Subordinated Debt and Market Discipline – Evidence from the UK Banking Industry

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ABSTRACT

This research empirically investigates how and to what extent bank subordinated debt plays a role in providing market discipline whereby the private sector is deployed to monitor and influence bank risk taking, hence complement government supervision and regulation of banks. The study comprises four essays on the use of subordinated debt as an instrument for creating direct and indirect market discipline, with specific reference to the case of the UK banking industry. Broadly, Chapters 2, 3 and 4 examine the effectiveness of subordinated debt as an instrument of direct market discipline; Chapter 5 approaches the issue of indirect market discipline.

First, we analyse whether the risk premiums or yield spreads of subordinated debt indicate banks' financial health. Our results show that yield spreads contain timely and accurate information on issuing banks' risk taking, and this underpins the proposals that advocate forcing large financial institutions to issue subordinated debt to the public on a regular basis. Then we examine whether the issued subordinated debt and its price have any impact on banks' performance. The results have positive signs, implying that the signalling and influencing effects of subordinated debt can induce banks to act prudently and restrain them from assuming unsound risk. However, the final chapter finds that the UK financial regulator, the Financial Services Authority (FSA) has little enthusiasm for utilizing the subordinated debt to indirectly discipline financial institutions. This reflects the FSA's doubt as to the usefulness of the market in providing disciplining effects. In contrast, the evidence documented in this research shows that the subordinated market proves to be sensitive to bank risk, and banks do respond to market information, hence it can be an effective mechanism for generating useful market discipline. In reforming the financial regulation regime, adding new regulations to the old is therefore not the best way forward. Rather, priority should be given to reforming the paradigm of financial regulation by allowing more room for the subordinated market to discipline the regulators to take more prompt and rigorous corrective actions.

Table of Contents

List of Tables

List of Figures

Author’s Declaration

I declare that no part of the material contained in this thesis has been previously submitted, either in whole or in part, for a degree at this or any other university.

X Sun

Statement of Copyright

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X Sun

Chapter 1 Introduction

1.1 Calls for Market Discipline

The dramatic growth of financial institutions' size and complexity over the last few decades has posted mounting challenges to the efficacy of financial regulation. Government discipline in the form of regulation has become less effective, since it is increasingly difficult for regulatory agencies to monitor and control banks' risk-taking activity through traditional supervisory means. Another fundamental challenge comes from policy design. There has been a global trend for governments, especially in developed countries, to install deposit insurance schemes. The basic intention of the program is to ensure the safety of the deposits made by the general public with banks, and hence increase public confidence in the financial system. However, while this insurance eliminates much of the risk to bankers, bank managers are also released from having strong incentives to avoid risky investments, and depositors have little incentive to monitor bank activities. The lack of market discipline thus contributes to moral hazard in the banking industry.

The recent global financial crisis highlights a critical dimension of moral hazard in banking. To contain contagion, governments in developed countries have engaged in large-scale financial bailouts for troubled banks. Such bailouts provide implicit guarantee for banks even if they behave badly, and reinforce the too-big-to-fail problem, while the costs involved are ultimately borne by the taxpayers. This encourages bank managers to act less prudently than they might otherwise, and so aggravates bank hazards.

The situation has called into question the conventional approach to financial regulation that relies solely on official effects, leading to the proposal to strengthen market discipline to complement traditional supervision and regulation (Bliss, 2001; Hamalainen et al., 2003). The growing calls for market discipline are echoed in a US Department of Treasury report which reveals that, in almost all policy discourse on financial reforms, an overarching theme is whether and how increased market discipline can supplement regulatory discipline to redress some of the moral hazard and efficiency problems in banking (US Department of the Treasury, 1991). In the UK, HM Treasury (2005) also claims that it will be beneficial to enhance the role of market mechanism in banking regulation, if sufficient care is given to the design and implementation of the process.

Among the calls to increase the role of market discipline in encouraging banks and other financial institutions to operate soundly and efficiently, the two most influential proposals are those put forward by the US Shadow Financial Regulatory Committee (2000) and the European Shadow Financial Regulatory Committee (1999, 2000). They have raised the profile of market discipline as a critical instrument for building an effective prudential framework. In the proposals, the mandatory subordinated debt policy is of particular importance. The Basel Committee on Banking Supervision (2001a, 2001b) further highlights the role of mandatory subordinated debt as an instrument for market discipline, while designating market

discipline as one of the three pillars underpinning prudential regulation.[1] While the notion of market discipline is intuitive, how its function can be activated is not well understood. One central proposition in the literature of market discipline in banking is that the use of subordinated debt could be an effective avenue. Issued by banks, subordinated debts are unsecured, uninsured, unsupported by a government safety net and in a subordinate position for repayment when the issuing bank defaults. On one hand, although subordinated debts are risky assets, and can offer higher returns than bank deposits, the implicit too-big-to-fail insurance provided by government means that big banks are virtually immune to default. This makes subordinated debt attractive to investors. On the other hand, in the case of default, subordinated debt holders have a lower priority in claiming bank assets and the debt is repayable only after other senior debt holders are paid in full. So, subordinated debt is risk-sensitive. This status makes subordinated debt a fitting tool for use to enhance market discipline in banking.

Early studies in the field show little evidence of subordinated debt being an effective means of market discipline. More recent research however finds stronger and positive indications in this regard. In addition to this inconclusiveness of the research on market discipline in banking and the role of subordinated debt therein, there is a dearth of inclusive research on the interaction between subordinated debt and the nexus of banks, investors and regulators, particularly under a financial

[1] The first two pillars focus on credit risk capital requirement and the future role of a national supervisor. The third pillar suggests that strengthening the role of market discipline has the potential to reinforce capital regulation and other supervisory effects to promote safety and soundness in banks and the financial system.

structure and institutional context that is different than that of the USA, where the proposal of using subordinated debt as an instrument for market discipline was first made popular.

1.2 Theory of Market Discipline

The meaning of market discipline has evolved gradually over the last few decades. Lane (1993) describes market discipline as a process whereby financial market participants produce value-relevant information able to restrain financial institutions' management behaviour. Flannery and Nikolova (2004) define market discipline as "a situation in which private sector agents – equity holders and debt holders – produce information that helps supervisors recognize problem situations and implement appropriate corrective measures".

The Board of Governors of the Federal Reserve System (1999) makes a distinction between direct and indirect market discipline. Direct market discipline is exerted when a firm's expected cost of issuing debt instruments increases substantially with an increase in its risk profile, and thus direct market discipline is the process whereby the expected cost of a bank's funds is a direct function of its risk profile. Given that investors can gather information about the firm's risks and prospects, and then incorporate that information into their decisions to buy the firm's debt, direct market discipline means that the anticipation of substantially higher funding costs should provide an incentive ex ante for the firm to refrain from excessive risk taking.

Indirect market discipline is the process whereby the yields of a bank's risk-sensitive sources of funds are used as a means for bank supervisors to improve their tasks of risk monitoring and controlling. This type of market discipline is exerted when private parties or government supervisors monitor secondary market prices of debt instruments to help determine the risk exposure (or default probability) of a bank. In response to perceived increases in bank risk, such parties could substantially increase the institution's cost of funds throughout the liability structure, limiting its supply of funding or reducing its ability to engage in certain types of contracts.

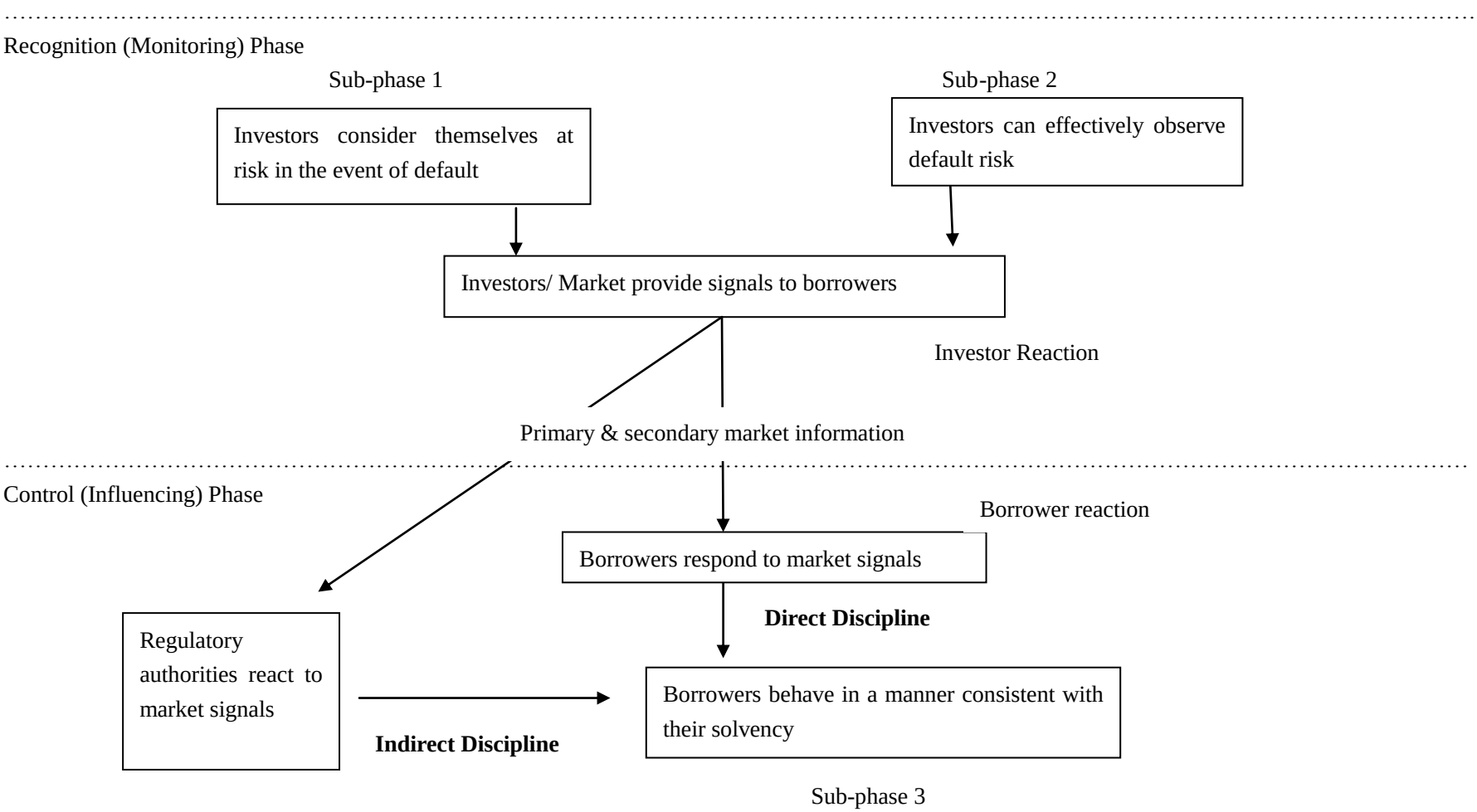
Flannery and Sorescu (1996) suggest that market discipline must satisfy a two-stage process: recognition and control. Supporting this two-stage process in a slightly different taxonomy, Bliss and Flannery (2001) and Bliss (2001, 2004) hold that market discipline involves two key functions: market monitoring and market influence. Market monitoring refers to the hypothesis that investors accurately understand changes in a firm's condition and incorporate those assessments promptly into the firm's security prices. Monitoring requires the market participants to have the incentives and ability to monitor the actions of the firm and its managers, and therefore monitoring generates the market signals to which managers care to respond. Monitoring is a necessary but not sufficient condition for market discipline (Bliss, 2004). For market discipline to be effective there must also be feedback from the monitors, which induces firm managers to adjust their behaviour. Bliss and Flannery (2001) call this "influence". As such, market influence is the process by which a security price change engenders firm responses to counteract adverse changes in firm

