results (Table 7.2) lead me to reject the idea that downward nominal wage rigidity is important in determining salaries in banking. A simple measure of returns has no effect on average pay, but neither does a measure that takes account only of upward movements while setting downward movements to zero – referred to as Positive ROA (pos_roa). This is contrary to the reasoning of Fehr and Goette (2005) that downward nominal wage rigidity arises because of the long-term nature of employment contracts, along with behavioural heuristics in which employees individually and collectively resist downward wage movements, while readily accepting upward movements. Their reasoning predicts that effects of positive firm performance on wages will be evident while effects of negative firm performance will not, but I do not observe this pattern. Instead, it appears that bank pay is rigid in both directions relative to changes in bank performance – pay does not respond to any measure of bank performance.

The fact that bank pay is insensitive to any measure of bank financial performance suggests that bonuses are not the main component of remuneration for most bank staff. If they were, the effect of bonuses dropping when ROA performance is weak or negative, and rising when the opposite is true, would be expected to manifest as significant positive parameter values for both of the first two regressors in Table 7.2 above.

It is also clear that higher loan impairments do not lead to lower average pay in the banks in my sample. This suggests that, even when impairments are high, as they were for certain bank-year observations in my sample, the effects on average pay are negligible. This suggests that the linkage of pay to risk expected by regulators (Financial Conduct Authority Handbook, Systems and Controls Sourcebook, Chapter 19) is not widespread for employees in general in the banks in my sample. So, although these findings are of no significant association, they nevertheless have interesting implications for regulation.

The literature shows that banks cut head-count to reduce costs after periods of negative performance (Haltenhof, 2014), but it is clear from my results that they do not modify pay to reflect financial wherewithal or incentive-setting priorities following changes in bank-level outcomes.

Another very interesting set of findings is that a Remuneration Committee and a higher NED ratio both have a positive effect on bank pay, as expected. This is in accordance with the view of Renneboog and Zhao (2011) that oversight structures can have effects on remuneration very different from what is envisaged in guidance such as the UK Corporate Governance Code (2014). Specifically, oversight structures may collude in, or be used as justification for, higher pay – and my work verifies this suspicion. This casts doubt on the view that internal controls within firms can be used to ensure reasonable and efficient remuneration.

A summarised by Morris *et al* (2009) the dominant view of corporate remuneration within the UK and similar economies has been that centralised regulation would introduce inefficiencies and that regulators, acting via the audit profession, should simply ensure that there are independent oversight structures at the firm level, designed to ensure that pay awards are justified. However, there have always been critics such as Renneboog and Zhao (2011) who point out that the Directors and CEOs of different firms belong to connected interpersonal networks and this may introduce inefficiency. There have also been critiques, such as in Stiglitz (2013), which point out that rent-seeking behaviour at the level of corporate pay is one way in which economic inequality has compounded upon itself in recent decades. The results I report here support the critics, rather than the established view.

However, it is important to reconcile these results with those reported in the preceding chapter finding that the presence of a Remuneration Committee lowers the rate of bank failure. It appears that, although a Remuneration Committee does not restrain the overall level of pay, it does in some way structure pay so as to reduce incentives for excessive risk-taking that may lead to bank failure. Thus, my recommendation is that Remuneration Committees are retained as a tool of risk management, but that some other policy is used to address excessive corporate pay, if the latter is deemed to be a policy objective.

I also confirm the hypothesis (H7.6) that executive remuneration disclosure has a negative effect on average pay. This is likely to be for reputational reasons. It is entirely consistent with the evidence of Lin *et al* (2016) that

Director's reputation is something they each seek to preserve for reasons of securing future business.

By contrast, there is no evidence that a Joint CEO-Chairman permits higher pay awards. Taken together with the findings of the previous chapter, this suggests that common critiques of combining the roles of CEO and Chairman are incorrect: doing so leads neither to excessive risk-taking nor excessive pay.

Finally, I find that remuneration is higher in investment banks and lower in mutual banks, compared to other banks. This is not surprising, but it is the first time it has been demonstrated by a rigorous econometric study.

All of the effects detected are large *ceteris paribus*. Because of how variables are defined, parameter estimates can be interpreted as the number of thousands of pounds sterling (GBP) added to average pay by increasing the relevant regressor by one unit. So having a balance sheet that consists entirely of securities holdings (as opposed to one with no securities holdings) raises average by around £350,000 (reflecting high salaries in investment banks). Having a remuneration committee raises it by around £70,000 while disclosing executive pay lowers it by around £67,000 and mutual ownership lowers it by around £67,000.

In summary, hypotheses H7.1 to 7.3 and H7.7 are rejected. There is, surprisingly, no evidence that financial outcomes at the bank level affect average pay within banks, and no evidence that the union or separation of the CEO and Chairman roles has any effect on pay. By contrast, hypotheses H7.4

to 7.6 and H7.8 are accepted. I find that disclosing executive pay leads to lower average pay, while the presence of a Remuneration Committee and large numbers of NEDs lead to higher pay. Mutual banks have comparatively low pay while investment banks have high pay.

These findings have interesting policy implications. First, they suggest that measures to improve dependence of bank pay on risk may be needed if, as implied in published regulation, regulators view this as a desirable link. Second, they suggest that a Remuneration Committee is more useful for risk management than for wage restraint, and they provide further evidence for the idea that having a Joint CEO-Chairman may actually be a good thing.

7.5 Excess Pay

The analysis in section 7.4 shows that it is possible to explain almost half of bank pay using a set of variables based on factors that other literature suggests should be important. Other variables that I tried adding to the models shown in section 7.4 did not add to explanatory power and could not be linked to meaningful behavioural hypotheses, so they were excluded. This suggests that any element of bank pay not explained by the above model (that is, half of it) is idiosyncratic to the bank and the year. I refer to such this element as 'excess pay' in the sense that it is not based on any systematic factor.

Excess pay is likely to be indicative of unresolved agency issues in which executives can pay themselves and managers arbitrary amounts (Carter, 2016). More excess pay implies greater agency problems. In an environment where excess pay is large we would therefore expect staff to perceive that their pay is unconnected to corporate outcomes (or to structures designed to control corporate outcomes) and thus to expend less effort. Put differently, excess pay cannot be an efficiency wage if it is unconnected to the very governance structures and institutional features that would drive the decision to set a particular level of efficiency wage. So, excess pay is expected to lead to slower growth, lower returns and higher risk (compared to other banks) because these are the likely consequences of an environment where employees feel they can do less work and lower-quality work.

To calculate a measure of excess pay for use as a regressor in subsequent analysis, I start from the predicted values from the above model (specifically equation 7.3). These are then subtracted from average pay to obtain the component of average pay that does not depend on systematic factors. The result of this computation is referred to as 'excess pay' in the sense that it is 'excess' to that which can be explained systematically – although it is possible for the 'excess' to be positive or negative.

7.6 Effects of Pay on Growth in Bank Assets

This section shows results that confirm hypotheses H7.9 and H7.12 above. Higher average pay is found to lead to faster bank growth while higher excess pay leads to slower growth, because of the presence of efficiency wage effects in the first case and large agency problems in the second.

Models used to test hypotheses are estimated using the following equations (Table 7.3) with equation numbers used for cross-reference in regression tables.

Table 7.3 Dependent and explanatory variables in models for testing hypotheses that bank pay affects bank growth.

Dependent Variable: growth_total_assets			
All equations (7.4 to 7.7)	Equation (7.5)	Equation (7.6)	Equation (7.7)
L.board_size L.director_ratio L.growth_total_assets L.loan_interest_income L.return_on_assets L.return_on_equity L.state_majority_owner L.mutual_ownership L.foreign_parent L.average_pay L.excess_pay L.irb_permission L.exposure_to_banks L.securities_holdings L.advisory_activity L.equity_ratio L.curr_dep_over_liab L.size_over_gdp Year Dummies	L.female_ratio L.no_exp_ratio	L.joint_ceo_chairman L.cro_present_onboard L.comm_dir_board L.low_ned L.cumul_gov L.female_ratio L.no_exp_ratio	L.joint_ceo_chairman L.cro_present_onboard L.comm_dir_board L.low_ned L.cumul_gov L.female_ratio L.no_exp_ratio

Note: variable abbreviations and definitions as per section 3.8. "L." signifies a one-year lag.

Only small alterations differentiate the equations here from the baseline specification in Table 3.1. Most importantly, excess pay has been added as a regressor because it is explicitly the focus of hypotheses to be tested. In addition, the presence of a remuneration committee and executive remuneration disclosures have been dropped as these are presumed to act mainly through remuneration setting (affecting the level or structure of pay).

In some of the equations, governance interaction terms are added as a robustness test. Finally, terms relating to financial performance have been included as explanatory variables because it seems obvious that stronger financial performance could make it possible to finance faster growth.

Specifications and estimation methods are varied across the equations as a means of testing robustness. Linear functional forms are used because there is no reason to believe that any particular nonlinearity is present and this format is sufficient to test hypotheses while treating other causal variables as held constant. Results I obtain are as follows.

Table 7.4 Estimation results for effects of bank pay on bank growth.

	OLS	OLS	OLS	Random Effects
	(7.4) growth_ total_assets	(7.5) growth_ total_assets	(7.6) growth_ total_assets	(7.7) growth_ total_assets
L.board_size	1.250**	1.048**	0.922*	0.922*
	(0.583)	(0.515)	(0.546)	(0.546)
L.director_ratio	-18.35	-24.85	2.026	2.026
	(14.21)	(16.85)	(13.37)	(13.37)
L.joint_ceo_chairman			1.055	1.055
			(5.909)	(5.909)
L.cro_present_onboard			4.305	3.250
			(7.369)	(5.214)
L.comm_dir_board			1.630	1.630
			(1.753)	(1.753)
L.low_ned			22.89	23.95*
			(15.28)	(12.89)
L.cumul_gov			-1.055	
			(5.909)	
L.growth_total_assets	0.150	0.142	0.110	0.110
	(0.139)	(0.136)	(0.116)	(0.116)
L.loan_interest_income	-0.123*	-0.108	-0.0706	-0.0706
	(0.0700)	(0.0703)	(0.0652)	(0.0652)
L.return_on_assets	-1.628	-1.977	-2.112	-2.112
	(2.118)	(2.248)	(2.326)	(2.326)
L.return_on_equity	0.126***	0.123***	0.121***	0.121***
	(0.0176)	(0.0182)	(0.0163)	(0.0163)
L.state_majority_owner	-0.587	-0.251	-0.627	-0.627
	(4.648)	(4.586)	(4.528)	(4.528)
L.mutual_ownership	-4.480	-4.869	-5.329	-5.329
	(4.720)	(4.872)	(4.785)	(4.785)
L.foreign_parent	-13.54	-13.69	-16.10*	-16.10*
	(8.783)	(8.813)	(8.530)	(8.530)
L.average_pay	**153.2*** **	**148.8*** **	**126.4*** **	**126.4*** **
	(51.85)	**(49.49)**	**(41.32)**	**(41.32)**
L.excess_pay	**-0.0952***	**-0.0953***	**-0.0714***	**-0.0714***
	(0.0484)	**(0.0477)**	**(0.0370)**	**(0.0370)**
L.female_ratio		-9.882	-6.066	-6.066
		(12.60)	(11.63)	(11.63)
L.no_exp_ratio		13.43	17.97	17.97*
		(9.687)	(10.84)	(10.84)
L.irb_permission	2.543	2.266	2.459	2.459
	(9.118)	(8.962)	(9.639)	(9.639)
L.exposure_to_banks	-27.22**	-30.85***	-37.56***	-37.56***
	(10.43)	(10.62)	(12.19)	(12.19)

L.securities_holdings	-49.44**	-45.59**	-40.54*	-40.54**
	(22.22)	(20.90)	(20.55)	(20.55)
L.advisory_activity	11.89	-16.59	-60.98	-60.98
	(122.2)	(117.8)	(121.0)	(121.0)
L.equity_ratio	-0.243	1.855	-3.607	-3.607
	(39.40)	(40.41)	(41.33)	(41.33)
L.curr_dep_over_liab	5.138	3.519	2.241	2.241
	(3.632)	(3.736)	(3.850)	(3.850)
L.size_over_gdp	-12.48	-12.63*	-12.37	-12.37
	(7.646)	(7.559)	(7.656)	0.922*
Constant	15.37	19.55	3.621	-0.260
	(14.13)	(14.77)	(15.91)	(11.51)
Observations	305	305	305	305
R-squared	0.270	0.279	0.300	0.299
VIFs	1.34-7.07	1.34-7.14	1.40-9.07	1.40-9.07
F statistic	154.5	90.6	97.2	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				3012.4
Pr > Chi^2				<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	

Year dummies included but not shown

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 7.3. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 7.4 to 7.6 are estimated using OLS, while 7.7 is estimated as a panel model with random effects. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.34 to 9.07, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, as was expected for this set of regressors. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

These results (Table 7.4) show clear evidence of a positive effect of average pay on growth in bank assets. The same effect is apparent in section 8.5, in models that do not also contain excess pay as a regressor. This is consistent with hypothesis H7.9: that higher pay motivates greater efficiency and thus yields better staff performance in general, including in capital deployment. In addition, the opposite effect is found for excess pay: it has a negative impact on growth in bank assets. This is consistent with hypothesis H7.12: that higher excess pay leads to slower growth, because it entails a perception by employees that their pay is not dependent on outcomes for the firm (or on structures designed to manage outcomes for the firm).

In the above, average pay is measured in millions while excess pay is measured in thousands. So it can be seen that increasing average pay by £1000 causes the rate of growth of bank assets to increase by 0.13%, while increasing excess pay by £1000 causes it to reduce by 0.09%. Given that the assets of the average bank in the data set are 7% of GDP and many banks are much larger (in a size distribution that is heavily positively skewed), these are not trivial effects. It seems that *ceteris paribus* paying the average employee of the average bank £1000 more could increase investment in the economy by their bank by £137m. Since the average bank in the data set has approximately 10,000 staff, the cost of the change would be £10m.

These precise numerical estimates should not be taken too literally (they could be altered in practice by confounders and market frictions) but it seems clear that a) motivating average bank staff by creating a higher-pay environment has macro-economic benefits in the sense of greater investment in the economy, but b) these benefits are almost entirely eroded when the extra pay has no clear link to bank financial outcomes or governance structures.

It is interesting to consider these findings in light of the principal-agent conflicts that lie at the heart of agency theory. As noted in section 2.4, Jensen and Meckling (1976) argued that the separation of ownership and control inherent in typical corporate structures may cause managerial decisions to deviate from the maximisation of shareholder value. In the case of bank growth, principal-agent conflict or alignment is clearly important: banks grow faster when employees earn a greater share of the bank's earnings (that is, when the interests of staff and shareholders are aligned) and they grow more slowly when managers earn an income unrelated to systemic factors. Efficiency wages are clearly a way for shareholders to overcome the agency problem.

In summary, hypotheses H7.9 and H7.12 are accepted: higher average pay leads to faster growth while higher excess pay leads to slower growth.

7.7 No Effects of Pay on Return on Equity

My analysis below shows that average pay has no effect on bank return on equity, and excess pay has no effect either, leading me to reject hypotheses H7.10 and 7.13. Models used to test hypotheses were estimated using the following equations (Table 7.3) with equation numbers used for cross-reference in regression tables.

Table 7.5 Dependent and explanatory variables in models for testing hypotheses that bank pay affects bank returns.

Dependent Variable: return_on_equity			
All equations (7.8 to 7.11)	Equation (7.8)	Equation (7.10)	Equation (7.11)
L.growth_total_assets	L.board_size	L.board_size	L.board_size
L.loan_impairments	L.director_ratio	L.director_ratio	L.director_ratio
L.loan_interest_income	L.joint_ceo_chairman		L.joint_ceo_chairman
L.state_majority_owner	L.cro_present_onboard		L.cro_present_onboard
L.mutual_ownership	L.comm_dir_board		L.comm_dir_board
L.foreign_parent	L.female_ratio		L.female_ratio
L.average_pay	L.no_exp_ratio		L.no_exp_ratio
L.excess_pay			
L.irb_permission			
L.exposure_to_banks			
L.securities_holdings			
L.advisory_activity			
L.equity_ratio			
L.curr_deposits_over_liabs			
L.size_over_gdp			
Year Dummies			

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

In terms of regressor choice, these models have three important differences form the baseline specification stated in Table 3.1. First, excess pay is added as a regressor because, as indicated in section 7.5, I am specifically interested in its effects. Second, I add as regressors financial variables that are considered elsewhere in this thesis as outcome variables. This is because, as discussed in section 3.4 different outcome variables in my study could affect one another. Third, the presence of a remuneration committee and of executive remuneration disclosures are excluded since there is an assumption that their effects operate entirely through remuneration (at least the structure of remuneration if not its level).