condition (Bliss, 2001).

Influence may come directly from market participants, as in the form of direct discipline. Alternatively it can come from other agents such as regulators, using the information provided by market monitoring to inform actions that influence managers' decisions, creating indirect market discipline. Figure 1.1 illustrates the recognition (monitor) and control (influence) phases.

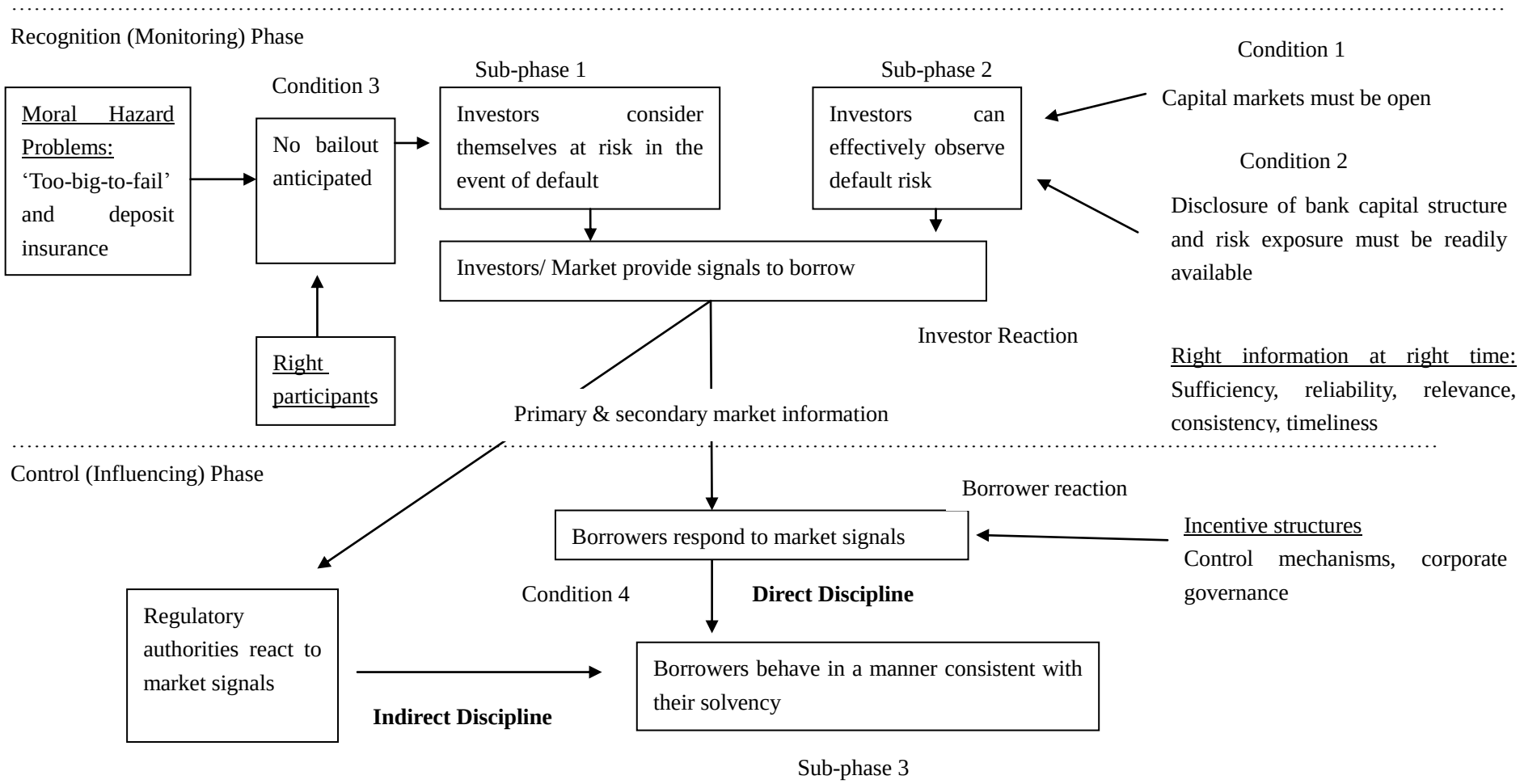
Figure 1.2 expands the theoretical framework of market discipline into the banking sector, and includes conditions necessary for the effective market discipline suggested by Lane (1993) and Hamalainen et al. (2003). To implement market discipline and satisfy these conditions, Rochet (2004a) suggests three types of instruments: imposing more transparency, changing the capital structure of banks and using market information.

Figure 1.1 Phases and Sub-phases of Effective Market Discipline



Source: Hamalainen, P., Hall, M., and Howcroft, B., 2003. *Market Discipline: A Theoretical Framework for Regulatory Policy Development.*

Figure 1.2 Conditions for Effective Market Discipline



Source: Hamalainen, P., Hall, M., and Howcroft, B., 2003. *Market Discipline: A Theoretical Framework for Regulatory Policy Development.*

1.3 Market Discipline and Subordinated Debt

1.3.1 Subordinated Debt: Basic Definition

Subordinated debt, also known as junior debt, is debt that has lower priority for repayment than other debt in the event of the issuer defaulting (Board of Governors of the Federal Reserve System, 1999). In the event of liquidation during bankruptcy, the order of claims for all securities is usually prioritized as follows. First are the liquidator and government tax authorities, followed by holders of general debt, subordinated debt, preference shares and ordinary shares. In the case where the liquidation involves a bank, subordinated debt-holders can claim only after depositors (Avery et al., 1988; Board of Governors of the Federal Reserve System, 1999).

The American Board of Governors of the Federal Reserve System (2000) defines subordinated debt issued by banks as "unsecured debt that has an original weighted average maturity of not less than five years; is subordinated as to payment of principal and interest to all other indebtedness of the bank, including deposits; is not held in whole or in part by any affiliate or institution-affiliated party of the insured depository institution or bank holding company". In 2000 the Federal Reserve and US Treasury Department jointly proposed a similar formal definition, according to which subordinated debt is: (1) unsecured debt with a maturity of five years or more; (2) subordinated in receiving default compensation to all other debts of the bank, including deposits; (3) not supported by any form of guarantee or credit facilities; (4) not held by any affiliates of the insured institution. The academic community largely follows this

official definition. For example, Maclachlan (2001a) defines subordinated debt (sub-debt) as a bank liability representing borrowing that, in the event of default, would be paid only after all other liabilities had been discharged.

While these definitions have their distinct emphases, they all commonly highlight two essential features of bank-issued subordinated debt: its lower priority in receiving compensation when the issuer falls into liquidation, and its status as non-insured debt. As such, Caldwell (2005) summarily calls subordinated debt "a fixed-income financial instrument that is both unsecured and junior (subordinated) to all other obligations of the bank".

1.3.2 Attractions of Subordinated Debt as a Means of Market Discipline

Because subordinated debt is repayable only after the senior debt holders are paid in full, and is not secured or insured by government as in the case of deposit insurance schemes, it is more risky for investors. But on the other hand, since it is issued by big banks and big banks rarely default, and because it pays better yields to compensate for the higher risk, it becomes attractive to investors. More importantly, however, for the interest of this research, it possesses several attractions that are very important to regulators.

In the current bank supervision and regulation system, market discipline has been given considerable attention. With banks becoming ever more large and complex, it is increasingly difficult for internal control to be fully effective. Therefore, bank

regulators need to control and monitor from outside, which leads regulators to resort to market discipline. The New Basel Accord, introduced in 2001, formally treats market discipline as the third pillar, and advocates increased transparency and disclosure (Ashcraft, 2006).