Beyond this, all other variables relating to ownership and governance structure are retained. This is because, as explained in sections 5.3 and 6.4, there are reasons to expect these to affect risk and performance, such that exclusion could lead to mis-specification and bias. Similarly, balance sheet characteristics are retained as regressors since, as discussed in section 3.4, there is reason to believe that balance sheet structures are indicative of business model and that risk and return are affected by business model.

As stated previously, models are estimated in linear form because there is no literature suggesting a specific nonlinear form to use, and the linear format is sufficient to test hypotheses while controlling for co-variates. There is robustness testing across the four equations in terms of both specification and estimation method.

Table 7.6 Estimation results for models of the effects of bank pay on bank returns.

	OLS	Random Effects	Random Effects	Random Effects
	(7.8) return_on_ equity	(7.9) return_on_ equity	(7.10) return_on_ equity	(7.11) return_on_ equity
L.growth_total_assets	0.00496	0.0322	0.0160	0.0194
	(0.0261)	(0.0213)	(0.0233)	(0.0218)
L.loan_impairments	-1.324	-1.233	-1.165	-0.867
	(0.867)	(0.914)	(0.911)	(0.879)
L.loan_interest_income	-0.105**	-0.0864	-0.0899	-0.0808
	(0.0495)	(0.0538)	(0.0572)	(0.0515)
L.state_majority_owner	-6.238	-4.174	-1.568	-5.134
	(4.551)	(5.953)	(6.155)	(4.746)
L.mutual_ownership	-7.105*	-7.855**	-5.527	-7.215*
	(3.653)	(3.834)	(3.741)	(3.821)
L.foreign_parent	-12.97***	-10.46**	-11.22**	-12.41**
	(4.759)	(4.741)	(4.766)	(5.047)
L.board_size	0.626		0.925	0.781*
	(0.403)		(0.569)	(0.440)
L.director_ratio	-8.376		-7.339	-6.171
	(7.965)		(7.438)	(8.005)
L.average_pay	**37.74**	**-0.106**	**15.69**	**40.69**
	(32.98)	**(17.80)**	**(23.33)**	**(37.64)**
L.excess_pay	**-0.0161**	**0.0260**	**0.00894**	**-0.0155**
	(0.0264)	**(0.0164)**	**(0.0187)**	**(0.0302)**
L.joint_ceo_chairman	-21.79			-23.29
	(15.39)			(16.61)
L.cro_present_onboard	-1.120			-1.356
	(2.655)			(2.428)
L.comm_dir_board	-0.0531			0.349
	(1.617)			(1.682)
L.female_ratio	-15.45***			-7.388
	(5.700)			(6.346)
L.no_exp_ratio	8.026**			7.576*
	(3.735)			(3.952)
L.irb_permission	-4.416	-0.699	-1.343	-5.115
	(3.509)	(2.931)	(3.002)	(3.494)
L.exposure_to_banks	-2.764	-1.532	-1.468	-5.377
	(9.456)	(9.884)	(10.37)	(10.68)
L.securities_holdings	-12.57	2.349	-3.234	-15.97
	(14.96)	(8.300)	(9.267)	(17.04)
L.advisory_activity	104.3	115.6*	70.33	91.29
	(70.50)	(68.63)	(66.84)	(69.86)

L.equity_ratio	21.59	20.46	24.03	14.18
	(24.63)	(31.03)	(32.42)	(25.35)
L.curr_dep_over_liabs	4.780	6.066	7.365*	6.346
	(3.813)	(3.740)	(4.374)	(4.032)
L.size_over_gdp	3.938	2.839	0.331	3.558
	(3.432)	(2.894)	(3.655)	(3.309)
Constant	6.318	6.662	0.181	2.373
	(8.423)	(5.114)	(9.629)	(8.467)
Observations	304	304	304	304
R-squared	0.368	0.251	0.263	0.359
VIFs	1.30-8.12	1.30-8.12	1.30-8.12	1.30-8.12
F statistic	14.43			
Pr > F	<0.001			
Wald Chi^2		226.8	266.7	452.0
Pr > Chi^2		<0.001	<0.001	<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	<0.001

Year dummies included but not shown

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 7.5. Dependent variables are stated at the top of columns and explanatory variables in rows. Equation 7.8 is estimated using OLS, while equations 7.9 to 7.11 are estimated as a panel model with random effects. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses. Diagnostic testing for heteroskedasticity using the Breusch-Pagan test shows it to be present, such that clustered standard errors are used. VIFs for this set of regressors vary from 1.30 to 8.12, but this has not prevented the detection of significant associations or caused sign reversals (shown using smaller sets of regressors). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any independent variable, as was expected for this set of regressors. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

This analysis (Table 7.6) shows that the effects which would be expected based on the literature on efficiency wages and agency theory are not evident. Higher average pay does not lead to higher ROE and higher excess pay does not lead to lower ROE, even though we would expect the former to motivate staff to do better and the latter to reflect dilution of incentive.

It is worth noting that signs of a positive effect of average pay on ROE are evident in section 5.5, in models of ROE that do not also contain excess pay as a regressor. However, this putative effect is clearly not robust in my analysis, and there is no sign of excess pay having any effect at all on ROE.

One possible interpretation of all this is that raising the level of average pay across the organisation increases effort towards expansion of the business (as shown in the preceding section) but does not motivate cost control, or perhaps cannot motivate cost control because only a limited number of senior individuals in the accounting and finance team have control over expenditure (Hoitash *et al*, 2016). If this is the case, then one would expect no effect on ROE because costs might simply rise in line with expansion of income and the balance sheet, as any extra effort can imply extra cost (for instance the cost of operational infrastructure to support new business ventures). Conversely, when employees have less effort to expend effort in an environment of high excess pay, costs might drop in line with income and the balance sheet, such that no effect on ROE is evident.

In summary, I reject hypotheses H7.10 and 7.13: average pay and excess pay have no detectable effects on bank ROE.

7.8 Effects of Pay on Bank Failure

In this section, I report results consistent with hypotheses H7.11 and H7.14: higher average pay leads to a lower rate of bank failure and higher excess pay leads to a higher rate of bank failure.

Models used to test hypotheses are estimated using the following equations (Table 7.5) with equation numbers used for cross-reference in regression tables.

Table 7.7 Dependent and explanatory variables in models for testing hypotheses that bank pay affects the failure rate of banks.

All equations (7.12 to 7.15)	Equation (7.13)	Equation (7.14)	Equation (7.15)
L.growth_gross_loans	L.joint_ceo_chairman	L.joint_ceo_chairman	L.joint_ceo_chairman
L.growth_total_assets	L.cro_present_onboard	L.cro_present_onboard	L.cro_present_onboard
L.loan_impairments	L.comm_dir_board	L.comm_dir_board	L.comm_dir_board
L.return_on_assets	L.female_ratio	L.female_ratio	L.female_ratio
L.return_on_equity	L.no_exp_ratio	L.no_exp_ratio	L.no_exp_ratio
L.state_majority_owner		L.irb_permission	L.irb_permission
L.mutual_ownership			L.exposure_to_banks
L.foreign_parent			L.securities_holdings
L.board_size			L.advisory_activity
L.director_ratio			
L.rem_co			
L.exec_rem_disclosed			
L.average_pay			
L.excess_pay			
L.equity_ratio			
L.curr_deps_over_liabs			
L.size_over_gdp			

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

The main difference between these models and the baseline specification stated in Table 3.1 is the inclusion of excess pay as a regressor. This was added because, as stated in hypotheses H7.12 to H7.14, I am explicitly interested in effects it may have. A second difference is that explanatory variables are included consisting of financial variables that are used elsewhere in this thesis as outcome variables. This is because it appears obvious that these variables can contribute directly to the success or failure of a bank so, on this basis, it is prudent to control for them.

Unlike in sections 7.6 and 7.7, the dummy variables reflecting the presence of a remuneration committee and the presence of executive remuneration disclosures are retained as regressors in the model. This is because a) they could have effects on bank failure (which is a complex aggregation of many influences) other than through control of pay and b) I sought to corroborate earlier evidence from Chapter 6 that these dummy variables have implications for the rate of bank failure.

Characteristics relating to ownership and governance are retained in the models because, as explained in sections 5.3 and 6.4 we can expect these to affect risk, such that their omission could cause mis-specification and bias. Balance sheet variables are also included because, as section 3.4 explains, risk may vary across different balance sheet structures.

Probit models are used because they are suitable for testing significance with co-variates treated as held constant in settings with binary dependent variables. Logit models were not used, simply because the choice between logit and probit is generally considered to be arbitrary. Linear probability models are not used because they can predict probabilities greater than 1 or less than zero, which is clearly meaningless. Results are as follows.

Table 7.8 Probit estimation results for models of the effect of bank pay on bank failure.

	(7.12) combined_ failure	(7.13) combined_ failure	(7.14) combined_ failure	(7.15) combined_ failure
L.growth_gross_loans	0.00483	0.00614	0.00988***	0.00611
	(0.00327)	(0.00384)	(0.00379)	(0.00534)
L.growth_total_assets	0.00841	0.00767	0.0161**	0.0276***
	(0.00613)	(0.00669)	(0.00751)	(0.00885)
L.loan_impairments	-0.340	-0.483**	-0.485**	-0.685*
	(0.236)	(0.224)	(0.244)	(0.377)
L.return_on_assets	-0.906	-1.262*	-0.386	-0.269
	(0.702)	(0.701)	(0.776)	(0.258)
L.return_on_equity	0.0255	0.0379	-0.0105	-0.0243***
	(0.0323)	(0.0336)	(0.0411)	(0.00603)
L.state_majority_owner	2.605***	3.833***	5.639***	9.248***
	(0.701)	(1.082)	(1.453)	(1.851)
L.mutual_ownership	0.240	-0.310	0.946	-0.344
	(0.697)	(0.749)	(1.020)	(1.269)
L.foreign_parent	2.653***	3.040***	4.488***	6.242***
	(0.766)	(0.670)	(1.076)	(1.445)
L.board_size	-0.0140	-0.0340	0.0267	0.0782
	(0.0846)	(0.0805)	(0.0954)	(0.105)
L.director_ratio	0.241	-1.347	-2.765	-5.132
	(1.819)	(1.974)	(2.077)	(3.741)
L.rem_co	-0.763	-0.134	-0.320	-1.687**
	(0.560)	(0.456)	(0.494)	(0.837)
L.exec_rem_disclosed	0.659	0.867	1.184*	2.595***
	(0.639)	(0.564)	(0.710)	(0.998)
L.average_pay	**-9.892*** **	**-18.42*** **	**-18.63*** **	**-28.20*** **
	(3.532)	**(3.337)**	**(3.571)**	**(9.038)**
L.excess_pay	**0.00809** **	**0.0131*** **	**0.0117*** **	**0.0230*** **
	(0.00406)	**(0.00306)**	**(0.00418)**	**(0.00835)**
L.joint_ceo_chairman		0.915	0.413	1.224
		(0.575)	(0.631)	(0.922)
L.cro_present_onboard		0.148	0.165	-0.0317
		(0.655)	(0.586)	(0.888)
L.comm_dir_board		-0.352	-0.570*	-0.914**
		(0.385)	(0.323)	(0.362)
L.female_ratio		0.00620	1.555	3.213
		(2.873)	(2.959)	(2.962)
L.no_exp_ratio		3.027***	3.561***	5.784***
		(0.924)	(1.152)	(1.629)
L.irb_permission			-4.712***	-6.241***
			(1.487)	(1.421)
L.exposure_to_banks				-6.360***
				(1.418)

L.securities_holdings				-0.402
				(3.737)
L.advisory_activity				-81.58
				(63.09)
L.equity_ratio	-9.822*	-8.061	-13.15*	9.580
	(5.659)	(7.387)	(6.933)	(10.58)
L.current_dep_over_liabs	-0.578	-1.005	-0.655	0.0384
	(0.607)	(0.662)	(0.713)	(0.852)
L.size_over_gdp	0.858	0.985**	1.942**	1.780**
	(0.578)	(0.465)	(0.852)	(0.826)
Observations	300	300	300	294
Pseudo-R-squared	0.436	0.488	0.527	0.601
VIFs (these regressors)	1.32 – 6.8	1.26 – 7.4	1.26 – 7.5	1.29 – 9.3
Wald Chi^2	355.3	873.9	947.6	4716.4
Pr > Chi^2	<0.001	<0.001	<0.001	<0.001
Pr < Smith-Blundell (if endogenous)	<0.001	<0.001	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in Table 7.7. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations are estimated using maximum likelihood with numerical optimisation. Estimated parameter values are shown along with star symbols for statistical significance. The presence of non-spherical error variance is assumed, such that clustered standard errors are used (shown in parentheses). Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr<Smith-Blundell is the probability of obtaining a Smith-Blundell statistic at least as small as was obtained under the null that regressors are endogenous.

These results (Table 7.8) show a significant negative effect of higher average pay on bank failure. This is consistent with the hypothesis, derived from the theory of efficiency wages, that higher average pay motivates greater effort, including higher-quality effort, such that the overall level of risk is reduced. It is important to note that there is no obvious idiosyncrasy of my data set, compared to other data, which could undermine result. In particular, the set of failed banks includes both large banking groups and investment banks (where salary is high) and also mutuals (where salary is low).

My results also show a significant positive effect of excess pay on bank failure. This is consistent with the argument that high excess pay represents an environment in which agency problems are serious and pay is arbitrarily high, such that staff feel limited incentive to expend effort because pay is not linked to effort.

In summary, I accept hypotheses H7.11 and H7.14: higher average pay in banks leads to lower bank risk and higher excess pay leads to higher risk.

7.9 Conclusions

In this chapter, I test a range of novel hypotheses and advance our understanding of the causes and consequences of bank pay. Specifically, I find that bank pay has no dependence on returns, with or without taking account of downward nominal wage rigidity, and no dependence on loan impairments. Thus, hypotheses H7.1 to 7.3 are rejected: average pay at all levels in a bank has no clear dependence on financial outcomes at the bank level.

By contrast, governance and institutional attributes do matter as determinants of pay, such that hypotheses H7.4, 7.5, 7.6 and 7.8 are accepted. The presence of a Remuneration Committee or of higher numbers of NEDs leads to higher average pay, likely because these structures are used to justify high pay – even though evidence in the preceding Chapter shows clearly that

Remuneration Committees are effective in mitigating risk. By contrast, the disclosure of executive remuneration leads to lower average pay, likely because it discourages excessive pay through the prospect of reputational costs. Finally, average pay depends negatively on mutual ownership and positively on investment banking activities – neither of which has been rigorously demonstrated before, although they are not surprising results.

Residuals from my simple model of average pay were used to generate a measure of 'excess pay', consisting of that element of average pay which cannot be explained by systematic causes. This derived variable is then used as a regressor to test further hypotheses relating to the consequences of bank pay, alongside the simpler measure of average pay.

My analysis of the consequences of bank pay reveals that higher average pay leads to faster bank growth and a lower probability of failure, two of the effects that are expected based on the theory of efficiency wages. It also shows that higher excess pay leads to slower growth and a higher probability of bank failure, consistent with the argument that high excess pay represents an environment in which agency problems are severe (Carter, 2016) and staff perceive no link of their pay to corporate outcomes or corporate structures.

In terms of practical applications, Chapter 6 identified a number of radical changes in corporate governance that may be desirable – especially replacing independent Chairmen and independent CROs with alternative structures that do not confuse decision-making or weaken the personal accountability of the CEO. This chapter has similarly radical implications for policy. In particular, it departs from the standard view as summarised in Morris *et al*

(2009) that controls at the firm level can restrain pay, and implies instead that Remuneration Committees are useful as tools of risk management but useless as tools of pay restraint. If pay restraint is to be an objective of policy, it will have to be achieved by other means.

Similarly, my analysis yields evidence that the component of bank pay which is outside the influence of systematic factors creates serious risks to bank stability and that regulators should do more minimise this component of pay, such as by enforcing rules designed to align remuneration with risk (like those already in the FCA Handbook).

Less controversially, it is clear that corporate disclosures of executive pay should continue and be extended if there is an objective to restrain pay awards not justified by performance.

On the broadest level, it is clear that some of the main determinants of bank pay do not behave in the manner expected by regulatory authorities, that a large part of bank pay appears to be arbitrary, being outside the control of systematic factors, and that the arbitrary portion of bank pay can cause substantial risk. More should be done to manage pay in banks.

Chapter 8: The Role of Bank Size

8.1 Introduction

In this Chapter I test hypotheses relating to the effects of bank relative and absolute size, complexity and diversification. In doing so, I use a simple one-equation framework to obtain the novel result that bank relative size has a positive effect on the rate of growth in bank assets, while absolute size does not. This occurs because larger banks can grow faster due to competitive advantages arising from implied subsidies, rather than economies of scale. It suggests that, if size leads to moral hazard and implied subsidy effects, and these lead to faster growth and even greater size, then there is problem that tends to compound on itself over time.

In the remainder of this Chapter, sections 8.2 and 8.3 use the existing literature to develop hypotheses relating to the effects of size, complexity and diversification, section 8.4 demonstrates that there are no robust effects of complexity and diversification on risk and return, section 8.5 demonstrates the results for size stated above, and section 8.6 synthesises and discusses policy implications.

8.2 Key Results in the Literature

Economies and diseconomies of scale are fundamental in economic theory (Varian, 2009). Economies of scale occur when fixed overhead costs are spread over more units of output, rendering the unit cost lower. Similarly, economies of scope occur when fixed costs are spread over different business lines. Diseconomies of scale arise when complexity reaches a level that impedes coordination and causes inefficiency.

Bank size may matter in other ways too, as discussed in Chapter 2. It may create moral hazard effects in which larger banks take more risk (Bhagat *et al,* 2015) because they understand that they are systemically important and will likely be bailed-out by the State in the event of distress. Similarly, bigger banks may gain from implied subsidies because their investors also expect that systemically-important banks will be bailed-out in the event of distress and therefore charge banks lower funding costs that do not include as much of a risk premium as they would if bailout was not expected.

Empirical results relating to bank size are clear-cut and in accordance with theory. Bhagat *et al* (2015) and Laeven *et al* (2015) both find that bank size has a positive effect on risk. Meanwhile, Hughes and Mester (2013), Beccalli *et al* (2015) and Hughes *et al* (2001) all estimate production functions to isolate scale effects from other effects (such as implied subsidies and moral hazard) and they all report that bank size has a positive effect on performance.

Potential impacts of complexity on bank performance are related to diseconomies of scale. Banks may have so many different components that coordination failures lead to elevated costs, missed revenue opportunities or mistaken decisions, such that financial outcomes deteriorate. This can occur as a result of mergers and acquisitions. Some banks have grown through acquisitions and have become universal banks, combining retail, commercial and investment banking activities in one group. One consequence of this is that banks have not been able to integrate internal systems well and have been left with systems that have important deficiencies (Eastburn and Boland, 2015). The literature suggests that acquisitions in various sectors tend to overestimate potential gains (Malimender and Tate, 2008) which may mean that they create entities that are inefficient. Thus, complexity in banking may reach levels that have adverse effects on risk and performance, but this has not been tested directly in the empirical literature.

Asset diversification is also important in finance theory. In principle, it allows a lower risk at a given level of return or a greater return at a given level of risk, because risks arising from different assets offset one another provided that these assets are not perfectly correlated (Jones 2008). Since diversification and complexity may be related, it is important to examine their effects alongside one another.

Empirical results relating to bank diversification are fairly clear-cut and in line with theory: diversification lowers risk and increases return. Brewer (1989), Shiers (2002) and Fang and van Lelyveld (2014) all find that bank diversification reduces risk. Mergaerts and Vennet (2016) and Meslier *et al* (2014) find that diversification increases performance. Baele (2007) finds that diversification leads to higher performance and lower risk. Kohler

(2014) reports that the effect of diversification on risk varies by entity type: in retail banks, diversification towards non-interest income reduces risk, while in investment banks it increases it. The dissenting results are Wall (1987), who finds no evidence that bank diversification has an effect on bank risk and Mercieca *et al* (2007), who finds no effect on performance, but these are minority conclusions.

In summary, the literature suggests that larger bank size will increase performance and risk, but it is silent on the possibility that relative and absolute size may have different effects (see section 8.3 below). It suggests that greater complexity will increase risk and/or reduce returns, and that diversification will have the exact opposite effects.

8.3 Literature Gaps and Hypotheses

No empirical studies have sought to differentiate the effects of bank absolute and relative size. If, as argued by Forrsbaeck (2011), it is important that banks are subject to implied subsidy effects arising from being systemically important and expecting government rescue in the event of distress, then we would expect that relative size (linked to being most important for depositors and the economy) would have detectable effects. If, as argued by Hughes and Mester (2013), Beccalli *et al* (2015) and Hughes *et al* (2001), simple scale is important, then we would expect absolute size to have detectable effects. Since absolute and relative size will be confounded, it is important to test them simultaneously in the same model, but no study has done so.

Likewise, no empirical studies have examined the role of complexity in banks in determining risk and return. This is important because the basic theory of diseconomies of scale (Varian, 2009) would predict adverse effects.

Therefore, in this Chapter I seek to test the following hypotheses:

> **H8.1:** Bank diversification leads to lower risk and/or higher performance because of gains from having incompletely correlated assets.
>
> **H8.2:** Bank complexity leads to higher risk and/or lower performance because of coordination difficulties (diseconomies of scale) that arise internally within the organisation.
>
> **H8.3** Greater absolute size leads to higher performance and/or faster growth because of classical economies of scale.
>
> **H8.4** Greater relative size leads to higher performance and/or faster growth and/or higher risk because of implied subsidy effects and moral hazard arising from the expectation of rescue in the event of distress.

Hypotheses 8.3 and 8.4 are not necessarily mutually exclusive. Although the two explanatory variables are confounded, including both in models means I have controlled for one while analysing the effects of the other. So it is possible to discover that they have opposite effects, or that one matters while the other does not.

In order to test the effects of complexity, I use the number of employees of a bank as a good indicator of complexity. A greater number of employees intrinsically implies a greater amount of activity that must be coordinated and is likely to be proportional to the number of business lines that must be coordinated.

To test the effects of diversification alongside complexity, I generated an indicator variable for diversification that takes a value of 1 if the proportion of current accounts in liabilities exceeds 40% (indicative of extensive retail banking activity) and the proportion of securities holdings in assets exceeds 20% (indicative of extensive investment banking activity). These cut-offs were chosen because they approximately divide the densities of the relevant empirical distributions in half. Where both criteria are not met, the diversification indicator takes a value of zero.

As a second indicator of complexity, I use the multiplicative interaction of employee number and the diversification indicator. This represents the number of employees present in a case where they are spread over very different business lines.

8.4 No Effects of Complexity or Diversification

My analysis reveals no effect on risk, performance or growth of any of the indicators of complexity or diversification used (results not shown for reasons of space but can be provided on request). The only hint of an association is a non-robust positive association of employee number with ROE, but the apparent effect disappears when model specification is varied and is thus not reliable.

Setting these results in the context of the literature summarised in the previous section, my findings align with the minority conclusions in the literature that diversification has no effects on bank risk or performance, as reported in Wall (1987) and Mercieca *et al* (2007).

Given that Kohler (2014) reports that diversification has opposite effects for retail compared to investment banks, one possible interpretation is that, because my data set contains both types of entity, these effects have cancelled each other out so that no average effects are evident. However, I have ruled this out by constructing interaction terms in which my diversification indicator is interacted with indicators of retail and investment bank status. This again suggested no effect of diversification on either risk or performance. In any case, the conclusion of Kohler (2014) is difficult to reconcile with finance theory: it is possible that diversification improves the risk-return trade-off in the way theory predicts, or that it is ineffective in doing so, perhaps because cross-asset correlations become strongly positive because of dependence on the macro-economy, but it is unclear why diversification would ever increase risk.

A more plausible conclusion is simply that diversification has different effects in different geographical and temporal contexts, perhaps because of different levels of cross-asset correlations. In my sample, it has no measurable effects. This is important in interpreting the effects of having a foreign parent, as discussed in Chapter 5. Theoretically plausible effects of having a foreign parent are an improved risk-return trade-off because of international diversification, or more adverse outcomes because of cross-border information asymmetries. The fact that I find no effects of diversification in my sample strengthens the argument that the effects of a foreign parent are due to information asymmetries.

The fact that I find no effect of complexity is also of some importance. It suggests that banks do not struggle to manage their internal complexities to the extent I have hypothesised. This is important in a policy sense because, if the opposite were found, it would provide an additional argument in favour of smaller banks.

In summary, Hypotheses H8.1 and H8.2 are rejected.

8.5 Positive Effects of Relative Size on Growth

To test my hypotheses relating to bank size, I use world rank by assets as an indicator of relative size and size over GDP as an indicator of absolute size. Results obtained are as follows.

Models used to test hypotheses are estimated using the following equations (Table 8.1) with equation numbers used for cross-reference in regression tables.

Table 8.1 Dependent and explanatory variables included in models for testing hypotheses that bank size influences bank growth.

Dependent Variable: growth_total_assets			
All equations (8.1 to 8.4)	Equation (8.2)	Equation (8.3)	Equation (8.4)
L.world_rank_by_assets	L.joint_ceo_chairman	L.state_majority_owner	L.state_majority_owner
L.size_over_gdp	L.cro_present_onboard	L.mutual_ownership	L.mutual_ownership
L.loan_impairments	L.comm_dir_board	L.foreign_parent	L.foreign_parent
L.return_on_assets	L.female_ratio	L.board_size	L.board_size
L.return_on_equity	L.no_exp_ratio	L.director_ratio	L.director_ratio
L.exposure_to_banks	L.irb_permission	L.rem_co	L.rem_co
L.securities_holdings		L.exec_rem_disclosed	L.exec_rem_disclosed
L.advisory_activity		L.average_pay	L.average_pay
L.equity_ratio		L.joint_ceo_chairman	L.joint_ceo_chairman
L.curr_dep_over_liab		L.cro_present_onboard	L.cro_present_onboard
Year Dummies		L.comm_dir_board	L.comm_dir_board
		L.female_ratio	L.female_ratio
		L.no_exp_ratio	L.no_exp_ratio
		L.irb_permission	L.irb_permission

Note: variable abbreviations and definitions as per section 3.8. “L.” signifies a one-year lag.

This set of equations differs from the baseline specification stated in Table 3.1 in that it includes an additional variable intended to test hypotheses relating to relative size: world rank by assets. Even though the intention is to test hypotheses relating to size, explanatory variables relating to governance, ownership and balance sheet characteristics are retained. This is because, as explained earlier, there are reasons to expect these to affect risk and performance, such that their exclusion would lead to mis-specification and bias. Linear models are used for estimation because there is no reason to believe any specific non-linearity is present, and both OLS and random effects estimation is used to avoid results that are biased by the vulnerabilities of any one method. Results are as follows.

Table 8.2 Estimation results for effects of bank size on growth in bank assets.

	OLS	OLS	OLS	Random Effects
	(8.1) growth_ total_ assets	(8.2) growth_ total_ assets	(8.3) growth_ total_ assets	(8.4) growth_ total_ assets
L.world_rank_by_assets	**-0.00249*****	**-0.00255****	**-0.00325****	**-0.00348****
	(0.000744)	**(0.000955)**	**(0.00136)**	**(0.00152)**
L.size_over_gdp	27.99	5.753	-45.16	-51.47
	(20.46)	(40.78)	(44.25)	(47.15)
L.loan_impairments	-3.231*	-4.427	-3.524	-3.519
	(1.893)	(2.721)	(2.542)	(2.525)
L.return_on_assets	1.920	-0.513	-0.0720	-0.0307
	(1.806)	(3.622)	(3.984)	(3.855)
L.return_on_equity	0.0997***	0.0896**	0.0214	0.0189
	(0.0368)	(0.0364)	(0.0283)	(0.0286)
L.state_majority_owner			-2.266	-2.953
			(6.052)	(6.049)
L.mutual_ownership			-7.596	-6.690
			(13.16)	(14.11)
L.foreign_parent			-10.15	-9.539
			(11.90)	(12.71)
L.board_size			0.188	0.0843
			(0.570)	(0.586)
L.director_ratio			-19.35	-20.63
			(15.26)	(15.94)
L.rem_co			-9.618	-10.90*
			(6.171)	(6.404)
L.exec_rem_disclosed			6.395	7.292*
			(3.829)	(4.125)
L.average_pay			95.33***	96.52***
			(29.88)	(30.79)
L.joint_ceo_chairman		6.972	-0.299	-0.573
		(6.291)	(7.762)	(7.665)
L.cro_present_onboard		6.739	5.375	5.887
		(7.294)	(7.883)	(8.149)
L.comm_dir_board		1.610	0.476	0.621
		(2.316)	(2.388)	(2.446)
L.female_ratio		-7.725	3.531	4.261
		(12.95)	(14.35)	(14.75)
L.no_exp_ratio		20.17**	22.90**	24.58**
		(7.947)	(10.09)	(10.37)
L.irb_permission		2.456	6.373	6.202
		(18.94)	(19.26)	(20.45)

L.exposure_to_banks	3.490	-14.91	-25.71	-26.34
	(9.325)	(9.788)	(17.21)	(18.79)
L.securities_holdings	3.412	16.68	-25.85	-22.66
	(7.930)	(15.58)	(24.68)	(26.81)
L.advisory_activity	-232.3***	-78.76	-126.7	-121.1
	(80.01)	(173.2)	(150.2)	(155.6)
L.equity_ratio	143.9**	173.1**	162.7*	174.4**
	(59.01)	(70.67)	(82.97)	(87.00)
L.curr_dep_over_liab	4.777	5.896	10.60	10.76
	(5.406)	(7.136)	(6.726)	(7.460)
Constant	2.130	-6.608	17.33	17.67
	(6.259)	(10.35)	(26.69)	(28.10)
Observations	375	308	298	298
R-squared	0.220	0.258	0.302	0.295
VIFs	1.30-3.77	1.08-5.70	1.37-9.83	1.37-9.83
F statistic	25.3	91.2	310.1	
Pr > F	<0.001	<0.001	<0.001	
Wald Chi^2				17559.1
Pr > Chi^2				<0.001
F (endo reg)	0.00	0.00	0.00	0.00
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999
Pr > Breusch-Pagan	<0.001	<0.001	<0.001	<0.001

Year dummies included but not shown
Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Equation numbers are as stated in the main text above. Dependent variables are stated at the top of columns and explanatory variables in rows. Equations 8.1 to 8.3 are estimated using OLS, while 8.4 is estimated using a panel model with random effects, for comparison purposes. Estimated parameter values are shown along with star symbols for statistical significance. Clustered standard errors are in parentheses, used to deal with the presumed presence of non-spherical error variance. VIFs for this set of regressors vary from 1.30 to 9.83, but this has not prevented the detection of significant associations or caused sign reversals (shown using shorter equations). Auxiliary regression using residuals as dependent variable shows no empirical evidence of endogeneity for any dependent variable. Pr>Chi^2 is the probability of obtaining a Chi^2 at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero. (Bivariate tests also confirmed absence of endogeneity; results not shown.) Pr>Breusch-Pagan is the probability of obtaining a test statistic at least as extreme as that obtained under the null hypothesis of spherical error variance.

These results (Table 8.2) indicate that world rank by assets has a negative effect on growth in total assets. Since a lower number for rank corresponds to larger size, this is consistent with the hypothesis that larger banks, because of implied subsidies, can grow more rapidly. This has not previously been shown empirically.

It is notable that size over GDP does not have the same effect (even when world rank by assets is omitted – results not shown). This suggests that it is relative size, not absolute size, which is important. This, in turn, is very important in terms of the literature discussed in section 8.2. Specifically, it is consistent with the argument of Forrsbaeck (2011) and others that moral hazard and implied subsidy are important in banking. It is inconsistent with the arguments of Hughes and Mester (2013), Beccalli *et al* (2015) and Hughes *et al* (2001) that simple scale is important. So relative size acting through moral hazard matters while absolute size acting through economies of scale does not (in this sample).

Statistically, it is important that the relationship of size over GDP and world rank by assets to one another is monotonic but not linear. This makes it possible to separately estimate effects of each, as indicated by the fact that VIFs are not extreme.

It is important not to over-state the importance of the findings I report here. They do not refute the fundamental theory of economies of scale. Rather they suggest that most UK banks are operating on a region of the scale curve where neither economies of scale nor diseconomies of scale are important. These banks are all (or nearly all) large enough that they all realise similar gains from scale but, as noted in the preceding section, no significant number of them is so large as to begin experiencing diseconomies of scale.

In summary, hypothesis H8.3 is rejected while H8.4 is accepted. This has implications for banking policy, as discussed in the next section and Chapter 9.

8.6 Conclusions

The results I have shown here differ from the existing literature in a number of ways. Firstly, the expected effects of complexity and diversification are absent and hypotheses H8.1 and 8.2 are rejected. Secondly, because hypothesis H8.3 is rejected while H8.4 is accepted, I can say that a new effect – not previously published – has been found, in which the relative size of banks has a positive effect on bank growth whereas absolute size does not. It appears that the largest banks gain competitive advantages through implied subsidy effects and then use the proceeds to grow faster. Neither economies nor diseconomies of scale are important in this sample.

In terms of implications for economic policy, this result is important. Specifically, if larger banks grow faster because of effects related to moral hazard, and if large banks cause moral hazard and systemic risk, then there are problems that can compound themselves over time in a pernicious feedback loop.

This, in turn, suggests a need for policy interventions to counteract the undue competitive advantage of larger banks. Measures that could achieve this goal include taxes related to size, competition regulations designed to break-up large banking groups and Recovery and Resolution Plans (RRPs) designed to ensure bank investors bear the cost of bank failure (through pre-emptive investment in separate infrastructure for different divisions of the bank, or subordinated bonds that convert to equity under distress). All of these tools have been employed by the authorities since the global financial crisis of 2007-2009.