In regulators' global search for ways to enhance the role of market discipline in complementing official regulation of banks, subordinated debt has received increasing interest as a potentially effective instrument for market discipline (Avery, Belton and Goldberg, 1988; Caldwell, 2005). The legal status of subordinated debt in bank regulation was established as early as 1988, when the Basel Accord set up general international guidelines for regulating banks' capital. The Accord requires that the risk-weighted assets ratio of commercial banks must not be less than 8%. Capital of commercial banks includes core capital, such as ordinary shares, and supplementary capital, such as bank-issued long-term subordinated debt (Montgomery, 2005). This Accord effectively bestows a formal role for subordinated debt in bank regulation.

The first attraction of subordinated debt as an avenue for regulators to promote market discipline in banks comes from the fact that it is a relatively simple and time-saving issuing method, compared with issuing stocks (Montgomery, 2005; Wihlborg, 2005). This makes it a fast, sustainable way to supply capital funds, and hence regulators are able to let in market forces to influence bank behaviour through adjusting required capital ratio and the portion of subordinated debt therein. At present, more than one hundred countries have adopted the 1988 Basel Accord as their basic guideline for bank regulation. As a result, subordinated debt is well established as an

important source of banks' supplementary capital.

Since bank-issued subordinated debt has excellent liquidity, and investors do not need to consider complex factors in bond prices in secondary market transactions, it provides an additional method to discover a bank's true strength. The performance of subordinated debt in the secondary market thus functions as a barometer of a bank. In recent years, credit spread has become a powerful method to evaluate a bank's risk-taking ability and assets volatility (Krishnan, Ritchken and Thomson, 2003; Bianchi, Hancock and Kawano 2005; Evanoff and Wall 2001a). When the issuing bank has a higher default risk, subordinated debt creditors will demand a greater risk premium to compensate their potential loss. This is a form of direct market discipline. If the issuing bank is exposed to abnormal changes in the external environment or experiences failures in internal risk management and risk control, subordinated debt prices in the secondary market will change accordingly, indicating an increased possibility of default. To a great extent, this facilitates indirect market discipline since supervisors and market participants can use the price variation information to scrutinize the issuing bank's soundness.

Transactions of subordinated debt strengthen indirect market discipline upon issuing banks effectively. Benink and Benston (2005) claim that "an important advantage of requiring refinanced debt capital is that it creates a creditable form of market discipline, mitigating the incentives that banks might have to present to their supervisors' internal rating and VAR systems that underestimate credit and market risk". The secondary market price for subordinated debt has a relatively direct relation

to bank risk factors; for example, the price can be reduced by default risk (Caldwell 2005; Evanoff, Jagtiani and Nakata 2007). When there are no abnormal changes in the external environment, supervisory bodies and investors will judge risks of issuing banks through monitoring P/E ratio and yield of secondary market (Avery, Belton and Goldberg 1988). Hence, the issuing bank is held under the restraint of the market's continuous supervision, which will enhance its own risk management.

Subordinated debt holders can also benefit from their debt. Because subordinated debt is not insurable debt and involves more risk than ordinary deposits, debt holders can get higher interest rates as compensation. Moreover, subordinated debt holders can monitor issuing banks' risk taking and other financial situations. Subordinated debt has relatively long maturity. During this time, it is not easy for investors to withdraw their money. Therefore, at some level subordinated debt mitigates the issuer bank's system risk (Board of Governors of the Federal Reserve System, 1999).

Limitations

There are some limitations that prevent the wider use of sub-debt for market discipline. First of all, Basel II requires a minimum proportion of total assets for commercial banks and bank holding companies. If this requirement is not fulfilled, sub-debt may not be an effective tool for these banks. For now, the SND only takes less than 3% of the total assets of UK banks (FSA, 2010b). As a consequence, compared with using other market tools such as shares, using the debt as a popular instrument to facilitate bank regulation is relatively limited. Moreover, although sub-debt holders can monitor an issuing bank's risk taking and financial situation,

they must be sophisticated enough to interpret and analyse public and private information. Furthermore, the cost of collecting information is higher for sub-debt holders than for holders of other securities. Meanwhile, there is a potential moral hazard issue, generated from the deposit insurance, between the bank manager and the sub-debt holder. Lastly, the SND issuing cost is relatively higher than other financial products: therefore, most of the SND issued so far are from large banks.

1.3.3 The Subordinated Debt Market

Subordinated debt has been issued by many financial institutions and for various uses. Apart from its extensive use in structured finance, such as asset-backed securities, collateralized mortgage obligations, collateralized debt obligations or hybrid securities of monthly income preferred stock, subordinated debt has been most frequently used as a funding source for bank capital.

Every large bank in the US and many in other major countries make extensive use of subordinated debt as a capital instrument. Well-performing banks optimize their financial status through issuing subordinated debt, while other banks use this instrument to supply capital and improve their financial situations. In addition to this use as a capital instrument, subordinated debt is also a major tool of long-term financing. Some large banks issue subordinated debt not only for replenishing capital, but also for raising long-term funds.

The development of subordinated debt as a capital instrument has been greatly promoted by the changing bank supervision and regulation policy. One of the most

important impetuses is from the Basel Capital Accord (Basel Committee on Bank Supervision, 2003), which specifies that subordinated debt can be counted among a bank's capital if it satisfies certain requirements.[2] In the European market for example, subordinated debt issuance has been quite active since the Basel Capital Accord became fully effective in 1992. From 1993 to 1999, the dollar value of subordinated debt outstanding for major EU banks increased significantly, from $85.746 billion in 1993 to $239.948 billion in 1999. At the end of 1999, European banks represented the largest issuers of subordinated debt, taking almost fifty per cent of the total amount of bank-issued subordinated debt worldwide. European banks' country average of the ratio of subordinated debt to total assets (SND/TA) increased from 1.26% in 1996 to 1.65% in 1999 (Sironi, 2000).

The structure of the subordinated market can be understood by its period, interest rates and redemption. According to the global scope statistics of the Bank for International Settlements (2001), with regard to bond period, the subordinated debt market includes dated subordinated debt and perpetual subordinated debt. The period of the subordinated debt is generally from 2 to 30 years, with 10-year debt representing nearly 73% of the whole market amount. With regard to nominal interest rates, subordinated debt can be divided into fixed-interest-rate debt and floating-interest-rate debt, with the fixed-interest-rate type taking about 82.5% of the total. With regard to redemption, there are two kinds of subordinated debt: redeemable and non-redeemable. To reduce the cost of issuing long-term subordinated debt, banks

[2] These include: (1) its minimum original maturity should be at least five years; (2) the total amount of subordinated debt counted into the bank's capital should be up to 50 % of core capital; (3) the proportion of subordinated debt credits to capital should have a cumulative discount of 20% every year.

usually prefer redeemable provisions, and the standard form is redeemed during the last five years of a 10-year period.

The main issuers of subordinated debt are financial institutions, such as large banks and bank holding companies (BHC). Very few of the smaller banks issue subordinated debt, mainly because issuing costs are higher than for ordinary debts, and these costs will be a heavy financial burden for small banks. Small banks do not have complicated risk-taking capabilities, and a minor change in the price of subordinated debt can put them at great risk of default. Furthermore, small banks do not have sufficient assets to make benefits. In other words, even if a small bank issues subordinated debt, it does not receive such substantial benefits as do large banks and bank holding companies (Lang and Robertson, 2002).

Normally, when banks decide to issue subordinated debt, the issuing documents should include a clear definition of the nature of the debts, and issuers should establish the financial status in detail in standardized contract language, including the equity situation with other subordinated debt, priority to ordinary shares, the junior status of the debt, and priority of repayment in the case of default. Subordinated debt is more risky, hence issuing banks must disclose more information to protect investors. If involving retail investors, the disclosure standards will be even higher.

The most important currencies of issuance are the US dollar (39%) and the Euro and its predecessor currencies (38% of total value), followed by the GBP and the Japanese Yen at 10% each (Basel Committee on Bank Supervision, 2003). With regard to issuing instruments, the vast majority of subordinated debt issues have been

“plain vanilla” fixed rate notes (80%) (Basel Committee on Bank Supervision, 2003). In terms of marketing type, 42% are publicly placed while 53% are private placements, public placements tending to be significantly larger than private placements, although there are cross-country variations such as in Germany and Japan (Basel Committee on Bank Supervision, 2003). Turning to the initial term to maturity, the vast majority of issues are between 5 and 15 years, except in the United Kingdom and Japan, where 40% of issuing-shares are perpetual.

From the first half of the 1990s, the number of issues per year in these countries followed a strongly increasing trend, with some levelling off after 1994. However, this trend is somewhat exaggerated by the large increase in Germany, where no fewer than 2500 private placements of subordinated debt are reported for the 1990s. If Germany is excluded, there is no strong trend during the 1990s in most of the other countries.

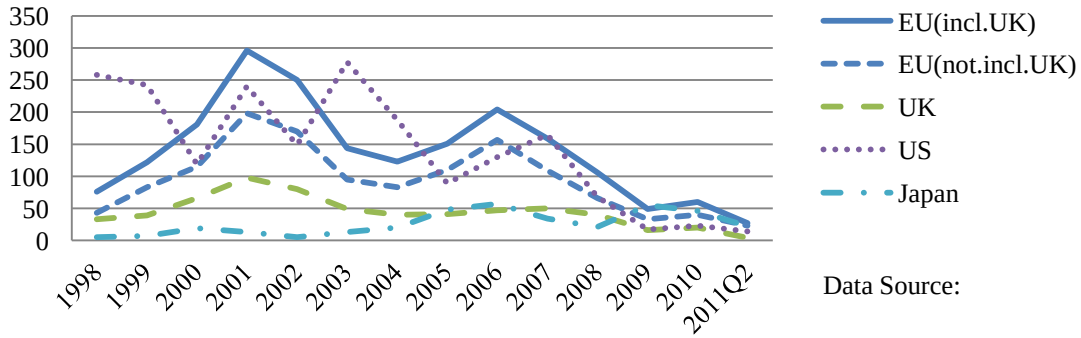
New issuance cases in the EU market increased dramatically from 1998 to 2001, then underwent a falling-off period. The possible reason for the increase is the introduction of the Euro currency. During 2001 and 2004, the stock market crash hit the United States and Europe, as a consequence of which the new subordinated debt issuance showed a sharp drop. Another peak in the EU market occurred in 2006. The significant increase may have been caused by the New Basel Accord, which launched market discipline and intensive proposals of subordinated debt policy.

Further, easy credit conditions during the period 2004 to 2006 encouraged high-risk lending and borrowing practices, and investors searched for high yields offered by treasury bonds. However, the booming of capital markets may have caused

the European sovereign-debt crisis from 2009. Since the beginning of the global financial crisis in 2007, new issuing of subordinated debt has declined significantly in both the EU and the US markets. However, there was a boom of new issuance in Japan between 2008 and 2009.

In terms of the amount of subordinated debt issued by major countries' banks, Japan took a relatively high percentage in 1990, 1991 and 1995. Since 1990, the cumulative amount of Japan's issuing has been only slightly less than that of the UK (Imai, 2007). In the Japanese subordinated debt market, debt may be Yen-dominated or Dollar-dominated, and these two types assume different proportions in different periods. Within issued debt, permanent debt that does not require the repayment period makes up the majority. This is related to the Bank of Japan's regulation that, if issuing permanent subordinated debt, its amount can be 100 per cent of the core capital, and counted as general subsidiary capital. If issuing period subordinated debt, its amount can be only up to 50 per cent of the core capital, and it is counted as junior subsidiary capital. Table 1.1 reports the new issuance of sub-debt for major issuing markets, and Figure 1.3 illustrates the changes graphically.

Figure 1.3 New Issuance of Subordinated Debt in Major Markets: from 1998 to 2011:Q2



Data Source:

Table 1.1 New Issuance of Publicly Traded Subordinated Debt in Major Issuing Countries

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011:Q2
Belgium	0	7	0	0	7	1	1	8	2	3	3	0	0	0
Denmark	0	1	0	4	1	4	5	6	5	3	1	1	0	0
France	18	4	12	19	29	29	15	21	33	27	22	17	7	6
Germany	9	23	30	33	32	18	22	20	21	12	2	3	5	3
Greece	0	0	0	1	3	3	3	7	3	4	2	0	0	0
Italy	2	5	19	59	28	10	11	17	32	17	19	5	18	6
Netherlands	2	14	23	61	33	13	6	11	13	12	8	5	2	4
Norway	2	0	0	2	4	5	3	2	4	3	5	0	0	0
Spain	8	25	26	15	31	10	16	12	38	23	1	2	4	0
Switzerland	2	4	5	4	2	2	1	6	6	5	3	0	4	4
UK	33	39	66	98	80	49	40	41	47	50	40	16	20	4
In total	76	122	181	296	250	144	123	151	204	159	106	49	60	27
US	258	242	119	240	149	278	188	89	130	165	68	17	23	14
Japan	5	7	19	13	5	13	20	48	57	34	21	55	46	22

Data Source: Thomson One Banker

1.4 Proposals for Using Subordinated Debt as Means of Market Discipline

1.4.1 Main Proposals

The idea of using subordinated debt as an instrument of market discipline goes back to the 1980s, in particular to proposals made in the US by the Federal Deposit Insurance Corporation (1983) and by Benston et al. (1986). A more recent elaboration can be found in Calomiris (1999). The idea was part of a joint statement by a sub-group of the Shadow Financial Regulatory Committee, and was a key element in proposals for the US banking regulatory reform in the early 21st century (US Shadow Financial Regulatory Committee, 2000 & 2001).

During the period 1999-2004, the literature analysing the proposals grew rapidly. Examples include the Board of Governors of the Federal Reserve System (1999 and 2000), Board of Governors of the Federal Reserve System and Department of the Treasury (2000), Calomiris (1999), Evanoff and Wall (2000 and 2001a) and Sironi (2000 and 2003), among others.

The Federal Deposit Insurance Corporation, the earliest bibliographic citation in most of the literature mentioned, proposed subordinated debt as a means of market discipline in 1983. It suggested that banks would be required to maintain a minimum protective cushion to support deposits (e.g. 10 per cent), which would be met by a combination of equity and sub-debt. Maturity selection should take into consideration the desirability of frequent exposure to market judgment. The total debt should mature

serially (e.g. by one-third every two years). As banks grew they would be required to add proportionately to their "capitalization". Those heavily dependent on debt, primarily the larger banks, would have to go to the market frequently to expand their cushion and to refinance maturing issues. This proposal also discussed covenants, stating that penalties would be imposed on banks that fell below minimum levels. Provisions for debt holders to receive some equity interest and to exercise some management control, for example in the selection of members of the board of directors, may be appropriate, as may convertibility to common stock under certain provisions. With regard to insolvency procedures, the FDIC stated that its assistance might still be granted and serious disruption avoided in a manner which would not benefit stockholders and subordinate creditors. This could be accomplished by effecting a phantom merger transaction with a newly-chartered bank capitalized with FDIC financial assistance. The new bank would assume the liabilities of the closed bank and purchase its high-quality assets (Evanoff and Wall, 2000).

During the 1980s, rapid deregulation exposed banks to unfamiliar sources of risk, resulting in an increase in the bank failure rate. Subsequently, banking regulators shifted their focus in building bank safety and soundness to banks' capital level, and started to impose minimum levels of capital among banks. These requirements were later strengthened through a system of structured early intervention and resolution mandated by the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991.

In 1999, the US passed the Financial Services Modernization Act

(Gramm-Leach-Bliley Act), which requires large US national banks to have outstanding debt that is highly rated by independent agencies in order to fund the expansion of financial activities into areas not previously allowed. The Act also instructed the Board of Governors of the Federal Reserve System and the Secretary of the Treasury to conduct a joint study of the potential use of sub-debt to protect the financial system and deposit insurance funds from "too-big-to-fail" institutions (Evanoff and Wall, 2000).

The early subordinated debt proposals in the late 1980s and early 1990s emphasize the role of subordinated debt as an inexpensive substitute for bank capital in providing a cushion to the deposit insurer in case of bank failure. More recently, the proposed requirement that large banking organizations regularly issue sub-debt has aimed to mitigate the moral hazard problem induced by risk-insensitive deposit insurance pricing. In addition, these recent proposals focus on the information content of subordinated debt prices and their possible links to supervisory actions in an effort to reduce regulatory forbearance by insolvent banks (Pornrojnangkool, 2006).

By the time of the new Basel Capital Accord (Basel II), implemented at the end of 2006, the traditional safety nets of the banking system had become ineffective, and integrating market forces increasingly necessary (Evanoff and Jagtiani 2004). Basel II proposes three pillars of safety and soundness for the banking system: risk-sensitive minimum capital requirements, coordinated supervisory review and enhanced market discipline. This proposal extends the use of the sub-debt market to supervisory and disciplinary purposes, and implies that the issuing of sub-debt should be more

extensive. In addition to the regulators, some academic researchers also propose subordinated debt requirements and frameworks. Sironi (2000) argues that a mandatory subordinated debt policy should be limited to the largest banks; that the policy should be aimed at improving direct rather than indirect market discipline, and that it is feasible and important to harmonize the characteristics of the mandatory subordinated debt policy by international co-ordination. In Table 1.2 we summarize major mandatory subordinated debt proposals.

The Bank for International Settlements (2003) divided these proposals for bank disciplining devices into three generations. Table 1.3 presents a summary of the main characteristics of each generation. The weakness of the 1st and 2nd generation of subordinated debt proposals is that they create strong direct market disciplinary strength but fail to focus on indirect market discipline. The early proposals overlook the potential benefits of information contained in the primary or secondary market, such as yield spreads. Moreover, there are some arguments against put options of subordinated debt. Put options enable investors to claim early repayment to avoid further loss, and therefore help to create a powerful disciplinary tool. However, demanding early repayment may reduce market liquidity and comparability of risk premiums. To alleviate these disadvantageous features, the 3rd generation proposals suggest risk-weighted assets, maturity requirements and issuing frequency basis. Furthermore, the 3rd generation proposals impose a cap on spreads. This gives market participants a criterion and an effective instrument to monitor and influence issuing banks.

Table 1.2 Summary of Mandatory Subordinated Debt Proposals

Reference	Recognition Phase and Control Phase Criteria		Control Phase Criteria	
	Debt Maturity	Frequency of Issue	Debt Size	Additional Control Features
Horvitz (1984, 1987)	x	x	√Discussed, but no specific details proposed	√Discusses the control characteristics of debt-holder covenants, but no specific details proposed
Benston et al. (1986)	√Discussed, but no specific details proposed	√Discussed, but no specific details proposed	√3 to 5% of deposits	√Covenants to restrict risky banks' activities √Some debt is puttable
Keehn (1989)	√Subordinated bonds would have maturities of greater than five years	√Staggered to ensure debt maturity in any one year is greater than 10% but less than 20% of issued subordinated debt	√Minimum of 4% of subordinated debt to risk assets	√Progressively increased sanctions as a bank's performance deteriorates (similar to the prompt corrective action provision of FDICIA)
Cooper and Fraser (1988)	√Should not be long-term	√Rolled over at frequent intervals	√3% of deposits	√Bonds would be puttable at 95% of par value √Failure by the bank to repurchase within a prescribed period would trigger revocation of its charter
Wall (1989)	√Minimum maturity of 90 days	√Discussed, but no specific time period proposed	√Minimum of 4-5% of risk-weighted assets	√Bonds would be puttable √Exercise of put would force a bank to raise new debt or sell assets to meet debt size criteria within 90 days, otherwise it would be deemed insolvent √Restrictions on % of debt owned by insiders