By contrast, there is limited evidence that bank diversification or complexity should be explicit targets of policy. Obviously regulators should deal with extreme cases (such as if banks have concentrations in one large asset or very fragmented internal systems) but these do not generalise to my whole sample. Relative size is the more relevant policy target.

Taken together with the results of my earlier chapters, I must recommend a system in which there are many mutual banks of limited size, limited foreign and state ownership, enhanced structures for using information, strong remuneration committees and alternative structures in place of certain elements of governance (independent CRO and Chairman) that do not work.

Chapter 9: Conclusions and Policy Implications

9.1 Introduction

It is has long been clear that ownership and governance have implications for corporate risk and performance, including in banks (Shleifer and Vishny, 1997). So we can infer that changing standards of governance across the banking system might change the level of risk in the economy.

This is a key motivation for seeking to determine if different kinds of ownership and governance structures can improve outcomes for banks. I have found a range of causal effects of bank ownership, governance and size on bank-specific risk and performance. In this final chapter I summarise and discuss my results (section 9.2), present policy implications given certain normative assumptions (section 9.3), consider limitations of the work (section 9.4), and discuss avenues for future research (section 9.5).

9.2 Key Conclusions

Overall, my work shows that the effects of a particular ownership or governance structure can be attributed to the ways in which categories of decision-maker are empowered by that structure, and that factors relating to information processing capability generally have important effects. Banks have lower return and lower risk when key agents have limited incentives to take risk or strong personal accountability to control it, or there are structures which empower risk-averse agents by providing them with relevant information.

The basis of these generalisations can be seen by considering lessons learned from my analysis of specific features of ownership and governance. The following sub-sections summarise the key lessons that can be extracted from Chapters 4 through 8, in the context of wider debates in the literature.

9.2.1 Bank Risk and Return are Simultaneous

In Chapter 4, I demonstrate that risk and return measured in the profit and loss account of banks are indeed simultaneous on both a same-year basis and lagged basis, when measured by loan impairments and return on assets respectively. This is the first time risk-return simultaneity has been confirmed and used in a study of bank ownership and governance. It is consistent with the argument of basic finance theory that risk and return are generally correlated, and it confirms that this correlation holds despite the complexity and opacity of banking.

I also demonstrated that, if the simultaneity between ROA and loan impairments is not taken into account in models where these are the dependent variables, biased estimates are obtained for the effects of several key features of banks, specifically: state majority ownership, mutual ownership, Board size, Joint CEO-Chairman and the presence of a Remuneration Committee. So identifying simultaneity (lagged and unlagged) is of interest in its own right and also important for obtaining unbiased answers to some of the most important questions in the field of bank ownership and governance.

9.2.2 State Ownership Has Limited Impact

One recurring question in the literature on corporate ownership and governance has been the importance, or otherwise, of ownership by the state, a foreign parent or mutual owners (staff or depositors). Such questions are important because they relate to different visions of how to run an economy: statist or privatised, globalised or inward-looking, capitalistic or worker-oriented.

In Chapter 5, I report robust evidence that state ownership reduces financial performance. Specifically, it lowers loan interest income. This is consistent with the argument that state ownership leads to weaker financial performance because social and political goals are prioritised (such as by offering soft loans) and managers do not have material direct cash flow rights.

However, my results have important differences from earlier studies. Specifically, I find that state majority ownership has far fewer effects than expected, in that it does not affect other measures of returns or loan impairments. The difference arises because, unlike earlier studies, I take account of the simultaneity of risk and return. Had I not done so, I would have concluded that state majority ownership also increases loan impairments, in line with earlier studies.

So, while state ownership of banks is not financially efficient, it is not as inefficient as its critics claim. It may therefore have some uses in the realm of industrial policy where development objectives matter more than bank profitability (Rodrik, 2007).

9.2.3 Mutuality Lowers Risk and Return

In Chapter 5, I also find that mutuality lowers bank risk and performance. This is important because it reinforces a thin literature that reached the same conclusions.

My findings represent a more direct test of the effects of mutuality than any earlier work. This is because the UK Building Societies Act, 1986 left limited differences between building societies and other banks in terms of business activities. Under this legislation, introduced for reasons of deregulation and boosting competition, building societies gained rights to offer unsecured loans and cheque accounts, and even to engage in foreign exchange activities, provide stock-broking services, manage retail investment funds and arrange and advise in respect of insurance.

Thus, a UK building society differs from other banks only in its mode of ownership: it is mutually owned by depositors, rather than being owned by shareholders. So, since virtually all of the mutual banks in the UK are building societies, testing the effects of mutuality in this context is freer from confounding factors than any of the earlier studies. It should also be noted that, had I not used a simultaneous equations framework, section 4.6 shows that I would have concluded that mutual ownership has no robust effects at all, which would have been a significant oversight.

9.2.4 A Foreign Parent Lowers Return with Mixed Effects on Risk

I also find that a foreign parent lowers banks' risk and return, but that the effect on return leads to a greater probability of failure in crisis periods (such that the overall effect on risk is mixed). This is important because it adds some clarity to a literature where there have been contradictory reports on the effects of banks being owned by a foreign parent.

My findings are the first time a particular combination of effects of foreign ownership has been found – lowering returns at the same time as lowering impairments and increasing the probability of failure. The first two effects are identical to the impact of mutual ownership. So, because the pattern is similar to mutuals where managers have little incentive to take risk in order to pursue profit, it suggests that managers in foreign-owned banks have a similarly protected position. This, in turn, suggests that information asymmetries between managers and foreign owners dominate over any beneficial effects of foreign ownership, such as diversification. The reason a foreign parent has an effect on failure rates while mutual ownership does not is that it has a larger negative effect on ROE, which then increases the chances of failure during stress periods.

9.2.5 Empowered Accountable CEOs Lower Risk

One area in which my results depart substantially from established corporate governance guidelines, such as the UK Corporate Governance Code 2014, is in respect of the roles of an independent CRO and an independent Chairman. Specifically, I found in Chapter 6 that an independent CRO and Chairman each cause higher impairments, likely because they lead to confused decision-making and CEOs perceiving less personal accountability for risk management. This contrasts with governance guidelines which recommend having an independent Chairman and CRO.

9.2.6 NEDs and Remuneration Committees Reduce Bank Failure Rates

I find in Chapter 6 that the presence of a high proportion of NEDs on the Board reduces the rate of bank failure. This is the first time non-executive Directors have been reported to affect what is arguably the most socially-important consequence of bank risk: bank failure. However, I find no evidence that the proportion of non-executive Directors affects any other aspect of bank performance or risk.

In a similar manner, I confirm that the presence of a remuneration committee lowers the probability of bank failure. This suggests that such committees are able to structure pay in a way that lowers the most serious risks banks face.

9.2.7 Information Processing Capability is Important

In Chapter 6, I argued that features of banks which represent greater ability to process information on risk and return should generally have consequences for risk and return. Such features include the size of the Board, the proportion of Directors with relevant financial services experience and having permission to use the IRB framework for credit risk measurement and management.

In the case of Board size, I found that larger Boards lead to stronger performance, as measured by Return on Equity, because they entail a greater base of skills and experience on which to draw. In addition, my empirical work rules out any nonlinear effect in which very large boards become ineffective because accountability is diluted or communication within the Board becomes more difficult.

In the case of Directors' experience, I found that having a higher proportion of Directors with no previous financial services experience leads to higher performance but also a higher probability of bank failure, because the eventual consequences of pursuit of profit are not adequately understood.

Finally, I found that IRB permission leads to lower risk and lower return because it empowers risk-averse individuals within banks. This is important in that it confirms that the IRB framework can have risk-reducing effects, even though some authors have argued that it is ineffective (Haldane, 2013 and Aikman, 2014).

It is notable that, although a foreign parent, mutuality and IRB permission each reduce both returns and loan impairments, only a foreign parent increases the probability of bank failure. This is because these regressors have different effects on ROE, which is crucial for bank solvency: a foreign parent has a large negative effect on ROE, mutuality has a small negative effect and IRB permission has no effect.

My over-arching conclusion here is that structures relating to information processing are the one area of corporate governance where I always find significant effects and where these effects are not materially inconsistent with what regulators expect. Banks need sufficient Board sizes, Directors with suitable experience and rigorous modelling frameworks for assessing risk.

9.2.8 Bank Pay is Determined by Governance not Performance

In the aftermath of the Global Financial Crisis of 2007-2009, bank pay was a major topic of public debate, to the point where some authors such as Admati and Hellwig (2014) argued that it detracted from discussion of more fundamental, structural problems in banking. I therefore sought to identify the determinants of bank pay and to evaluate the importance of bank pay alongside, and in comparison with, other aspects of bank ownership and governance.

I find that neither return on assets nor a measure containing only the positive component of return on assets has any effect on average pay. This is inconsistent with the idea that banks set performance-related pay, and with the existence of downward nominal wage rigidity, arising due to the long term nature of most wage contracts and behavioural heuristics. In the case of banking, it appears that average pay is rigid in both directions relative to the profitability of the organisation overall.

Similarly, for loan impairments I find no sign of the expected negative impact on average pay. This suggests that the regulatory requirements that risk be taken into account in pay settlements, which has existed since before the financial crisis that began in 2007 (Financial Conduct Authority Handbook, Systems and Controls Sourcebook, Chapter 19) have not been implemented in any widespread way in banking.

With potentially controversial implications for policy, I find that a Remuneration Committee and a high ratio of NEDs on the Board each lead to higher pay. These results accord with the argument that Board-level oversight of corporate pay may, because of network effects amongst Directors and executives at different firms, not be effective in restraining pay. It is clear that a Remuneration Committee is effective as a tool of risk management, but not as a tool of pay restraint.

Less controversially, I find that disclosure of executive remuneration lowers average pay. This is consistent with the argument that Directors seek to preserve reputation because it may have future value for their business relationships, such that they grant lower pay awards when these awards will be visible, because they do not want to be known for potentially over-generous payments.

In the same analysis, I confirm that mutuals have lower average pay than other banks while investment banks (as indicated by securities activities) have higher pay. This is not surprising but it is the first time this has been shown rigorously.

Finally, I found that around half of bank pay appears to be outside the control of factors that are relevant across banks.

9.2.9 *Average and Excess Pay have Opposite Effects*

Similarly to the issues discussed in the preceding sub-section, it has been of particular interest since the Global Financial Crisis of 2007-2009 to determine if bank pay structures have implications for risk and return, and whether these issues are important when compared to other structural issues in the sector.

I find that higher average pay leads to faster growth and lower risk, likely because of efficiency wage effects. Bank employees are more effective in pursuing growth and minimising risk when they are motivated by a higher fixed salary, either because they fear losing this salary or because the perception of fairness is intrinsically motivating.

In addition, I find that higher excess pay in banks (defined as pay beyond that which can be explained by factors which are important across banks) leads to slower growth and a higher probability of bank failure. It is likely that this occurs because excess pay represents unresolved agency problems and a perception by employees that their rewards are unrelated to bank-level financial outcomes or structures.

9.2.10 *Relative Size is More Important than Absolute Size*

Alongside bank pay, another issue that has received much attention in public debate is the size of banks and the issue of “Too Big To Fail” (TBTF) – banks that have grown so large and interconnected that the failure of a single one could have severe repercussions for the economy.

In Chapter 8, I find that greater relative size in banking boosts the growth rate of the balance sheet, while greater absolute size does not. This is consistent with the argument that greater relative size entails systemic importance and thus a greater expectation of being rescued by government in a crisis, such that funding costs are lower and the bank receives an implied subsidy.

It runs contrary to the arguments that absolute size is important in that it leads to economies of scale in banking. It seems clear that economies of scale are not important in my sample. Neither are diseconomies of scale, in that I find no adverse impact of the indicators of complexity considered in section 8.4. The banks in my data may simply be of a size where most are large enough to have achieved fully efficient scale, but few are so large that scale leads to inefficiency.

9.2.11 Some Aspects of Governance and Activities Have No Impact

In any empirical study, information on variables which do not matter can be as important as identifying those which do matter; it can refute hypotheses previously considered believable. So I briefly note here some factors that do not appear to have any significant impact on bank risk and performance.

The presence of a Commercial Director as a full Board member has no robust impacts. It is unclear why this might be so, given the distinct incentives associated with the role, but it is an empirical reality. It is possible that the role might carry less influence in practice than bank annual reports suggest.

Likewise, a greater proportion of female Directors on the Board has no robust effects on risk or return. Rather, there are indications that banks with structurally weaker performance may appoint more female Directors. This may be because they wish to distract from weak financial performance by doing well in other matters, or because they have assigned greater priority to non-financial goals compared other banks (which would manifest as different outcomes for finances, diversity and likely other metrics).

Finally, neither diversification nor bank complexity had any important effects in my sample. It is possible that asset correlations were high enough for diversification to have little impact, while, as noted above, most banks in the sample may be of a size where neither economies nor diseconomies of scale are important. What is clear is that the finding that diversification is not important is consistent with the conclusion in section 5.5 that cross-border information asymmetries dominate over putative benefits of international diversification in foreign-owned banks.

9.2.12 Context can be Important

A final lesson I can extract from my results is that particular governance structures may have different effects in different contexts. There is reason to believe that this could be so where my results add to a diversity of findings in the literature. Specifically, I find that Board size increases returns in my sample, likely because of better use of information, but there are studies which show a negative effect in other settings, possibly because these settings have features that make it easier for dilution of accountability to occur. There is a complex mix of findings in the literature as to whether a foreign parent increases or reduces each of risk and return, suggesting that context-specificity may matter, even though I identify strong reasons why cross-border information asymmetries should be the dominant consequence. Similarly, I conclude that an independent CRO (like an independent Chairman) mainly detracts from clear decision-making and the personal accountability of the CEO, but studies with different results may imply that there are settings where the independence of the CRO in limiting bad decisions dominates over this fact, possibly because other aspects of governance are weak in those settings.

In short, no recommendation relating to any aspect of governance can ignore context. The policy recommendations that follow are therefore firm in the case of the UK banking system (which was the sample for my study) and for systems similar to the UK (such as other Western economies) but more tentative for settings that are very different from the UK.

9.3 Policy Implications

A major reason that investigators seek to identify relationships between economic variables is to inform policy or management decisions. Lucas (1976) pointed out that we should not make policy recommendations solely from statistical correlations because these correlations may not represent invariant behavioural patterns and may break down under the pressure of the policy itself (the "Lucas critique"). Instead, we should seek deeper patterns verified through correlations ("deep parameters") and base policy recommendations on these. My work has formulated behavioural hypotheses grounded in micro-level studies in the literature and has validated these econometrically. It can therefore be used as the basis of policy recommendations.

I consider banking policy in a context where bank regulation has already changed substantially in response to the crisis of 2007-2009. In the UK, the supervisory bodies responsible for regulation have changed, standards relating to liquid asset resources and capital requirements have become stronger in several respects, new arrangements for dealing with bank failures have been introduced, and some adjustments have been made to bank governance. However, changes to bank governance have been incremental adjustments within a pre-existing framework and have not extended to re-consideration of ownership types. (See Section 2.3 for details.)

In this section, I draw policy recommendations from my empirical results by interpreting them in the context of the relevant financial-policy literature and making assumptions relating to which outcomes are desirable and which are undesirable. Specifically, I follow widely-accepted assumptions in the literature that loan impairments and bank failure are clearly undesirable (with bank failure being worse because of the potential for severe systemic effects – e.g. Bernanke, 1983), that provision of investment to the economy is clearly desirable (Romer, 2006) and that the desirability of bank profit is ambiguous as we do not know if it is based on efficiency or rent-seeking (Stiglitz, 2013). I treat an increase in profitability as desirable only if there are no accompanying adverse impacts and there is reason to believe it occurs due to better information processing. I treat a decline in profitability as less important than any other improvement that may accompany it (unless there is reason to believe the decline is large enough to affect a bank's ability to survive crisis periods).

The first policy implication that arises from my work is that, because bank risk and return are simultaneous in the same period and at a lag, regulators must accept that any policy which seeks to lower bank risk will also have an impact on bank ROA. However, under the assumptions stated in the preceding paragraph, it is still reasonable for regulators to have a bias towards minimising risk.

A second policy implication arises from the presence of a simultaneous relationship between bank risk and return and the absence of any impact of indicators of bank complexity. Taken together, these suggest that, while banking is clearly complex and opaque, it is not so opaque that classical market mechanisms cannot operate at all. So, while studies such as Lo (2011) suggesting that controlling complexity in banking should be a priority cannot be dismissed entirely, I do not ascribe the same importance to the issue. Robustness against shocks, rather than simplicity *per se* should be the goal of bank prudential regulation.