Table 1.2 continued

Evanoff (1993)	√Long enough to tie debt holders to the bank (e.g. five years)	√Semi-annual calls on the market	√A significant proportion of total regulatory capital (e.g. 50%)	√Progressively increased sanctions as a bank's performance deteriorates (similar to the prompt corrective action provisions of FDICIA) √Possible issue of puttable debt, the exercise of which would force a bank to raise new debt within 90 days, otherwise it would be taken over by regulators
Calomiris (1997)	x	√Discusses the rollover of overlapping generations of debt, but no specific time period proposed	√2% of non-reserve assets or 2% of risk-weighted assets	√Debt yield would be restricted to 50 basis points above a riskless rate
Litan and Rauch (1997)	√At least one year	√A fraction due in each quarter	√Minimum of 1-2% of risk-weighted assets	x
The Bankers Round-table (1998)	x	x	√Minimum of 2% of liabilities	x
Calomiris (1999)	√Two years	√1/24th of the issue would mature each month	√Minimum of 2% of risky assets	√Debt rates would be capped at a spread above treasury rates
United States Shadow Financial Regulatory Committee (2000)	√At least one year	√At least 10% of debt would have to mature in each quarter	√Minimum of 2% of risky assets	√Progressively increased sanctions as a bank's performance deteriorates (similar to the prompt corrective action provisions of FDICIA) √Debt must be sold at arm's length
Evanoff and Wall (2001a)	√Five years	√Minimum two issues per year, with issues at least two months apart	√Minimum of 3% of risk-weighted assets	√Tie debt yields to the "trip wires" under prompt corrective action, such that progressively increased sanctions are imposed as a bank's performance deteriorates

Key: √ – Issue considered; x – Issue not considered Source: Hamalainen et al. (2010a)

Table 1.3 Summary of Subordinated Debt Proposals

Generation	Citations	Objective	Amount	Maturity	Issuance	Covenants	Rate Cap	Puttable Debt
1st	FDIC (1983); Benston et al. (1986); Horvitz (1987); Litan and Rauch (1997); The Bankers' Round-table (1998)	Discipline through increasing costs of funds	Differs: 2% of liabilities; 3-5% of deposits; 1-4% of RWA	Relatively short, but long enough to prevent runs	Frequent	Generally not	Not	Generally not
2nd	Cooper and Fraser (1988); Keehn (1989); Wall (1989); Evanoff (1993)	Discipline through ability to issue and put options	3% of deposits; 4% of RWA	Long-term (at least 5 years)	Frequent (semi-annually)	Yes; as a function of a bank performance; Convertible to equity; limits on insider ownership	Generally not	Yes, SND may be puttable at 95% of par value
3rd	Calomiris (1997, 1999)	Discipline through cap in spread over risk-free rate	2% of RWA	2 years	Frequent (monthly)	Limits on insider ownership	Yield capped at 50bp above riskless rate	No

Source: Basel Committee on Banking Supervision (2003 August), Markets for Bank Subordinated Debt and Equity in Basel Committee Member Countries，Working Paper No.12. Basel: Bank for International Settlement

1.4.2 Rationale of the Proposals

A subordinated debt requirement could serve to produce both direct market discipline, by enticing the private sector to monitor and regulate bank risk taking; and indirect discipline, by having bank supervisors respond to the signal from sub-debt spreads. If investors gather information about bank risk and prospects and then incorporate that information into their transaction, the expected cost of issuing the subordinated debt will be an increasing function of bank risk. The anticipated higher funding costs should exert pressure on banks that take excessive risks, directly addressing the moral hazard issue. It has been well documented in the literature that the market accounts for risk when pricing sub-debts of banking organizations.

Furthermore, recent research finds that market environment could be improved by a mandatory sub-debt program (Evanoff et al., 2007). With the improvements in market depth, trading and issuance frequency, and debt characteristics, the resulting market signals become more informative, market discipline becomes more effective, and it is likely that the market will become more complete.

Meanwhile, the markets seem to respond by pricing risk more accurately, as debt holders no longer perceive themselves to be protected from losses. In the literature, the potential usefulness of incorporating market information into the bank supervisory system has been well documented (e.g. Evanoff, et al., 2011). This market information includes sub-debt spreads and changes in sub-debt spread, equity prices, returns, volatility and EDF estimated default probabilities[3].

[3] EDF stands for expected default frequency.

The literature also suggests that market information could be used to improve the predictive accuracy of traditional off-site monitoring models in predicting the future condition of the bank, frequently measured in the US context by changes in the CAMEL rating assigned by regulators.[4] An indirect discipline is achieved when banks' stakeholders utilize pricing information from the subordinated debt market, especially the secondary market, to increase various costs of bank operations. For example, other creditors, such as uninsured depositors, can increase the cost of their funds or limit their supply of funds to excessively risky banks.

More importantly, regulators can incorporate market information into various supervisory decisions, thus linking the supervisory review process in the second pillar to the market discipline in the third pillar under the Basel II framework. Therefore, a subordinated debt policy will be effective if its prices possess the following two qualities: the debt spread should reflect bank risks in a timely fashion; and as a bank increases risk, the widened spread should directly and/or indirectly influence the bank to reduce risk (Pornrojnangkool, 2006).

Although these proposals aimed at increasing the role of sub-debt in the bank capital structure differ as to the specifics, they all agree that sub-debt has desirable properties for regulatory purposes. One argument based on the capital requirements claims that with the expanded use of sub-debt, banks can adjust fund portfolios, and satisfy regulators' minimal private funds requirements without placing issuing banks at a competitive disadvantage. Another argument suggests that sub-debt signals

[4] However, some argue that there is no evidence to show that the market knows more about the condition of banks than do bank supervisors, who have access to extensive private information through their on-site examination process. CAMEL stands for Capital, Asset quality, Management, Earnings and asset Liability management.

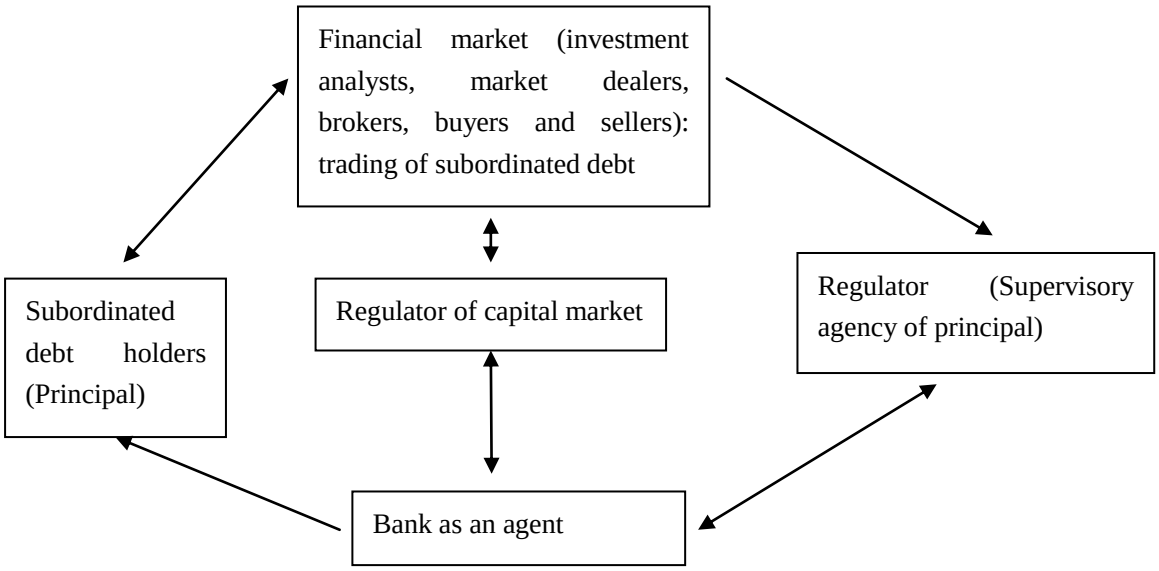
provide timely information and reflect insolvency and system risks, and help regulators reach their statutory objects. For the equity holders, increasing risk has potential benefits since it may lead to higher profits. On the other hand, depositors are protected by a government safety net; therefore for both equity and deposit holders it is hard to achieve strong and efficient disciplinary strength (Evanoff and Wall, 2000).

In conclusion, adopting subordinated debt in banking supervision has three main potential benefits. First, subordinated debt can mitigate principal-agent problems (Covitz et al., 2004 a&b). Driven by competitive forces and profitability, banks continuously take new risks and explore new businesses. Excessive risk-taking behaviour raises the probability of bank failure, and the likelihood that depositors will lose their savings. However, because not all depositors are able to process a bank's information, due to a lack of the sophisticated skills and techniques needed to analyse a bank's financial reports, the resulting information asymmetry raises the principal-agent problem in a bank's operation and risk-taking behaviour. Market participants such as investment analysts and brokers, who use subordinated debt as a market-based instrument as a source of information, have greater incentives and skills to get information. If the information is accurate and timely it will be reflected in bond price.

On the other hand, to minimize loss, market participants always choose the bank which has the more comprehensive report. For market regulators, public disclosure of a bank's risk profile would reduce the regulatory cost. Therefore, issuance of subordinated debt enhances information disclosure and transparency. The process of

how sub-debt mitigates the principal-agent problem is illustrated in Figure 1.4.