A third policy recommendation is that, while state majority ownership of banks should not be the norm, it is not so inefficient that it should never be considered. I make this recommendation because my simultaneous-equations framework shows that the full range of adverse effects identified by earlier studies such as Schliefer and Vishny (1997) and Iannotta *et al* (2007 and 2012) are not present – and the one impact that is robustly present (reduced loan interest income) is of less societal interest than development goals. So, where the criteria for efficient industrial policy identified in works such as Esteban *et al* (2013) and Rodrik (2007) are satisfied, state-owned banks should be considered as a tool of such policy, at least until such time as the target market failure has been successfully addressed[7].

To improve bank stability, mutual ownership of banks should be more widespread. I find that mutuality lowers the rate of loan impairments (which could be important for bank stability and market function) while its only negative impact is on bank profitability – which I have argued should be a lower policy priority. In addition, Gupta (2014) argues that mutuals are beneficial because they enhance economic democracy and increase the alignment between decision-makers and those affected by commercial decisions. Mutuals could be made more widespread through tax incentives or some form of public support for their establishment.

I am forced to argue against widespread foreign ownership of banks on the basis that it increases the rate of bank failure, probably through large negative effects on return on equity or linkage to other, unstable, economies. I make this recommendation because, even though the effects of foreign

[7] To avoid any appearance of a conflict of interest in stating this recommendation I should note that, at the time of writing, I work for a state-owned bank created to address a market failure – the UK Green Investment Bank plc.

ownership are otherwise similar to the effects of mutuality in the sense of reducing ROA and loan impairments, bank failure entails large social costs. If international trade agreements make it impossible to block foreign take-overs of banks, an alternative could simply be to ensure that stress testing takes account of the specific ways in which foreign ownership increases risk, such that acquirers who do not wish to bear the cost of mitigating this risk are deterred and pre-existing foreign-owned banks are adequately stabilised.

In terms of governance, regulators should focus on structures to improve information processing within banks. Firms should have large Boards populated with a high proportion of NEDs with suitable financial services experience. Regulators already have the power to bring about this outcome through the 'approved persons' regime. Meanwhile, IRB or frameworks similar to it should be strengthened and extended to more banks. In order to improve the risk-return trade-off systemically, firms should be encouraged to use IRB to identify cases where the risk-return pairing of loans is anomalously good.

Other aspects of corporate governance standards require a fundamental re-think. Currently, firms are encouraged to have an independent CRO and an independent Chairman. The former is suggested in the FCA Handbook for all financial services firms exceeding certain thresholds while the latter is required by the UK Corporate Governance Code. However, I find convincing evidence that the real effect of these roles is to increase risk by confusing decision-making and diluting the personal accountability of the CEO.

This suggests that these roles should be replaced with structures that have the same objectives of ensuring transparency and oversight, but which avoid confusing decision-making or diluting CEO accountability. One option could be to give the NEDs a dedicated, independent staff with the ability to directly monitor all communication, documentation and meetings within the firm. An alternative could be to give similar powers to some external monitor, such as an audit firm.

Similarly, while I find there is evidence that a Remuneration Committee is effective as a tool of risk management, there is no evidence that it is effective as a tool of pay restraint. If restraining executive pay is a policy objective, then other means should be sought to achieve it. I find evidence that more widespread use of executive pay disclosures could help in this regard, although it seems unlikely that they could be a full solution.

In other areas of governance, my recommendations are less controversial: high NED ratios and remuneration committees should each be retained as effective means of limiting the rate of bank failures.

Finally, the finding that bank relative size is more important than absolute size has interesting policy implications. I cannot argue that the relative size of banks should be reduced – if they were all made smaller some bank would still be the biggest. However, what this finding really points to is that bank managers' and investors' perception that an institution is systemically important can lead to implied subsidy effects. Specifically, perception of systemic importance leads to expectations of bailout in the event of distress, leading in turn to lower risk premia in funding costs, cheaper funding and faster growth. This causes the most important banks to grow larger still – increasing the vulnerability of the economy in the event that they fail. There is evidence that systems composed mainly of many small banks can still produce contagion and severe crises, such as in the US in the early 1930s (Bernanke, 1983), but it nevertheless is advisable to interrupt a feedback loop that increases the vulnerability of the economy to the status of specific firms.

Therefore, measures to reduce the size of the largest banks are justified. One mechanism to achieve this would be competition law: breaking up large banks on the grounds that implied subsidies are effectively a gain from anti-competitive conditions. Another option would be to tax banks based on balance-sheet size or leverage (which is risky in its own right and magnifies size). Another would be to remove tax breaks for debt, which magnify borrowing and bank size. Yet another would be to impose costs through comparatively more rigorous Recovery and Resolution Plans for larger and more complex firms.

Taken together, these recommendations amount to proposing a system in which mutual banks are numerous, governance focuses on use of information, NED oversight and CEO accountability, and there are few state-owned banks, large banks or foreign banks. We might call this 'data-driven community banking'. Based on other literature, state-owned banks should be limited to specific industrial-policy roles where private-sector action is insufficient to meet societal goals.

On a macroeconomic level, these recommendations should not be stated with too much certainty. It is possible that general equilibrium effects arise in which effects identified at the bank-specific level are less powerful at the macroeconomic level. For instance, it is conceivable that more widespread mutuality could lead to a less dynamic commercial culture (although no real evidence has been presented for this argument, only arguments from practitioners that may be self-interested). General equilibrium effects could also push in the opposite direction: design of better systems for using information within banks could have positive externalities for the economy as a whole. In any case, it is clear that there is an argument for the banking system to move some way in the directions I recommend, with monitoring of general equilibrium effects along the way.

How do my recommendations compare, in terms of promise for improving banking, to more radical proposals that would involve abolishing the fractional reserve system and moving to narrow banking, such as discussed in Kobayakawa and Nakamura (2000)? In the absence of an actually-existing narrow banking system from which to draw empirical data, it is impossible to compare rigorously. However, three things are clear. Firstly, no set of reforms focused on governance and ownership can ever completely eliminate the possibility of bank runs in a fractional reserve system, although it can sharply reduce their probability. Secondly, the set of potential reforms I identify here is broad enough that it has clear potential to yield a system much more stable than has existed to date. Thirdly, a series of incremental reforms is easier to implement than a re-design of system fundamentals, but at the same time more vulnerable to reversal by vested interests within the system. So, while I have identified one viable reform package that contains some radical elements, more radical possibilities remain a reasonable option.

9.4 Limitations

One significant limitation of this study is that it has not been possible to evaluate the importance of structures relating to internal and external audit of banks' governance and controls. Corporate governance standards (UK Corporate Governance Code 2014) require larger banks to operate an independent Audit and/or Risk Committee (ARC) and an independent Internal Audit (IA) function. In addition, recent regulation has instructed that external auditors be changed periodically as a means to ensure independence (European Parliament and Council, 2014). However, essentially all banks in my data set had an ARC and an IA function and the rate of change of external auditors was essentially zero, meaning that there is insufficient variation in these factors for econometric evaluation of their effects on risk and return. It should be noted that, because these factors do not vary, they cannot cause omitted variables bias. Instead, any effects they may have are absorbed into intercept terms in my models.

It would be of interest to consider impacts of bank ownership and governance on financial crime and wider social, macroeconomic and environmental outcomes. But, compared to measures of bank-specific risk and performance, it is more challenging to obtain data on these other dependent variables in a form that can be related to the governance of particular banks, so they must be left to future studies.

It would also be of interest to determine if the parameter estimates I obtain for UK data would be similar if the same models were applied to non-UK banks. Given different legal and structural conditions, it is likely that some variation in parameter estimates would occur. However, since the regressors used should represent the same incentive structures in any setting (e.g. control functions have lower risk-taking incentives than profit centres regardless of country) there is no reason to expect fundamentally different results. The study was restricted to the UK in order to avoid combining data points that exist in different legal and structural contexts.

9.5 Future Research

The literature considered and the results I present in this thesis suggest a number of interesting avenues for future research, not followed as yet. These are briefly discussed below.

9.5.1 Governance

A number of explanatory variables relating to governance have surprisingly non-robust effects in my study. For instance, my results show only non-robust evidence that there are effects on risk and return arising from the presence of a Commercial Director as a full Board member. This is very surprising given that a role which is explicitly constructed to have highly commercial incentives would be expected to sway bank decision-making towards greater risk in the pursuit of greater return. Further investigation of why this impact is not present would be desirable.

This is not likely to be achieved using the current data set. Except where there is reason to believe that the techniques chosen are biased, using more advanced econometric methods to find a correlation where none was evident previously may well constitute data mining bias.

Instead, it would be of interest to expand the data set by collecting similar data for other time periods or high-income countries to determine if robust effects of having a Commercial Director on the Board can be detected.

9.5.2 Gender Balance

The findings I report in respect of gender suggest further interesting questions that I have not pursued because they would take me beyond the scope of this thesis. Specifically, I find that the apparent negative effect on ROE of a higher ratio of female Directors disappears when a panel model is used, suggesting that some stable, unmeasured feature of banks is associated with high female ratios on the Board and also low ROE. As discussed in Chapter 6, it could be that banks with structural financial weakness attempt to do well on other metrics, for the sake of their reputation. Or it could be that banks which give greater priority to social goals alongside financial ones are both less likely to aggressively pursue profit and more likely to avoid gender bias.

Which of these hypotheses are correct could be resolved using some indicator of the extent to which banks prioritise Corporate Social Responsibility (CSR). The presence of a dedicated CSR team, or the extent of CSR activities or reporting, could serve as such indicators. If the CSR indicator could explain both lower returns and a higher female Director ratio, and if its inclusion in models removed the apparent negative effect of the female ratio on ROE, then we would have an explanation that non-financial objectives lead to both lower profit and greater equality of opportunity. Alternatively, if we compute some indicator of structurally-weak performance (perhaps based on returns in the past five years compared to market average) and show that this explains both low current profitability and a high female ratio, and that its inclusion removes the apparent effect of the female ratio, then we would know that structurally weak banks attempt to look good in other regards.

9.5.3 Credit Growth

In theory, rapid credit growth may represent bubble conditions or uncontrolled lending. It may thus lead to higher impairments with a lag. Most studies examining the lagged effects of credit growth have done so at the macroeconomic level. Only one study (Foos *et al,* 2010) has done so at the bank level.

To test the hypothesis that credit growth has lagged effects on impairments and other outcomes in my sample and modelling framework, I could simply use rates of growth of loans (and other forms of credit, perhaps differentiated by borrower type) as regressors for bank risk and performance. This would serve to determine if the association reported in earlier theoretical and empirical work is robust, which would be of interest for policy-makers seeking to manage credit cycles.

9.5.4 Short-Termism

Some literature suggests that decision-making within firms and banks unduly prioritises returns in the short term, particularly when remuneration is based on current-period returns and/or stock market valuation is an outcome of interest to management (e.g. Chen *et al* 2015). However, if decisions excessively prioritise the next financial period, long-term projects may be foregone and long-run results may be suboptimal.

Bankscope data includes variables (senior debt >1 year maturity and total long-term funding) that could serve as proxies for a long-termist outlook. Banks with long-term funding secured may be able to focus more easily on long-term priorities, because they have less need to respond to the priorities of short-term investors. I could employ the regressors mentioned above to determine if they lead to better financial outcomes with a lag. In the literature I find no studies which consider the effects of short-termism versus long-termism in this way.

9.5.5 Changes in the Effects of Variables

The literature has not considered changes in the effects of ownership or governance structures over time. One might expect such changes given lessons collectively learned (or forgotten) and changing enforcement of governance codes in light of market experience. I could test this possibility by considering if the effects of regressors differ in 2003-2007 compared to 2008-2012 (that is, the periods before and after onset of the Global Financial Crisis, which is likely to have changed attitudes of both bank managers and regulators). Changes in sign or significance would not be expected, given that the fundamental incentives associated with a given structure do not change, but magnitudes of effect could well change.

Alongside changes of effects, effects of changes might also be interesting. This is because changing a governance structure might send signals to employees about which behaviours are preferred – signals that might dissipate over time. This could be examined using lagged first differences of governance variables as regressors.

9.6 Closing Remarks

From my results, it seems that a well-functioning banking system would have many mutuals with strong NED oversight, empowered and accountable CEOs, and structures designed to maximise the use of information. It would have few large banks or foreign banks, and state-owned banks would exist only for well-defined industrial-policy goals. We might call this system 'data-driven community banking'. I cannot comment, on the basis of available empirical evidence, on the likely effectiveness of proposed fundamental changes in the nature of money and banking, such as full-reserve banks. But it does seem clear that there is a package of reforms which, within the confines of the fractional-reserve system, could materially improve outcomes for the economy and society.

Appendix A: Data Processing Audit

As discussed in Chapter 3, data processing in this thesis involved merging multiple extracts of financial data from Bankscope with one another and merging these with governance and ownership data collected by hand, all using bank-year as a merge key. Data processing steps were carried out with a very high level of caution to avoid introducing error. In order to provide further assurance that data processing did not introduce error, I carried out a sample-based audit of the final processed data set. This involved selecting an arbitrary sample of 50 cells in the data set, consisting of the value of a specific variable for a specific bank and year, and re-confirming the values against original raw data (either Bankscope or annual reports). Results obtained are as follows.

Table A.1 Results of Data Processing Audit.

	Entity	**Year**	**Variable**	**Value in Data Used For Analysis**	**Value in Original Extract**	**Re-Confirmed Value From Source**
1	ABN AMRO (Guernsey) Limited	2011	State Majority Owner	1	1	1
2	Arbuthnot Banking Group Plc	2011	Mutual Ownership	0	0	0
3	Banc of America Securities Limited	2010	Foreign Parent	1	1	1
4	Bank Leumi (UK) Plc	2009	Number of Executive Directors	3	3	3

	Entity	Year	Variable	Value in Data Used For Analysis	Value in Original Extract	Re-Confirmed Value From Source
5	Bath Investment & Building Society BIBS	2008	Joint CEO Chairman	0	0	0
6	BMCE Bank International Plc	2008	State Majority Owner	0	0	0
7	Bradford & Bingley Plc	2006	Cash and amounts due from banks	202.6	202.6	203
8	Britannia Building Society	2005	Residential mortgage loans	19002.5	19002.5	19003
9	British Arab Commercial Bank Plc	2009	Loans and advances to banks	1526	1526	1526
10	Brown, Shipley & Co Limited	2004	Total assets	725.4	725.4	725
11	Butterfield Bank (Guernsey) Limited	2011	Total equity	77.0	77.0	77.0
12	C. Hoare & Co	2011	Cash and amounts due from banks	636.5	636.5	637
13	Cambridge Building Society	2010	Net income	1.00	1.00	1.00
14	Coventry Building Society	2009	Loan impairments	17.00	17.00	17.00
15	Credit Suisse International	2009	Customer current deposits	971.00	971.00	**600**
16	Cumberland Building Society	2007	State Majority Owner	0	0	0

	Entity	Year	Variable	Value in Data Used For Analysis	Value in Original Extract	Re-Confirmed Value From Source
17	Darlington Building Society	2006	Mutual Ownership	1	1	1
18	Derbyshire Building Society	2005	Foreign Parent	0	0	0
19	Fairbairn Private Bank Ltd	2004	Number of Executive Directors	Missing	Missing	Missing
20	FBN Bank (UK) Limited	2011	Joint CEO Chairman	0	0	0
21	Hanley Economic Building Society (The)	2012	CRO Present on Board	0	0	0
22	HBOS Plc	2006	Corporate and commercial loans	140060	140060	140060
23	Lambeth Building Society	2009	Net Income	2.1	2.1	2
24	Lazard & Co Holdings Limited	2007	Cash and amounts due from banks	73.3	73.3	73
25	Lloyds TSB Bank Plc	2005	Loans and advances to banks	31655	31655	31655
26	London Scottish Bank Plc	2006	Total assets	386.5	386.5	387
27	Market Harborough Building Society	2007	Total equity	26.2	26.2	26

	Entity	Year	Variable	Value in Data Used For Analysis	Value in Original Extract	Re-Confirmed Value From Source
28	Melton Mowbray Building Society	2006	Cash and amounts due from banks	0.2	0.2	0.2
29	Mitsubishi UFJ Securities International plc	2005	Loans and advances to banks	446.2	446.2	446
30	Monmouthshire Building Society	2003	Customer current deposits	329.4	329.4	329
31	Morgan Stanley & Co. International Plc	2012	State Majority Owner	0	0	0
32	N M Rothschild & Sons Limited	2011	Mutual Ownership	0	0	0
33	Newbury Building Society	2010	Number of Executive Directors	3	3	3
34	Newcastle Building Society	2009	Number of Executive Directors	5	5	5
35	Nomura Bank International Plc	2010	Joint CEO Chairman	Missing	Missing	Missing
36	Northern Bank Limited	2007	CRO Present on Board	Missing	Missing	Missing
37	Paragon Group of Companies Plc	2006	Loan Impairments Charge	47.8	47.8	48
38	Portman Building Society	2005	Residential mortgage loans	13523.2	13523.2	13523.2

	Entity	Year	Variable	Value in Data Used For Analysis	Value in Original Extract	Re-Confirmed Value From Source
39	Principality Building Society	2005	Loans and advances to banks	49.9	49.9	50
40	R Raphael & Sons Plc	2009	Total assets	156.3	156.3	156
41	Rathbone Brothers Plc	2012	Total equity	229.5	229.5	230
42	Scottish Building Society	2011	Cash and amounts due from banks	0.1	0.1	0.1
43	Swansea Building Society	2010	Net income	1.3	1.3	1.3
44	Tesco Personal Finance Group Limited	2009	Loan impairments	176.6	176.6	177
45	Tipton & Coseley Building Society	2008	Customer current deposits	317.7	317.7	318
46	UFJ International Limited	2004	State Majority Owner	0	0	0
47	Unity Trust Bank Plc	2006	Mutual Ownership	0	0	0
48	Vernon Building Society	2010	Number of Executive Directors	2	2	2

	Entity	Year	Variable	Value in Data Used For Analysis	Value in Original Extract	Re-Confirmed Value From Source
49	Virgin Money Plc	2010	Number of Executive Directors	3	3	3
50	Yorkshire Building Society	2005	Joint CEO Chairman	0	0	0

Note: I compare values in the final data set used for analysis against both the original extract produced at the outset of my thesis research and against values obtained by re-running the same searches in Bankscope or annual reports. Monetary amounts are in £m GBP. One case where a new search of Bankscope yielded a different result from what Bankscope reported initially is highlighted in **red**. This case is discussed and justified in the text immediately after the table. No other discrepancies were found.

The audit reveals no discrepancies between data used in analysis and the data originally extracted at the outset of my research. This provides robust confirmation that no errors were introduced during data processing (which was expected since processing was carried out with extreme caution).

However, the audit does reveal that, in a small minority of cases, extracts for the same variable for the same observation can differ in Bankscope extracts made at different times. This is due to accounting re-statements by banks or corrections in data-entry errors by the curators of the Bankscope database. Such re-statements or corrections are not likely to affect my econometric results in a systematic way since a) they occur in a small minority of cases and b) re-statements are unlikely to introduce systematic bias. In addition, older results are less likely to be subject to re-statement since errors will either have been rectified or forgotten.

In addition, since lagging of variables by one year forms an important part of my analysis, I confirmed that this operation was performed correctly. To perform the operation I used the time series lag operator in STATA, which respects both the calendar and the panel structure of the data. (For similar reasons I used the time series lead operator in missing-value replacement.) To verify the correct functioning of the lag operator, I extracted a data set in which lagged values had been generated and I confirmed by visual inspection that this operation had functioned as intended. The following table provides an example of this audit for two variables for two banks, although the actual inspection performed was broader than this.

Table A.2 Confirmation of the correct functioning of the STATA lag operator used in generating lagged variables.

Entity	Year	Director Ratio	Lagged Director Ratio	Leverage Ratio	Lagged Leverage Ratio
Royal Bank of Scotland Group Plc	2004	4.666666508		22.48829651	
Royal Bank of Scotland Group Plc	2005	5	4.666666508	20.6911087	22.48829651
Royal Bank of Scotland Group Plc	2006	2.400000095	5	21.75479889	20.6911087
Royal Bank of Scotland Group Plc	2007	2	2.400000095	23.90649986	21.75479889
Royal Bank of Scotland Group Plc	2008	5	2	37.67001724	23.90649986
Royal Bank of Scotland Group Plc	2009	5.5	5	19.69703674	37.67001724
Royal Bank of Scotland Group Plc	2010	5.5	5.5	20.31297302	19.69703674
Royal Bank of Scotland Group Plc	2011	5.5	5.5	21.2951622	20.31297302
Royal Bank of Scotland Group Plc	2012	5	5.5	20.14081573	21.2951622
Manchester Building Society	2005	2.333333254		15.23719692	
Manchester Building Society	2006	1.399999976	2.333333254	16.61425018	15.23719692
Manchester Building Society	2007	1.399999976	1.399999976	17.60666656	16.61425018
Manchester Building Society	2008	1.399999976	1.399999976	20.25213623	17.60666656
Manchester Building Society	2009	2	1.399999976	20.1137352	20.25213623
Manchester Building Society	2010	2.333333254	2	19.0575676	20.1137352
Manchester Building Society	2011	1.5	2.333333254	34.681633	19.0575676

Note: values are not rounded because they come from an intermediate analytical step. In all analysis, it is best practice to conduct rounding only at the final step.

Appendix B: First Stage Regressions

The following tables show estimation results for first-stage regressions employed in 2SLS estimators (see Sections 3.5 and 4.4 for details of this estimator and its use). First-stage equations are estimated by OLS. There are no first-stage equations to show for my multi-equation models using GMM because the estimation in this case does not use a multi-stage procedure. Model numbers are as per the main text.

It should be noted that the first-stage equation serves purely to predict a value for endogenous terms that is independent of causal effects from other endogenous terms, thus permitting estimation of the second stage. Therefore, it is not appropriate to interpret parameter sign or significance in the first stage. The only things that matter are that the first stage has predictive power and is free from endogeneity. I therefore present only the following diagnostic statistics: R-squared, the F statistic and the F statistic from a test for endogeneity that entails an auxiliary regression.

These tests show that all the equations have predictive power and are free from endogeneity. The latter is expected given the arguments in Section 3.10 that my explanatory variables should generally be exogenous because of their nature and because they are lagged.

Table B.1 First Stage Regression for Table 4.2

	For Model 1		For Model 2	
	loan_ impairments	return_on_ assets	loan_ impairments	return_on_ assets
L.growth_total_assets			-0.00482	0.00143
			(0.00316)	(0.00210)
L.loan_interest_income			-0.0416***	-0.000836
			(0.00599)	(0.00342)
L.state_majority_owner	-0.475	0.151	-1.294***	0.105
	(0.449)	(0.235)	(0.402)	(0.265)
L.mutual_ownership	-0.917**	-0.336	-0.502	-0.380
	(0.401)	(0.208)	(0.371)	(0.245)
L.foreign_parent	-0.412	-0.333	-0.578	-0.417*
	(0.403)	(0.213)	(0.376)	(0.249)
L.board_size	0.0305	0.00869	0.0792**	0.0108
	(0.0367)	(0.0189)	(0.0318)	(0.0211)
L.director_ratio	1.045	-0.538	0.851	-0.570
	(0.944)	(0.501)	(0.811)	(0.532)
L.rem_co	0.979***	-0.295	0.948***	-0.222
	(0.355)	(0.190)	(0.309)	(0.205)
L.exec_rem_disclosed	-0.297	0.115	-0.0941	-0.0140
	(0.268)	(0.141)	(0.223)	(0.146)
L.average_pay	-2.967**	1.808***	-1.990*	1.247*
	(1.286)	(0.682)	(1.090)	(0.721)
L.joint_ceo_chairman	-0.241	-0.886***	0.327	-1.073***
	(0.384)	(0.194)	(0.456)	(0.303)
L.cro_present_onboard	-0.307	-0.0996	-0.265	-0.0536
	(0.442)	(0.239)	(0.388)	(0.257)
L.comm_dir_board	-0.139	0.0244	0.170	-0.0649
	(0.193)	(0.104)	(0.160)	(0.105)
L.female_ratio	0.464	-0.175	1.295	-1.013
	(1.178)	(0.629)	(0.984)	(0.645)
L.no_exp_ratio	0.159	0.336	0.450	0.379
	(0.544)	(0.284)	(0.474)	(0.311)
L.irb_permission	-0.452	-0.0871	-0.0551	-0.262
	(0.376)	(0.203)	(0.306)	(0.202)
L.exposure_to_banks	1.912**	-0.635	4.026***	-1.057**
	(0.862)	(0.405)	(0.759)	(0.496)
L.securities_holdings	0.989	-0.931**	2.183***	-0.796
	(0.883)	(0.456)	(0.829)	(0.545)
L.advisory_activity	-7.530	24.41***	-36.85***	30.66***
	(5.636)	(2.902)	(7.749)	(5.061)
L.equity_ratio	8.698***	-4.735***	36.92***	-8.681***
	(1.620)	(0.646)	(2.073)	(0.944)

L.curr_deposits_over_liab	-0.760**	0.537***	-1.613***	0.735***
	(0.367)	(0.196)	(0.307)	(0.202)
L.size_over_gdp	-0.0589	0.152	-0.130	0.232
	(0.439)	(0.230)	(0.370)	(0.245)
Constant	-1.084	1.008**	-3.306***	1.290**
	(0.935)	(0.490)	(0.837)	(0.541)
Observations	403	431	303	311
R-squared	0.352	0.466	0.737	0.522
F statistic	7.3	12.6	26.4	10.6
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999

Year dummies included but not shown
Clustered errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero.

Table B.2 First Stage Regression for Table 5.6

	For Model 1		For Model 2	
	loan_ impairments	return_on_ assets	loan_ impairments	return_on_ assets
L.state_majority_owner	-1.421***	0.0217	-1.294***	0.105
	(0.374)	(0.236)	(0.402)	(0.265)
L.mutual_ownership	-0.281	-0.451**	-0.502	-0.380
	(0.367)	(0.229)	(0.371)	(0.245)
L.foreign_parent	-0.326	-0.366*	-0.578	-0.417*
	(0.321)	(0.201)	(0.376)	(0.249)
L.growth_total_assets	-0.00453	0.00194	-0.00482	0.00143
	(0.00321)	(0.00205)	(0.00316)	(0.00210)
L.loan_interest_income	-0.0401***	-0.000858	-0.0416***	-0.000836
	(0.00614)	(0.00338)	(0.00599)	(0.00342)
L.board_size			0.0792**	0.0108
			(0.0318)	(0.0211)
L.director_ratio			0.851	-0.570
			(0.811)	(0.532)
L.rem_co			0.948***	-0.222
			(0.309)	(0.205)
L.exec_rem_disclosed			-0.0941	-0.0140
			(0.223)	(0.146)
L.average_pay			-1.990*	1.247*
			(1.090)	(0.721)
L.joint_ceo_chairman	0.304	-1.060***	0.327	-1.073***
	(0.459)	(0.294)	(0.456)	(0.303)
L.cro_present_onboard	-0.479	0.0592	-0.265	-0.0536
	(0.353)	(0.226)	(0.388)	(0.257)
L.comm_dir_board	0.235	-0.0330	0.170	-0.0649
	(0.156)	(0.0987)	(0.160)	(0.105)
L.female_ratio	1.732*	-1.292**	1.295	-1.013
	(0.983)	(0.617)	(0.984)	(0.645)
L.no_exp_ratio	0.683	0.423	0.450	0.379
	(0.441)	(0.280)	(0.474)	(0.311)
L.irb_permission	0.0321	-0.240	-0.0551	-0.262
	(0.309)	(0.196)	(0.306)	(0.202)
L.exposure_to_banks	3.342***	-0.912**	4.026***	-1.057**
	(0.733)	(0.458)	(0.759)	(0.496)
L.securities_holdings	1.366**	-0.206	2.183***	-0.796
	(0.628)	(0.396)	(0.829)	(0.545)
L.advisory_activity	-30.00***	30.32***	-36.85***	30.66***
	(7.653)	(4.801)	(7.749)	(5.061)
L.equity_ratio	37.72***	-8.866***	36.92***	-8.681***
	(2.034)	(0.862)	(2.073)	(0.944)

L.curr_deposits_over_liab	-1.831***	0.758***	-1.613***	0.735***
	(0.295)	(0.186)	(0.307)	(0.202)
L.size_over_gdp	0.536	0.0990	-0.130	0.232
	(0.352)	(0.223)	(0.370)	(0.245)
Constant	-1.391**	0.769**	-3.306***	1.290**
	(0.594)	(0.365)	(0.837)	(0.541)
Observations	305	314	303	311
R-squared	0.712	0.514	0.737	0.522
F statistic	28.9	12.7	26.4	10.6
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999

Year dummies included but not shown
Clustered errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero.

Table B.3 First Stage Regression for Table 6.2

	For Model 1		For Model 2	
	loan_ impairments	return_on_ assets	loan_ impairments	return_on_ assets
L.board_size	0.0892***	0.00779	0.0951***	-0.00479
	(0.0295)	(0.0211)	(0.0299)	(0.0213)
L.director_ratio	-1.122	0.0127	-114.4**	51.35
	(0.896)	(0.634)	(46.09)	(32.60)
L.joint_ceo_chairman	0.428	-1.102***	0.531	-1.249***
	(0.423)	(0.302)	(0.422)	(0.301)
L.cro_present_onboard	-0.200	-0.0737	-0.144	-0.164
	(0.359)	(0.257)	(0.358)	(0.254)
L.comm_dir_board	-0.0279	-0.00483	0.0764	-0.0714
	(0.156)	(0.111)	(0.158)	(0.112)
L.female_ratio	0.813	-0.865	0.815	-1.062
	(0.918)	(0.649)	(0.915)	(0.645)
L.no_exp_ratio	-0.0374	0.527	-0.0232	0.540*
	(0.455)	(0.322)	(0.449)	(0.317)
L.low_ned	-2.085***	0.621*	-2.965***	0.728
	(0.518)	(0.370)	(0.723)	(0.513)
L.growth_total_assets	-0.00198	0.000586	-0.00153	0.000235
	(0.00301)	(0.00215)	(0.00297)	(0.00212)
L.loan_interest_income	-0.0440***	-0.000261	-0.0456***	0.000980
	(0.00557)	(0.00342)	(0.00552)	(0.00338)
L.state_majority_owner	-1.173***	0.0687	-0.836**	-0.334
	(0.373)	(0.265)	(0.404)	(0.287)
L.mutual_ownership	-0.469	-0.388	-0.362	-0.444*
	(0.344)	(0.244)	(0.342)	(0.241)
L.foreign_parent	-0.211	-0.524**	-0.186	-0.563**
	(0.360)	(0.257)	(0.355)	(0.252)
L.rem_co	0.873***	-0.200	0.945***	-0.286
	(0.286)	(0.205)	(0.285)	(0.203)
L.exec_rem_disclosed	-0.0921	-0.0140	-0.151	0.0538
	(0.206)	(0.146)	(0.205)	(0.145)
L.average_pay	-1.925*	1.227*	-1.164	0.424
	(1.009)	(0.718)	(1.050)	(0.744)
L.irb_permission	-0.0445	-0.264	-0.0531	-0.248
	(0.283)	(0.201)	(0.279)	(0.198)
L.exposure_to_banks	4.438***	-1.175**	4.651***	-1.455***
	(0.709)	(0.499)	(0.711)	(0.499)
L.securities_holdings	2.376***	-0.849	2.283***	-0.822
	(0.769)	(0.544)	(0.759)	(0.535)
L.advisory_activity	-32.30***	29.24***	-30.10***	27.28***
	(7.256)	(5.116)	(7.210)	(5.060)

L.equity_ratio	37.49***	-8.780***	37.71***	-8.952***
	(1.923)	(0.943)	(1.899)	(0.928)
L.curr_deposits_over_liab	-1.440***	0.682***	-1.546***	0.732***
	(0.287)	(0.204)	(0.287)	(0.202)
L.size_over_gdp	-0.118	0.229	-0.179	0.334
	(0.342)	(0.245)	(0.342)	(0.243)
L.director_ratio_sq			166.2**	-83.64*
			(64.56)	(45.65)
L.director_ratio_cu			-79.61***	43.83**
			(29.79)	(21.07)
Constant	-1.937**	0.868	23.07**	-8.864
	(0.846)	(0.595)	(10.86)	(7.682)
Observations	303	311	303	311
R-squared	0.750	0.527	0.757	0.547
F statistic	27.4	10.4	26.3	10.5
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999

Year dummies included but not shown
Clustered errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero.