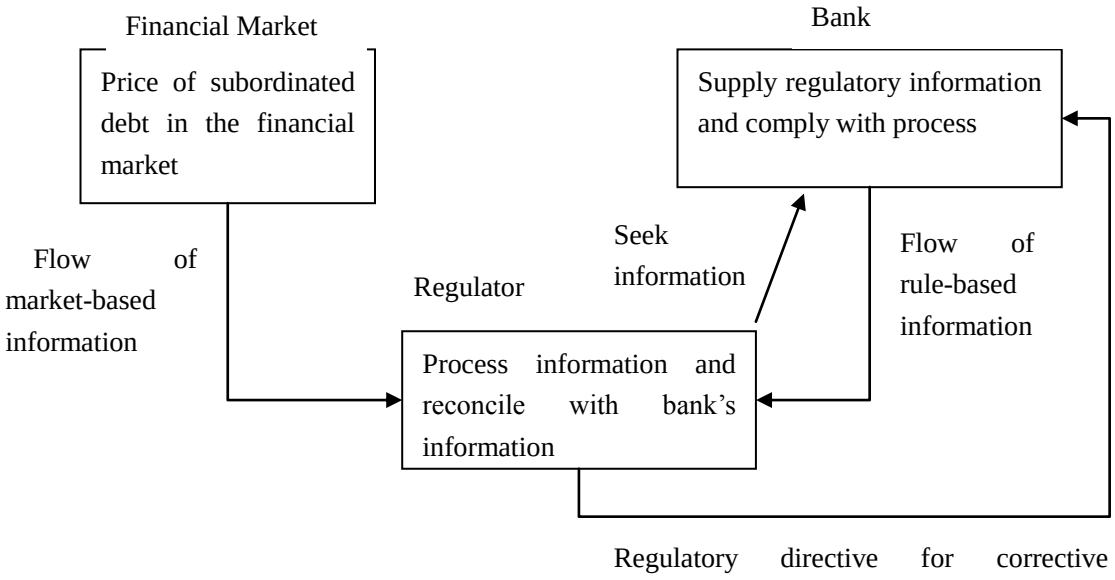
Figure 1.4 Mitigation Process of Principal-Agent Problem



Source: Ahmed, 2009.

Second, subordinated debt plays an important role in mitigating the moral hazard issue faced by banks (Chen and Hasan, 2011). In a bank's operation, shareholders wield significant influence. However, shareholders earn more profits if a bank takes more risk, while they have only limited liability in the case of the bank defaulting. Therefore it is less likely that shareholders will constrain bank managers' risk-taking behaviour. In some cases, shareholders may even encourage the bank to take excessive risk for higher profitability. During public trading the price of subordinated debt, which contains market-based information, will give regulators a signal to re-estimate a bank's risk exposure and capital adequacy, and enact further regulatory enforcement. The process of how subordinated debt mitigates the moral hazard problem is shown in Figure 1.5.

Figure 1.5 Mitigation Process of Moral Hazard Problem



Source: Ahmed, 2009

Last, but not least important, when a regulator imposes supervisory steps on banks there might be time-inconsistency problems, which could lead to difficulties in detecting bank failure. The Basel Accord II suggests that a regulator should monitor a financial institution using on-site and off-site supervisory approaches. However, both approaches have weaknesses, leading to the inefficient triggering of "prompt corrective actions". The market signals of subordinated debt provide continuous information of a bank's exposure to risk, and hence can provide more efficient and accurate triggers for regulators to take prompt corrective actions (Evanoff et al., 2003 and 2007).

1.5 Potential Contributions and Thesis Organization

Potential Contributions

This research empirically investigates how and to what extent bank subordinated debt plays a role in promoting market discipline in the UK banking industry. The work contributes to the literature on market discipline in banks in several important ways, which may improve our understanding of the source and mechanism of market discipline as an effective complement to official supervision and regulation of banks.

The current research fills a critical void in the literature by focusing on the UK case. While previous research mainly concerns the US banks, and to a lesser extent European and Japanese banks, our study complements the plethora of prior empirical studies with analysis of the UK market. British banks have their particular attractions as a case for studying desirability and feasibility of subordinated debt as an instrument of market discipline. In the global subordinated debt market, the British banks have been very active. According to the Basel Committee of Banking Supervision (2003), the total amount of the British subordinated debt market is no smaller than the US market, and is larger than the markets in other European countries (e.g. France, the Netherlands). However, the existing literature is largely silent about this very important UK market. Exploring whether market discipline is effectively channelled into British banks via subordinated debt in this data rich environment may meaningfully complement similar research in the previous literature. Moreover, most of the debt securities issued by the UK banks are publicly placed, hence the scope for

and depth of the working of market discipline via subordinated debt could be substantial in the UK banking industry, as compared to privately issued debt, as is the situation in Japan.

Another reason we adopt the UK banking industry as my case for empirical study is that a series of bank failure events and responses to them by supervisory authorities provides a useful setting for an empirical examination. The collapse of Northern Rock in 2007, the problems of Bradford & Bingley and Halifax Bank of Scotland (HBOS) in September / October 2008, and the intense criticism of the Royal Bank of Scotland Group (RBS) from 2009 onwards reveal the inherent fragility of the UK banking sector and the flaws in domestic financial regulation. One of the central issues of the current debate about how to reform the UK's financial regulatory framework is the enhancement of market efficiency. On one hand, subordinated debt can enhance market discipline and efficiency. On the other hand, market discipline generated by sub-debt market can complement bank capital regulation in mitigating banks' moral hazard problems at low cost (Chen and Hasan, 2011).

A further contribution of this research to the literature is the comprehensive nature of the investigation, which covers a broad range of issues pertinent to the working of market discipline. Despite persistent recognition of its critical importance by policymakers and academics, e.g. Greenspan (2001), Knight (2004) and Turner (2009), subordinated debt is an under-researched topic and many aspects of it remain unknown. This thesis conducts a wide-ranging study to fill the gaps in the knowledge about how subordinated debt facilitates market discipline in banks. We approach both

forms of market discipline, direct and indirect, to examine whether subordinated debt brings about more transparency of banking activity and imposes pressure on bank managements to act prudently. To explore essential attributes of the nexus between subordinated debt and market discipline, we consider in particular depth the monitoring effect, influencing effect and constraining effect that subordinated debt may have on investors' decisions and banks' risk taking. We also investigate whether subordinated debt price and its movements contain timely and accurate market information to improve the efficiency of official supervision and regulation of banks. The list then extends to cover the role of subordinated debt in promoting the establishment of an early warning system for banking crises, and whether the regulator in the UK has used information released from subordinated debt signals timely and effectively.

Research findings that shed critical light on the key premises of deploying subordinated debt as a promoter of market discipline in the banking industry represent another aspect of the vital contribution made by the thesis. This area is a very crowded one, and we must postpone until the next sub-section an indication of the particular contributions of specific findings to the relevant literature. However, it is imperative that we highlight here two critical findings. First, we find that in the UK, yield spreads of subordinated debt are sensitive to bank risk indicators. This is crucial evidence proving that subordinated debt is risk-sensitive and hence it is justifiable to experiment with the market discipline via the signalling effect of subordinated debt price. Second, we unearth evidence that the UK banks take signals from the

subordinated market seriously. The study has subjected to careful scrutiny a variety of market signals from the sub-debt market, including changes in the level of outstanding debt amount, interest rates and size of the issuing banks, and we find supportive evidence that these market signals are able to induce UK issuing banks' fundamentals to move in a direction desired by the regulator. These findings positively confirm that the subordinated debt market in the UK context can be an effective mechanism to discipline banks.

Finally, the contribution made by this thesis is embodied in a critical appraisal of the relation between the British financial regulator and market forces. For the first time in the literature, we provide research evidence that the UK banking regulator lacks interest in using market discipline to complement government financial regulation, although it should do so. Whether the UK's bank regulator or the Financial Services Authority (FSA) adopts market information to improve supervisory effectiveness, as the Federal Reserve Bank does in the US, is largely unknown. Our results show little evidence that the FSA has been using subordinated debt market information along with other accounting information wisely and efficiently to enhance the disciplinary process. Therefore, the research results demonstrate that the UK bank regulator is yet to be commended for using market discipline to improve the efficacy of UK bank regulation.

Objectives and Aims

This thesis therefore intends to analyse subordinated debt as an instrument for enhancing market discipline in regulating the banking industry, with specific reference to the UK. The fundamental aim of this research is to ascertain whether subordinated debt can contribute to generating market discipline in the banking industry. To this purpose, I will empirically investigate the following questions:

1. Is there a signalling effect stemming from price movements of subordinated debt? Specifically, I will examine whether fluctuations of yield spreads are a sensible indicator of the level of risk that banks are taking, by analysing the relationship between the two phenomena.

2. To what extent do banks react to the price signal? For subordinated debt to act as an effective instrument for improving market discipline, it is not adequate that price movements of subordinated debt can indicate the risk-taking level of the banks. For the debt instrument to perform its desirable effects on facilitating and promoting market discipline, the price signal must be taken seriously by and influence the behaviour of the banks.

3. How useful is subordinated debt as a tool contributing to regulatory action and efficacy?

The research reaches three main conclusions. First, the UK evidence shows that the yield spreads of subordinated debt contain timely and accurate information on issuers' risk taking, and this underpins the rationale of the proposals requiring

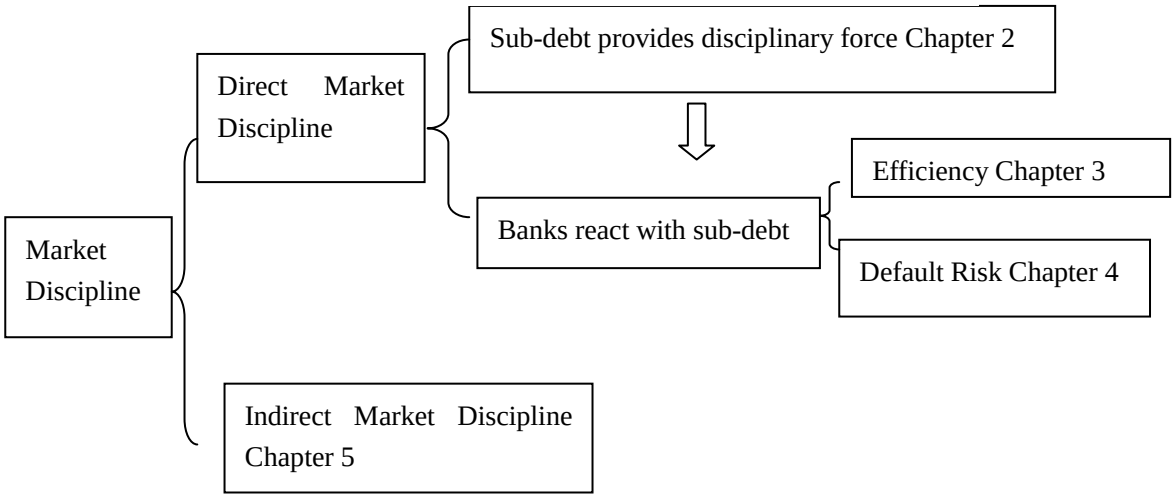
financial institutions to issue subordinated debt on a regular basis. Second, banks are sensitive to the signalling effect of subordinated debt and so subordinated debt has a constraining effect on banks' risk-taking behaviour. Third, there is no conclusive evidence to suggest that the UK regulatory agency, the Financial Services Authority (FSA), has been utilizing the subordinated debt program efficiently.