Table B.4 First Stage Regression for Table 6.5

	For Model 1		For Model 2	
	loan_ impairments	return_on_ assets	loan_ impairments	return_on_ assets
L.board_size	0.0975***	-0.00705	0.0883***	0.00762
	(0.0312)	(0.0209)	(0.0306)	(0.0207)
L.director_ratio	-109.7**	47.03	-1.062	0.0234
	(47.61)	(31.85)	(0.876)	(0.584)
L.director_ratio_sq	159.1**	-77.20*		
	(66.49)	(44.47)		
L.director_ratio_cu	-76.27**	40.79**		
	(30.65)	(20.50)		
L.low_ned	-3.167***	0.623	-2.246***	0.555
	(0.847)	(0.567)	(0.609)	(0.411)
L.cumul_gov	-0.170	-0.140	-0.191	-0.0720
	(0.374)	(0.251)	(0.374)	(0.253)
L.cro_or_chair	-0.359	1.386***	-0.237	1.174***
	(0.591)	(0.398)	(0.586)	(0.397)
L.female_ratio	0.849	-1.092*	0.801	-0.868
	(0.965)	(0.642)	(0.965)	(0.646)
L.no_exp_ratio	-0.0640	0.580*	-0.0221	0.530*
	(0.467)	(0.311)	(0.470)	(0.315)
L.growth_total_assets	-0.00142	0.000133	-0.00203	0.000578
	(0.00313)	(0.00211)	(0.00315)	(0.00214)
L.loan_interest_income	-0.0454***	0.000975	-0.0440***	-0.000258
	(0.00583)	(0.00338)	(0.00586)	(0.00342)
L.state_majority_owner	-0.815*	-0.352	-1.185***	0.0667
	(0.425)	(0.285)	(0.386)	(0.261)
L.mutual_ownership	-0.378	-0.431*	-0.464	-0.387
	(0.360)	(0.240)	(0.361)	(0.243)
L.foreign_parent	-0.182	-0.567**	-0.213	-0.525**
	(0.376)	(0.252)	(0.379)	(0.256)
L.rem_co	0.939***	-0.281	0.874***	-0.200
	(0.301)	(0.202)	(0.302)	(0.204)
L.exec_rem_disclosed	-0.143	0.0466	-0.0943	-0.0143
	(0.217)	(0.144)	(0.217)	(0.145)
L.average_pay	-1.158	0.415	-1.937*	1.225*
	(1.111)	(0.743)	(1.060)	(0.715)
L.irb_permission	-0.0523	-0.250	-0.0447	-0.264
	(0.295)	(0.198)	(0.298)	(0.201)
L.exposure_to_banks	4.617***	-1.427***	4.449***	-1.174**
	(0.748)	(0.496)	(0.745)	(0.497)
L.securities_holdings	2.234***	-0.773	2.397***	-0.845
	(0.796)	(0.529)	(0.801)	(0.537)

L.advisory_activity	-29.70***	26.94***	-32.48***	29.21***
	(7.578)	(5.026)	(7.569)	(5.060)
L.equity_ratio	37.64***	-8.927***	37.52***	-8.779***
	(2.002)	(0.926)	(2.021)	(0.941)
L.current_dep_over_liabs	-1.546***	0.734***	-1.438***	0.682***
	(0.303)	(0.202)	(0.303)	(0.203)
L.size_over_gdp	-0.191	0.344	-0.113	0.230
	(0.361)	(0.242)	(0.359)	(0.243)
Constant	22.81**	-9.106	-1.377	-0.172
	(11.33)	(7.582)	(1.093)	(0.730)
Observations	303	311	303	311
R-squared	0.757	0.546	0.750	0.527
F statistic	27.1	10.8	28.3	10.8
Pr > F	<0.001	<0.001	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999	>0.999	>0.999

Year dummies included but not shown
Clustered errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero.

Table B.5 First Stage Regression for Table 6.10

VARIABLES	For Model 1 loan_ impairments	 return_on_ assets
L.growth_total_assets	-0.0160***	0.00468**
	(0.00425)	(0.00216)
L.loan_interest_income	-0.0377***	0.00529
	(0.00813)	(0.00331)
L.state_majority_owner	-1.225**	0.0891
	(0.541)	(0.272)
L.mutual_ownership	-1.396***	-0.203
	(0.497)	(0.252)
L.foreign_parent	-1.169**	-0.290
	(0.508)	(0.259)
L.board_size	0.0882**	0.0122
	(0.0441)	(0.0226)
L.director_ratio	1.331	-0.591
	(1.086)	(0.550)
L.rem_co	0.896**	-0.153
	(0.416)	(0.212)
L.exec_rem_disclosed	-0.219	-0.0568
	(0.299)	(0.151)
L.average_pay	-0.493	0.383
	(1.124)	(0.572)
L.joint_ceo_chairman	0.0680	-0.946***
	(0.603)	(0.309)
L.cro_present_onboard	0.0402	-0.133
	(0.498)	(0.255)
L.comm_dir_board	0.0154	-0.0543
	(0.215)	(0.110)
L.female_ratio	-0.0789	-0.718
	(1.315)	(0.666)
L.no_exp_ratio	-0.0424	0.430
	(0.635)	(0.321)
L.irb_permission	0.254	-0.561*
	(0.663)	(0.339)
L.big_and_irb	-0.689	0.446
	(0.834)	(0.427)
L.exposure_to_banks	2.417**	-0.741
	(0.998)	(0.497)
L.advisory_activity	-24.37**	30.30***
	(10.41)	(5.252)
L.equity_ratio	20.69***	-7.656***
	(2.420)	(0.810)

L.current_deposits_over_liabs	-1.323***	0.775***
	(0.418)	(0.212)
L.size_over_gdp	-0.236	0.0946
	(0.509)	(0.260)
Constant	-1.272	0.749
	(1.120)	(0.580)
Observations	306	316
R-squared	0.508	0.540
F statistic	9.8	11.6
Pr > F	<0.001	<0.001
Pr > F endo reg	>0.999	>0.999

Year dummies included but not shown
Clustered errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Pr>F is the probability of obtaining an F at least as large as was obtained under the null hypothesis that the regression coefficients are all zero. Pr>F endo reg is the probability of obtaining an F statistic at least as large as was obtained in an auxiliary regression of residuals on regressors (a test for endogeneity) under the null hypothesis that the auxiliary regression coefficients are all zero.

References

Acrey, J.C., McCumber, W.R., Nguyen, T.H., 2011. CEO incentives and bank risk. *Journal of Economics and Business* 63, 456-471.

Admati, A. and Hellwig, M., 2014. *The bankers' new clothes: What went wrong with banking and what to do about it*. Princeton University Press.

Aebi, V, Sabato, G, Schmid, M, 2012. Risk management, corporate governance and bank performance in the financial crisis. *Journal of Banking and Finance* 36, 3213-3226.

Aikman, D., Galesic, M., Girerenzer, G., Kapida, K, Katsikopoulos, K., Kothiyal, A., Murphy, E., and Neuman, T., 2014. Taking uncertainty seriously: simplicity versus complexity in financial regulation, *Bank of England Financial Stability Paper* No. 28.

Akerlof, G.A., 1970. The market for 'lemons': quality uncertainty and the market mechanism. *Quarterly Journal of Economics* 84(3), 488–500.

Akerlof, G.A. and Yellen, J., 1987. *Efficiency Wage Models of the Labour Market*. Cambridge University Press.

Allen, F, and Gale, D, 1997. Bubbles and crises. Wharton school working paper.

Allen, F, and Gale, D, 1998. Optimal financial crises. *Journal of Finance* Vol. LIII, No. 4, 1245-1283.

Allen, F, and Gale, D, 2000. Financial contagion. *Journal of Political Economy* 108, 1-33.

Allen, F, and Gale, D, 2004. Financial fragility, liquidity and asset prices. Wharton school working paper.

Allen, F. and Gale, D., 2007. *Understanding Financial Crises*, Oxford University Press.

Allen, F, and Morris, S, 1998. Financial applications of game theory. Wharton school working paper.

Allen, L. and Jagtiani, J., 2000. The risk effects of combining banking, securities and insurance activities. *Journal of Economics and Business* 52(6), 485-497.

Al-Tamimi, H.A.H., Jellali, N, 2013. The effects of ownership structure and competition on risk-taking behaviour: evidence from UAE conventional and Islamic banks. *International Journal of Business and Finance Research* 7, 115-124.

Amadou-Barry, T, Lepetit, L, Tarzai, A, 2010. Ownership structure and risk in publicly held and privately owned banks. *Journal of Banking and Finance* 35, 1327-1340.

Anderson, R.C., Fraser, D.R., 2000. Corporate control, bank risk taking and the health of the banking industry. *Journal of Banking and Finance* 24, 1383-1398.

Anginer, D., Demirguc-Kunt, A., Huizinga, H., Ma, K., 2014. Corporate governance and bank insolvency risk. *World Bank Policy Research Working Paper* 7017.

Anginer, D., Demirguc-Kunt, A., Huizinga, H., Ma, K., 2016. Corporate governance and bank capitalisation strategies. *Journal of Financial Intermediation* 26, 1-27.

Angkinand, A, Wihlborg, C, 2010. Deposit insurance coverage, ownership and banks' risk-taking in emerging markets. *Journal of International Money and Finance* 29, 252-274.

Ashraf, T, 2008. Empowering people through information: A case study of India's Right to Information Act. *International Library and Information Review* 40(3), pages 148-152.

Atrill, P., and McLaney, E., 2006. *Accounting and Finance for Non-Specialists*. Prentice Hall.

Auvray, T, and Brossard, O, 2012. Too Dispersed to Monitor? Ownership Dispersion, Monitoring and the Prediction of Bank Distress. *Journal of Money, Credit and Banking* 44, 685-714.

Baele, L., De Jonghe, O., Vennet, R.V., 2007. Does the stock market value bank diversification? *Journal of Banking & Finance* 31(7), 1999-2023.

Bai, G, Elyasiani, E, 2012. Bank stability and managerial compensation. *Journal of Banking and Finance* 37, 799-813.

Banca D'Italia Financial Stability Report No. 1, April 2016.

Bank for International Settlements, 1988. *International Convergence of Capital Measurement and Capital Standards.*

Bank for International Settlements, 2006. *Basel II: International Convergence of Capital Measurement and Capital Standards – Comprehensive Version.*

Bank for International Settlements, 2009. *Basel III: International Regulatory Framework for Banks.*

Bank for International Settlements, 2013. *Global systemically important banks: updated assessment methodology and the higher loss absorbency equivalent.*

Bebczuk, R.N., 2003. *Asymmetric Information in Financial Markets: Introduction and Applications*, Cambridge University Press, 170 pp.

Beccalli, E., Anolli, M. and Borello, G., 2015. Are European banks too big? Evidence on economies of scale. *Journal of Banking & Finance* 58, 232-246.

Bernanke, B.S., 1983. Nonmonetary effects of the financial crisis in the propagation of the great depression. *American Economic Review* 73, 257-276.

Bhagat, S., Bolton, B., and Lu, J., 2015. Size, leverage, and risk-taking of financial institutions. *Journal of Banking & Finance* 59, Pages 520-537.

Bhaumik, S.K., Piesse, J, 2006. Does lending behaviour of banks in emerging markets vary by ownership? Evidence from the Indian Banking Sector. *Economic Systems* 32 177-196.

Bircher, U. and Butler, M., 2007. *Information Economics*, Routledge, 488 pp.

Boot, W.A., 2011. Banking at the crossroads: How to deal with marketability and complexity? *Review of Development Finance* 1(3), 167-183.

Boubakri, N, Cosset, J.C., Fischer, K, Guedhami, O, 2005. Privatisation and bank performance in developing countries. *Journal of Banking and Finance* 29, 2015-2041.

Brandao Marques, L., Oppers, S., Araújo Ribeiro, I., Asai, K., Beauchamp, J., Deb, P., Duma, N., Ehrentraud, J., Khadarina, O., Khan, A., Pancorbo, A., Pazarbaşiogˇlu, C., Singh, R., Wuensch, O., Hong, H., Poonam, K., 2014. Risk-taking by banks: the role of governance and executive pay. *International Monetary Fund Financial Stability Report*, October 2014, Chapter 3.

Brewer, E., 1989. Relationship between bank holding company risk and nonbank activity. *Journal of Economics and Business* 41(4), 337-353.

Brookfield, D. and Ormrod, P., 2000. Executive stock options: volatility, managerial decisions and agency costs. *Journal of Multinational Financial Management* 10(3-4), 275–295.

Bryant, J, 1980. A model of reserves, bank runs and deposit insurance. *Journal of Banking and Finance* 4, 335-344.

Calvo, G.A., 2009. Financial crises and liquidity shocks: a bank-run perspective. National Bureau of Economic Research working paper.

Carter, M.E., Li, L., Marcus, A.J. and Tehranian, H., 2016. Excess pay and deficient performance. *Review of Financial Economics* in press corrected proof.

Casu, B., Girardone, C. and Molyneux, P., 2006. *Introduction to Banking*. Prentice Hall.

Cathcart, L., El-Jahel, L. and Jabbour, R., 2015. Can regulators allow banks to set their own capital ratios? *Journal of Banking and Finance* 53, 112-123.

Chari, V.V. and Jagannathan, R, 1988. Banking panics, information and rational expectations equilibrium. Federal Reserve Bank Research Department working paper.

Charofas, D.N., 2004. Chapter 11: IRB, technological infrastructure, models and correlations. *Economic Capital Allocation with Basel II*. Elesvier.

Chen, S.H., Liao, C.C., 2011. Are foreign banks more profitable than domestic banks? Home- and host-country effects of banking market structure, governance and supervision. *Journal of Banking and Finance* 35, 819-839.

Chen, Y., Rhee S.G., Veeraraghavan, M. and Zolotoy, L., 2015. Stock liquidity and managerial short-termism. *Journal of Banking and Finance* 60, 44-59.

Chisholm AM; *An Introduction to International Capital Markets: Products, Strategies, Participants*; Wiley 2009.

Churm, R., Raida, A., Leake, J. Srinivasan, S., and Whisker, R., 2012. The funding for lending scheme. *Bank of England Quarterly Bulletin* Q4 2012.

Chun, S.E., Nagano, M, Lee, M.H., 2010. Ownership structure and risk-taking behaviour: evidence from banks in Korea and Japan. *Asian Economic Journal* 25 151-175.

Claessens, S., Pozsar, Z., Ratnovski, L. and Singh, M., 2012. International Monetary Fund Staff Discussion Note.

Cooper, E.W., 2009. Monitoring and governance of private banks. *The Quarterly Review of Economics and Finance* 49(2), 253-264.

Cornett, M.M., Guo, L, Khaksari, S, Tehranian, H, 2010. The impact of state ownership on performance differences in privately-owned versus state-owned banks: an international comparison. *Journal of Financial Intermediation* 19, 74-94.

Cornett, M.M., McNutt, J.J, and Tehranian, H., 2009. Corporate governance and earnings management at large U.S. bank holding companies. *Journal of Corporate Finance* 15(4), 412-430.

Davies R and Davies G; *A History of Money from Ancient Times to the Present Day*; University of Wales Press; 1996.

Dey, A., Engel, E. and Liu, X, 2011. CEO and board chair roles: To split or not to split? Journal of Corporate Finance 17(5), Pages 1595-1618.

Diamond, D.W. and Dybvig, P.H., 1983. Bank runs, deposit insurance and liquidity. *Journal of Political Economy* 91 401-419.

Dong, Y., Meng, C., Firth, M., and Hou, W., 2014. Ownership structure and risk-taking: Comparative evidence from private and state-controlled banks in China. *International Review of Financial Analysis* 36, 120-130.

Eastburn, R.W. and Boland R.J. Jr., 2015. Inside banks' information and control systems: Post-decision surprise and corporate disruption. *Information and Organization* 25(3), Pages 160-190.

Edwards, F.R. and Mishkin, F.S., 1995. The decline of traditional banking: implications for financial stability and regulatory policy. *Federal Reserve Bank of New York Economic Policy Review*, July 1995.

Efing, M., Hau, H., Kampkötter, P. and Steinbrecher, J., 2015. Incentive pay and bank risk-taking: Evidence from Austrian, German, and Swiss banks. *Journal of International Economics* 96, Supplement 1, S123-S140.

Elyasiani, E. and Jia, J.J., 2008. Institutional ownership stability and BHC performance. *Journal of Banking & Finance* 32(9), 1767-1781.

Elyasiani, E. and Zhang, L., 2015. Bank holding company performance, risk, and “busy” board of directors. *Journal of Banking & Finance* 60, 239-251.

Esteban, J., Stiglitz, J., Lin Yifu, J., 2013. *The Industrial Policy Revolution I: The Role of Government Beyond Ideology*. Palgrave.

European Parliament and Council, 2014. Directive 2014/56/EU. *Official Journal of the European Union* 16 April 2014.

Fahlenbrach, R, Stulz, R.M., 2011. *Journal of Financial Economics* 99, 11-26.

Fama, E.F., 1980. Agency problems and the theory of the firm. *Journal of Political Economy* 88, 288–307.

Fama, E.F., Jensen, M.C., 1983a. Agency problems and residual claims. *Journal of Law and Economics* 26, 327-349.

Fama, E.F., Jensen, M.C., 1983b. Separation of ownership and control. *Journal of Law and Economics* 26, 301-325.

Fang, Y. and van Lelyveld, I., 2014. Geographic diversification in banking. *Journal of Financial Stability* 15, 172-181.

Fernandez, A.I., Gonzalez, F, and Suarez, N, 2013. The real effect of banking crises: finance or asset allocation effects? Some international evidence. *Journal of Banking and Finance* 37, 2419-2433.

Fehr, E. and Goette, L., 2005. Robustness and real consequences of nominal wage rigidity. *Journal of Monetary Economics* 52(4), Pages 779-804.

Ferri, G. and Pesic, V., 2016. Bank regulatory arbitrage via risk weighted assets dispersion. *Journal of Financial Stability*, In Press, Corrected Proof, Available online 21 October 2016.

Financial Conduct Authority Glossary; extracts made 7th June 2016.

Financial Conduct Authority Handbook, Prudential Standards.

Financial Conduct Authority Handbook, Approved Persons Sourcebook.

Financial Conduct Authority Handbook, Systems and Controls Sourcebook, Chapter 19.

Financial Services Authority, 2011. The Failure of the Royal Bank of Scotland. *Financial Services Authority Board Report*.

Flabbi, L. and Ichino, A., 2001. Productivity, seniority and wages: new evidence from personnel data. *Labour Economics* 8(3), Pages 359-387.

Forssbaeck, J, 2011. Ownership structure, market discipline and banks' risk-taking incentives under deposit insurance. *Journal of Banking and Finance* 35, 2666-2678.

Frexias, X. and Rochet, J.C., 2008. *Microeconomics of Banking*, MIT Press.

Gai, P, Haldane, A. and Kapadia, S., 2011. Complexity, concentration and contagion. *Journal of Monetary Economics* 58(5), 453-470.

Gauch, H., 2012. *Scientific Method in Brief*. Cambridge University Press.

Ghosh, A., 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. *Journal of Financial Stability* 20, 93-104.

Glimcher, P., and Fehr, E., 2013. *Neuroeconomics: Decision Making and the Brain*. Academic Press.

Goh, L. and Gupta, A., 2015. Remuneration of non-executive directors: Evidence from the UK. *British Accounting Review*, In Press, Corrected Proof.

Gonzales-Garcia, J., and Grigoli, F., 2013. State-owned banks and fiscal discipline. *IMF Working Paper*.

Gorton, G, 2012. *Misunderstanding Financial Crises: Why We Don't See Them Coming*. Oxford University Press USA, 2012, pp240.

Greene, WH; *Econometric Analysis*; Pearson, 2012.

Grossman, S. J., Hart, O.D., 1980. Takeover Bids, the Free-Rider Problem and the Theory of the Corporation. *Bell Journal of Economics* 11, 42–64.

Gu, C, 2010. Herding and Bank Runs. University of Missouri working paper.

Guadano, J.F., 2009. Analysis of the economic differences between capitalist and labour-owned enterprises. *International Journal of Social Economics* 36(6), 679-691.

Gupta, C., 2014. The co-operative model as a 'living experiment in democracy'. *Journal of Co-operative Organization and Management* 2(2), 98-107.

Hagendorff, J, Vallascas, F, 2011. CEO pay incentives and risk-taking: evindence from bank acquisitions. *Journal of Corporate Finance* 17, 1078-1095.

Hakenes, H. and Schnabel, I., 2011. Bank size and risk-taking under Basel II. *Journal of Banking & Finance* 35(6), 1436-1449.

Haldane, A.G., 2013. Constraining discretion in bank regulation. *Bank of England speech to the Federal Reserve Bank of Atlanta Conference on Maintaining Financial Stability*.

Haltenhof, S., Lee, S.J. and Stebunovs, V., 2014. The credit crunch and the fall in employment during the Great Recession. J*ournal of Economic Dynamics and Control* 43, 31-57.

Hanousek, J., Kocenda, E. and Maskia, M., 2012. Firm efficiency: Domestic owners, coalitions and FDI. *Economic Systems* 36(4), 471-486.

Hanousek, J., Kocenda, E. and Shamshur, A., 2015. Corporate efficiency in Europe. *Journal of Corporate Finance* 32, 24-40.

Havrylchyk, O, Jurzyk, E, 2011. Inherited or earned? Performance of foreign banks in central and eastern Europe. *Journal of Banking and Finance* 35, 1291-1302.

Hoitash, R., Hoitash, U. and Kurt, A., 2016. Do accountants make better chief financial officers? *Journal of Accounting and Economics* 61(2), 414-432.

Hossain, M, Panjak P.K., Mitra, S, 2010. State ownership and bank equity in the Asia-Pacific region. *Pacific-Basin Finance Journal* 21, 914-931.

Huang, Y.S. and Wang, C.J., 2015. Corporate governance and risk-taking of Chinese firms: The role of board size. *International Review of Economics & Finance* 37, Pages 96-113.

Hughes, J.P. and Mester, L.J., 2013. Who said large banks don't experience scale economies? Evidence from a risk-return-driven cost function. *Journal of Financial Intermediation* 22(4), 559-585.

Hughes, J.P., Mester, L.J. and Moon, C.G., 2001. Are scale economies in banking elusive or illusive?: Evidence obtained by incorporating capital structure and risk-taking into models of bank production. *Journal of Banking & Finance* 25(12), 2169-2208.

Hume, D., 1748. *An Enquiry Concerning Human Understanding*.

Iannotta, G, Nocera, G, Sironi, A, 2007. Ownership structure, risk and performance in the European banking industry. *Journal of Banking and Finance* 31, 2127-2149.

Iannotta, G, Nocera, G, Sironi, A, 2012. The impact of government ownership on bank risk. *Journal of Financial Intermediation* 22, 152-176.

International Accounting Standards Board, 2015. International Financial Reporting Standards IFRS 2016 (Blue Book) Consolidated without early application.

International Monetary Fund Financial Stability Reports and associated data releases, April 2011, April 2013 and November 2016.

Jacklin, C.J. and Bhattacharya, S, 1988. Distinguishing panics and information-based bank runs: welfare and policy implications. *Journal of Political Economy* 96, 568-592.

Jensen, M.C., Meckling, W., 1976. Theory of the firm: managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics* 3, 305–360.

Jones C; *Financial Economics*; Routledge; 2008.

Kahneman, D., Knetsch, J. and Thaler, R., 1986. Fairness as a constraint on profit seeking: entitlements in the market. *American Economic Review* 76(4), 728-741.

Karas, A, Schoors, K, Weill, L, 2010. Are private banks more efficient than public banks: evidence from Russia. *Economics of Transition* 18, 209-244.

Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. *American Economic Review* 80, 1183–1200.

Kim, K.A., Lee S.H., Rhee, S.G., 2007. Large shareholder monitoring and regulation: the Japanese banking experience. *Journal of Economics and Business* 59, 466-486.

Kindleberger CP and Aliber RZ; *Manias, Panics and Crashes: A History of Financial Crises*; Palgrave Macmillan; 2011.

King, M.R., 2013. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking and Finance* 37(11), 4144-4156.

Kiss, H.J., 2010. A Diamond-Dybvig model without a bank run: the power of signalling. Universidad Autonoma de Madrid working paper.

Kobayakawa, S., and Nakamura, H., 2000. A theoretical analysis of narrow banking proposals. *Monetary and Economic Studies*.

Köhler, M., 2014. Does non-interest income make banks more risky? Retail- versus investment-oriented banks. *Review of Financial Economics* 23(4), 182-193.

Konishi, M, Yasuda, Y, 2004. Factors affecting bank risk taking: Evidence from Japan. *Journal of Banking and Finance* 28, 215-232.

Laeven, L, Levine, R, 2009. Bank governance, regulation and risk taking. *Journal of Financial Economics* 93, 259-275.

Laeven, L., Ratnovski, L. and Tong, H., 2015. Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance*, In Press, Corrected Proof.

Lee, S.W., 2008. Ownership structure, regulation and bank risk-taking: evidence from Korean banking industry. *Investment Management and Financial Innovations* 5, 70-74.

Lensink, R., Meersters, A., and Naaborg, I., 2008. Bank efficiency and foreign ownership: Do good institutions matter? *Journal of Banking and Finance* 32(5), 834-844.

Liang, D., Lu, C., Tsai, C., and Shih, G., 2016. Financial ratios and corporate governance indicators in bankruptcy prediction: A comprehensive study. *European Journal of Operational Research* 252(2), 561-572.

Liang, Q., Xu, P. and Jiraporn, P., 2013. Board characteristics and Chinese bank performance. *Journal of Banking and Finance* 37(8), Pages 2953-2968.

Lin, Z., Song, B.Y., and Tian, Z., 2016. Does director-level reputation matter? Evidence from bank loan contracting. *Journal of Banking and Finance*, in press, corrected proof.

Lin, J.Y., Sun, X. and Wu, H.X., 2015. Banking structure and industrial growth: Evidence from China. *Journal of Banking and Finance* 58, Pages 131-143.

Lo, A.W., 2011. Complexity, concentration and contagion: A comment. *Journal of Monetary Economics* 58(5), Pages 471–479.

Lucas, R., 1976. Econometric policy evaluation: a critique. In *The Phillips Curve and Labor Markets*. Carnegie-Rochester Conference Series on Public Policy 1, 19-46. American Elsevier.

Magri, S., and Pico, R., 2011. The rise of risk-based pricing of mortgage interest rates in Italy. *Journal of Banking and Finance* 35(5), 1277-1290.

Mallin, C., Melis, A. and Gaia, S., 2015. The remuneration of independent directors in the UK and Italy: An empirical analysis based on agency theory. *International Business Review* 24(2), Pages 175-186.

Malimender, U. and Tate, G., 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89(1), 20-43.

Markman, G.M. and Venzin, M., 2014. Resilience: Lessons from banks that have braved the economic crisis—and from those that have not. *International Business Review* 23(6), 1096-1107.

Markowitz, H., 1952. Portfolio selection. *Journal of Finance* 7(1), 77-91.

Mehran, H., Morrison, A., Shapiro, J., 2011. Corporate governance and banks: what have we learned from the financial crisis? *Federal Reserve Bank of New York Staff Report* No. 502.

Mercieca, S., Schaeck, K., Wolfe, S., 2007. Small European banks: Benefits from diversification? *Journal of Banking & Finance* 31(7), 1975-1998.

Mergaerts, F. and Vennet, R.V., 2016. Business models and bank performance: A long-term perspective. *Journal of Financial Stability* 22, 57-75.

Merton, R. C., 1977. Analytic derivation of the cost of deposit insurance and loan guarantees. *Journal of Banking and Finance* 1, 3–11.

Meslier, C., Tacneng, R. and Tarazi, A., 2014. Is bank income diversification beneficial? Evidence from an emerging economy. *Journal of International Financial Markets, Institutions and Money* 31, 97-126.

Mishkin, F., 2012. *The Economics of Money, Banking and Financial Markets*. Pearson.

Mishra, R.K. and Jhunjhunwala, S., 2013. Chapter 2: Women on Boards. *Diversity and the Effective Corporate Board*. Elesvier.

Mittnik, S. and Semmler, W., 2013. The real consequences of financial stress. *Journal of Economic Dynamics and Control* 37(8), 1479-1499.

Moenninghoff, S.C., Ongena, S. and Wieandt, A., 2015. The perennial challenge to counter Too-Big-to-Fail in banking: Empirical evidence from the new international regulation dealing with Global Systemically Important Banks. *Journal of Banking and Finance* 61, Pages 221-236.

Morris, G.D., McKay, S., Oates, A., 2009. Chapter 6: Corporate Governance. *Finance Director's Handbook*, Pages 267-344.

Noss, J. and Toffano, P., 2016. Estimating the impact of changes in aggrenage bank capital requirements on lending and growth during an upswing. *Journal of Banking and Finance* 62, 15-17.

Oliver Wyman, 2014. European Retail and SME Credit.

Oludare, S., Olagunju, M. and Adelodun, O., 2013. Stock market volatility and non-performing loans: evidence from stocks of the Nigerian banks. *African Finance Journal* 15, 82-104.

Ozcan S.K., Sorensen B. and Yesiltas, S., 2012. Leverage across firms, banks and countries. *Journal of International Economics* 88(2), 284-298.

Pack, H., and Saggi, K., 2006. The case for industrial policy: a critical survey. *World Bank Policy Research Working Paper* 3839.

Pathan, S, 2009. Strong boards, CEO power and bank risk-taking. *Journal of Banking and Finance* 33, 1340-1350.

Pennathur, A.K., Subrahmanyam, V, Vishwasrao, S, 2012. Income diversification and risk: Does ownership matter? An empirical examination of Indian banks. *Journal of Banking and Finance* 36, 2203-2215.

Postlewaite, A, and Vives, X, 1987. Bank runs as an equilibrium phenomenon. *Journal of Political Economy* 95, 485-491.

Prudential Regulation Authority, Annual Report and Accounts, 2014.

Radowski, D. and Bonin, H., 2010. Downward nominal wage rigidity in services: Direct evidence from a firm survey. *Economics Letters* 106(3), Pages 227-229.

Rasmussen, E., 1988. Mutual banks and stock banks. *Journal of Law and Economics*, 31, 395–421.

Reinhart CM and Rogoff K; *This Time is Different: Eight Centuries of Financial Folly*; Princeton University Press; 2009.

Renneborg, L., and Zhao, Y., 2011. Us knows us in the UK: On director networks and CEO compensation. *Journal of Corporate Finance* 17(4), Pages 1132-1157.

Riewsathirathoran, P, Jumroenvong, S, Jiraporn, P., 2011. University of Pennsylvania Working Paper.

Robert Walters Salary Survey 2016.

Rochet, J.C. and Vives, X, 2004. Coordination failures and the lender of last resort: was Bagehot right after all? *Journal of the European Economic Association* 2, 1116-1147.

Rodrik, D., 2007. *One economics many recipes*. Princeton.

Romer, D, 2006. *Advanced macroeconomics*. McGraw-Hill.

Rus, D., Van Knippenberg, D., and Wisse, B., 2012. Leader power and self-serving behavior: The Moderating Role of Accountability. *The Leadership Quarterly* 23(1), Pages 13-26.

Ruthenberg, D. and Landskroner, Y., 2008. Loan pricing under Basel II in an imperfectly competitive banking market. *Journal of Banking and Finance* 32(12), 2725-2733.

Sapienza, P., Zingales, L. and Maestripieri, D., 2008. Gender differences in financial risk aversion and career choices are affected by testosterone. *Proceedings of the National Academy of Sciences* 106(36), 15268–15273.

Schooner, H., and Taylor, M., 2009. *Global Bank Regulation: Principles and Policies*. Academic Press.

Shannon, C.E., 1948. A mathematical theory of communication. *Bell System Technical Journal* 27, 379–423 & 623–656.

Shiers, A.F., 2002. Branch banking, economic diversity and bank risk. *Quarterly Review of Economics and Finance* 42(3), 587-598.

Shleifer, A., Vishny, R.W., 1986. Large Shareholders and Corporate Control. *Journal of Political Economy* 94, 461–88.

Shleifer, A., Vishny, R.W., 1997. A survey of corporate governance. *Journal of Finance* 52, 737–783.

Siegel, S., and Castellan, N.J., 1988. *Nonparametric Statistics for the Behavioural Sciences*. McGraw-Hill.

Šilingienė, V., Stukaitė, D. and Radvila G., 2015. The Remuneration Determinants of Chief Executive Officers: A Theoretical Approach. *Procedia – Social and Behavioral Sciences* 213(1) Pages 848-854.

Standard and Poor's, 2012. 2012 Annual Global Corporate Default Study and Rating Transitions.

Stiglitz, J. 2013. *The price of inequality*. Princeton.

Sullivan, R.J., Spong, K.R., 2007. Manager wealth concentration, ownership structure and risk in commercial banks. *Journal of Financial Intermediation* 16, 229-248.

Tian, S., Yang, Y. and Zhang, G., 2013. Bank capital, interbank contagion and bailout policy. *Journal of Banking and Finance* 37(8), 2765-2778.

Tokle, R.J., Fullerton, T.M. Jr. and Walke, A.G., 2015. Credit union loan rate determinants following the 2008 financial crisis. *The Social Science Journal* 52(3), 364-373.

Trinugroho, I. Agusman, A. and Tarzai, A., 2014. Why have bank interest margins been so high in Indonesia since the 1997/1998 financial crisis? *Research in International Business and Finance* 32, 139-158.

Uhde, A., 2015. Risk-taking incentives through excess variable compensation: Evidence from European banks. *Quarterly Review of Economics and Finance*, In Press, Corrected Proof.

UK Building Societies Act 1986 obtained from www.legislation.gov.uk on 17th July 2016.

UK Financial Reporting Council; UK Corporate Governance Code (formerly the Combined Code); 1998, 2010, 2012 and 2014.

Valencia, F., 2014. Monetary policy, bank leverage and financial stability. *Journal of Economic Dynamics and Control* 47, 20-38.

Varian, H., 2009. *Intermediate Microeconomics: A Modern Approach*. W. W. Norton & Company.

Wall, L.D., 1987. Has bank holding companies' diversification affected their risk of failure? *Journal of Economics and Business* 39(4), 313-326.

Wilkinson, N, 2008. *An Introduction to Behavioural Economics*. Palgrave-Macmillan.

Yang, T. and Zhao, S. 2014. CEO duality and firm performance: Evidence from an exogenous shock to the competitive environment. *Journal of Banking and Finance* 49, Pages 534-552.