As such, the thesis argues that a mandatory subordinated debt policy should be implemented in the UK banking industry. Furthermore, the UK regulatory authority should adopt the mandatory subordinated debt policy in their off-site supervision, in order to enhance the scope and scale of discipline.

Organization of the Thesis & Major Findings

The thesis comprises four essays on the use of subordinated debt as an instrument for market discipline, with specific reference to the case of the UK banking industry. The thesis is organized according to the potential roles of subordinated debt in promoting direct and indirect market discipline in the UK banking industry. Chapters 2, 3 and 4 examine the effectiveness of subordinated debt as an instrument of direct market discipline; Chapter 5 approaches the issue of indirect market discipline. The following chart graphs the structure of the research.

Figure 1.6 Structure of Thesis



Following this introductory chapter, Chapter 2 empirically examines whether yield spreads of subordinated debt issued by UK banks are sensitive to bank risks, with a unique dataset that includes spreads, ratings, accounting measures of bank risk and market condition indexes in the sample period between 1997 and 2009. The results show that traditional ratings have significant and negative impacts on spreads. Investors have exercised rational discrimination between different risk profiles of UK financial institutions. However, accounting measures show an absence of the explanatory power of spreads. Market condition indicators, particularly those related to European markets, also have significant influence on credit yield spreads.

These findings make four major contributions to the market discipline literature in relation to subordinated debt. First, they reveal several potential problems in banks' risk management which are under-researched. For example, our results suggest that rating agencies may mislead investors by over-rating or over-estimating subordinated debt and their issuing banks. Second, and more importantly, the findings provide evidence that subordinated debt could be an instrument to mitigate principal-agent

problems. Because subordinated debt is unsecured and uninsured, holders of sub-debt are sensitive to the issuing bank's risk-taking behaviour and its strategic decisions. Furthermore, as a market-based investment instrument, sub-debt is traded in the open financial market. Market participants such as investment analysts have closer relationships with the issuing banks. Therefore, market participants of sub-debts have incentives and skills to extract information and allay information asymmetry. Third, the capital market regulator requires banks to publish information relating to its sub-debt and the issuing banks must disclose information regarding risk profiles. Investors can then require higher or lower premiums according to banks' risk levels. In this respect, issuing sub-debt will also reduce the cost of regulation. Fourth, the different components (firm-and market-level components, liquidity) of yield spreads are recognized, thus providing a wider-ranging understanding of their effects in the market discipline mechanism. This understanding advances the existing knowledge on the relevant factors that affect yield spreads (e.g. Sironi, 2003; and Caldwell, 2007).

The main objective of Chapter 3 is to investigate whether the issuing banks take market disciplinary signals seriously, or in other words, to what extent the issuing banks would respond to the signals of subordinate debt. To fill in the lacuna left by previous studies,[5] we use panel datasets that include subordinated debt issued by banks, bank holding companies and building societies in the UK for the period between 1997 and 2009, to examine the effects of changes in subordinated debt market signals, such as amount of debt and interest payable, on the performance of

[5] For cross-sectional data, see, for example, Morgan and Stiroh (2001) and Covitz et al. (2004b). For time-series data, see, for example, the Board of Governors of the Federal Reserve System (1999), and Krishnan et al. (2005).

banks. Furthermore, we check whether market discipline has more effect on bigger banks, and whether market discipline has increased during the financial crisis.

We find that, with a time-lag of one year, levels of sub-debt issued are a conditioning factor on banks' capital adequacy and management quality. Interest and amount levels both have the power to explain changes in the quality of loans and securities investments, among other factors. The level of subordinated debt interest exerts strong market discipline on all proxies of bank liquidity, while the quantity of subordinated debt issued appears to intensify discipline on the liquidity ratio only. With this multitude of evidence, we conclude that, with some time hysteresis, signals emanating from the subordinated debt market induce interactions of market discipline with banks' fundamentals.

Chapter 3 provides a unique angle to examine the effect of market discipline via the subordinated market. Traditionally, the extent of market discipline is investigated in terms of quantity effects (e.g. Pop, 2009a; Cebenoyan and Cebenoyan, 2008), cost effects (e.g. Blum, 1999, 2002; Imai, 2007) and competition effects (e.g. Morgan and Stiroh, 2001; Mendonca and Loures, 2009) of sub-debts. We base our study on a distinct strand of literature of bank efficiency studies, and conduct investigations not only into the proxies of market discipline and bank efficiency, but also into changes in these proxies. Furthermore, we consider whether market discipline may be affected by issuing banks' size, rather than by the sub-debt's characteristics. In addition, by comparing the market discipline strength during pre- and post-crisis periods, we draw some valuable lessons from the global financial crisis.

In Chapter 4 we further examine the impacts of subordinated debt on banks' default risks and financial distress indicators. We adopt distance to default (DD), which is popularly used by investors, rating agencies and supervisory authorities, as an indicator of a credit institution's default risk. We analyse whether issuing subordinated debt enhances the explanatory and predictive powers of fundamentals to the likelihood of default risks.

We find that investors in bank-issued subordinated debt require more fundamental information to perform quantitative analysis of a bank's default probabilities. This implies that upon banks' issuing subordinated debt, market participants would require more information on bank performance. This will impose discipline on firms in terms of adequate information disclosure. Moreover, we find that issuing banks with a higher charter value or low capitalization are more efficient, indicating that issuing banks' charter values and capitalization convey further information to market participants and enhance market discipline through better information disclosure.

This chapter's uniqueness as a market discipline study lies in its deployment of market-based risk measures in investigation of market discipline and the subordinated debt program. Previous studies on whether sub-debt can enhance informational efficiency and market discipline strength focus on information contained in sub-debt yield spreads (e.g. Avery et al., 1988; Sironi, 2003). By contrast, we construct distance to default, a formal quantitative analysis of market-based indicators of banks' likelihood to default widely adopted by central banks and bank regulators, to analyse

whether bank fundamentals predict the distance to default efficiently. Furthermore, this chapter contributes to the existing literature by comparing the ability of bank fundamentals to predict financial distress for banks issuing subordinated debt with the predictive ability for banks which do not issue subordinated debt, hence revealing that subordinated debt enhances information transmission, mitigating information asymmetry and moral hazards, and works effectively as an enabler of market discipline.

In Chapters 3 and 4, sub-debt is regarded as a tool to mitigate moral hazards in supervising a bank's risk taking. Although depositors are major creditors of a bank, their money is guaranteed by deposit insurance introduced by the UK government (as in most other advanced countries), hence depositors' lack of incentive to constrain banks' risk taking. Instead, shareholders and bank managers would encourage banks to take risks imprudently to maximize their own benefits. In addition, banks believe that when default occurs the government will bail them out to avoid adverse impact on the whole financial system, and the dire social consequences thereof. These are the origins of the moral hazard in the banking industry (Ahmed, 2009). Sub-debt, on the other hand, provides signals which indicate the true value of the bank, within a range, to the regulators. This will exercise a level of discipline upon bank managers and help regulators re-estimate a bank's risk exposure.

In Chapter 5 we examine the effectiveness of subordinated debt in promoting indirect market discipline. A sample of the five largest UK banks is selected, along with disciplinary actions taken by the UK FSA towards these five big banks between

June 2001 and June 2011. Existing empirical studies adopt government ratings on each bank (for the US market, see Berger et al., 2000; Krainer and Lopez, 2001; Curry et al., 2003; for other markets, see Cannata and Quagliariello, 2004 as an example for Italian banks). However, ratings assigned by the British FSA to UK banks are confidential. To circumvent the problem, we test the role of subordinated debt in indirect market discipline in two separate steps. The first step of the investigation applies extensive bivariate analysis to ascertain whether there exists timely information in sub-debt spreads, which may be useful for the FSA's regulatory actions. The second step tests whether sub-debt market information provides additional information. The results fail to provide significant evidence that the FSA has used sub-debt market data appropriately as an instrument of indirect market discipline.

To further investigate whether sub-debt can indicate impending problems that should be a regulatory concern, we study the case of the Royal Bank of Scotland Group (RBS). Compared with stock-based market indicators, we find that it is difficult to extract clear signals from existing sub-debt spreads about a single bank.

This chapter makes two contributions to the market discipline literature. First, based on a unique dataset that matches accounting, market and supervisory information, we conduct an event study for a major UK bank, RBS, to compare and contrast the performance and behaviour of the sub-debt indicators and three other widely used equity-based indicators. Second, we study to what extent the UK regulator cares about using signals from the subordinated debt market to improve regulatory efficacy. Evanoff and Wall (2001a, 2002) and Evanoff et al. (2011)

investigate whether sub-debt mitigates time-inconsistency behaviour on the part of regulators in the USA. With empirical evidence from America, they believe that previous studies have probably underestimated the potential usefulness and effectiveness of the sub-debt programs. However, in the UK case, we show that the current bank regulator, the UK FSA, fails altogether to use sub-debt information. This may also explain why subordinated debt as an instrument of market discipline works less effectively in mitigating regulatory forbearance in the UK than in the US.

Chapter 6 concludes.

Chapter 2 Risk Sensitivity of Subordinated Debt Yield Spreads

2.1 Introduction

The New Basel Accord suggests the use of subordinated notes and debentures (SND or sub-debt) as an instrument of market discipline. Underlining the numerous proposals, Basel II introduces a mandatory subordinated debt policy, which has been drafted and critically discussed by many economists, practitioners and regulators. Subordinated debt yield spread has received the most attention so far, as an alternative market risk measure. The subordinated debt yield spreads are the differences between the yields on sub-debt and the yields on a Treasury security issued with same currency with similar maturity.

In this chapter subordinated debt's efficiency as an instrument of market discipline is empirically investigated by testing the risk sensitivity of the UK banks' sub-debt spreads. A unique dataset of spreads, ratings, accounting measures of bank risks and market condition indicators is used for a sample of sub-debt issued during the 1997-2009 period.

Four important findings emerge from the analysis. First, traditional rating agencies have a significant impact on sub-debt issuance and issuing banks: for Moody's, S&P and Fitch ratings, when ratings worsen, spreads rise. Furthermore, sub-debt investors seem to have rational discriminations between different risk profiles of UK credit institutions. In addition, some accounting measures of bank risks show an absence of explanatory power of spreads. Market conditions, finally, have a significant impact on credit yields, especially European market indicators.

The structure of this empirical chapter is organized as follows: section two presents a review of theoretical studies on this topic, and section three reviews empirical studies. The methodology and hypothesis are outlined in section four, and in

section five the data sources are explained and sample characteristics are described. Interpretations of empirical results are shown in section six, and section seven concludes the section.

2.2 Literature Review

2.2.1 Theoretical Underpinning

The most commonly applied model in examining the impact of debt market discipline on risk-taking incentives is the contingent claims valuating model, derived from Black & Scholes (1983) and Merton (1984). Levonian (2001) suggests a theoretical framework to evaluate the impact of subordinated debt discipline on risk-taking incentives for banks. Hypothetically, a bank has assets with a market value of A and limited liabilities, and the bank operates continuously for T periods. The bank issues three types of claims to finance its assets: senior debt (or deposits) with promised payment D_T, junior (or subordinated) debt with promised payment B_T, and equity with the value of E($E=A_T - D_T - B_T$ in the event of the bank is solvent). Depositors are protected by a safety net and payments are guaranteed by governance in the period during which subordinated debt and equity are risky, which means it is possible that the promised payments on the claims might not be received. Table 2.1 shows various possible terminal asset values.

Table 2.1. Payoffs to Claimants at Termination (t=T) for Various Values of Assets

	$D_T+B_T < A_T$	$D_T < A_T<D_T+B_T$	$A_T < D_T$
Senior debt (deposits)	D_T	D_T	A_T
Junior debt	B_T	$A_T - D_T$	0
Equity	$A_T - D_T - B_T$	0	0

Source: Levonian (2001)

In the case of $D_T+B_T < A_T$, deposit holders and subordinated debt holders receive full repayments, and equity holders pick up the residual. If the bank's total assets are not insufficient for the sum of deposits and sub-debt, then deposit holders still secure full repayment and sub-debt holders will receive the residual. Equity holders, in this case, are unable to recover their investment. If the assets value is smaller than the deposit value, then the bank's assets are fully employed in repaying deposits. Sub-debt and equity holders must absorb the losses.

To examine the disciplinary impact of subordinated debt on banks' risk-taking incentives, Levonian (2001) suggests that:

$$\frac{dE}{d\sigma} = DN'(z-\sigma) - (B+D)N'(x-\sigma)$$

which indicates debt holders lose if asset risk rises. The first term of expression above reflects that an increase in assets volatility increases the likelihood of sub-debt being fully repaid, because senior debt absorbs a portion of the downside risk. The second negative term implies that an increase in asset risk reduces the market value of assets and raises the possibility that banks have insufficient assets to repay claims in full. Therefore, the subordinated debt market does 'punish' shareholders for shifting risk to debt holders, which is the essence of market discipline (Levonian, 2001).

2.2.2 Empirical Literature Review

The findings to the question whether SND spreads are sensitive to bank risks are inconsistent between the periods before and after the enactment of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) in 1991. Studies prior to FDICIA find that subordinated debt yield spreads are not sensitive to bank risks (e.g. Average et al., 1988; Gorton and Santomero, 1990). In later studies, sub-debt yield spreads are believed to correlate with the riskiness of the bank (Evanoff and Wall, 2001a &b). Economists and researchers (e.g. Board of Governors of the Federal Reserve System, 1999; Flannery and Sorescu, 1996, etc.) have provided some evidence on the usefulness of these spreads. Flannery and Sorescu (1996) argue that "too-big-to-fail" (TBTF) may mislead sub-debt creditors in believing that they would not suffer credit losses on debt issues of the largest banks. Since the Federal Deposit Insurance Corporation (FDIC) imposed losses on sub-debt holders at large failed banks in the late 1980s, and passed the least-cost resolution provisions in 1991, part of Federal Deposit Insurance Corporation Improvement Act (FDICIA), they found that sub-debt yield spreads are related to a bank's risk exposure, and strongly suggested that sub-debt holders would remain at risk in future failures. Jagtiani et al (2001) and the Board of Governors of the Federal Reserve System (1999) find similar results in the post-FDICIA period and the early to middle 1980s, respectively. The possible reason for the inconsistency is that before the FDICIA in 1991 the issued SND were covered by the government safety net, or guaranteed by the government. In this case, SND yield spreads fail to reflect issuers' risk-taking information. After the FDICIA, the SND was not longer covered by the government safety net, and became attractive to market participants.

Many studies have concerns on using primary or secondary market spreads (e.g. Board of Governors of the Federal Reserve System, 1999). Balasubramniam and Cyree (2011) examine data from secondary subordinated debt market for the period 1994 – 1999 and find that sub-debt spreads reflect firm-specific default risks. By examining the sizes of banks, they find that the "Too-big-to-fail" phenomena reduce the risk sensitivity because the market expects that governments will bail out sub-debt-issuing banks. This perception has been enhanced particularly since the Federal Reserve Bank brokered the Long Term Capital Management bailout in September 1998. Furthermore, as the determinants of yield spreads are changing, some traditional risk measures become irrelevant. Besides, other securities, such as trust-preferred securities (TPS) which began to be issued in October 1996 reduce the risk sensitivity of sub-debt yield spreads.

The majority of empirical studies focus on the US market, and only very few have been concerned with the European and UK subordinated debt markets. Hamalainen et al (2003) focus on examining the mandatory subordinated debt policy in the UK and assessing the suitability of introducing into UK banking regulation mandatory subordinated notes and a debentures policy. Furthermore, the authors explore the issuance of subordinated notes and debentures and their characteristics at a bank-level and, uniquely, considered them in relation to regulatory, structural and economic events that are either specific to the UK or otherwise affect international banking. Therefore, our research fills the gap.

In previous literature, using rates from different rating agencies appears to be intuitive. Sironi (2003), employing the Moody's Banking Financial Strength (MBFS) and Fitch IBCA individual (FII) ratings and analyzing data concerning issuers, investors, markets and securities structure, has a unique comprehensive browse

through the market of banks' subordinated notes and debentures in Europe.

Also, in past scholarship the use of accounting variables is quite common. Flannery and Sorescu (1996) hypothesize that a bank's spread should increase relative to the amount of risk implied by its accounting reports as measured by loan quality, leverage, interest rate risk exposure, and profitability. In addition, debt-holders could monitor banks' risk through these accounting indicators. Svec (2003) uses total assets, total loans, total equity issued, total demand deposits, operating income, net income, required capital based on risk, and certain off-balance sheet variables: off-balance sheet claims against central banks, off-balance sheet claims against banks, off-balance sheet collateralized loans, and off-balance sheet loans to corporations. Benink and Benston (2005) claim that the present regulatory structure of European banks is likely to achieve banking stability in the future based on the record of and changes in EU banking regulation, new data on bank capital/asset ratios in ten European countries and an analysis of market and technological changes.

Pornrojnangkool (2006) uses non-accruing loan to asset ratio, 90 days or more past due loans to total assets ratio, absolute value of the difference between assets and liabilities that will be reprised within one year divided by book value of equity, leverage ratio defined as total liabilities divided by book value of equity, and the ratio of other real estate owned to total assets.

There are very few studies that have considered market condition variables. Part & Perostiani (1998) use several market variation control variables, intending to test the presence of depositor discipline, including local banking wage and state population growth. Pornrojnangkool (2006) uses market conditions including market value of equity and the market leverage. In our research, we adopt market conditions from several resources, which also fill the gap in the related field.

2.3 Models and Hypothesis

As in previous literature, this study also correlates the yield to maturity spreads of subordinated debt to observable risk measures. Previous proposals have recommended using subordinated debt yield spreads as a trigger for supervisory discipline under prompt correct action (PCA). Evanoff and Wall (2001a) provide the first empirical analysis of the relative accuracy of various capital ratios and subordinated debt spreads in predicting a bank's condition, suggesting that the performance of sub-debt yield spreads satisfy an important pre-requisite for using sub-debt as a PCA trigger. The main reason for this is that some capital ratios, including the summary measure currently used to trigger PCA, have almost no predictive power. However sub-debt yield spreads perform slightly better than the best capital measure, the Tier – 1 leverage ratio.

Sironi (2003) suggests that the spreads should relate to banks' risks, which including rating risks and accounting risks, maturity, issuing amount and currency. Based on this basic idea, we consider the market conditions to be an independent variable for spreads. Based on Sironi (2003), the following baseline regression equation has been estimated:

$$SPREAD_i = f(RISK_i, MATU_i, AMOUNT_i, CURR_i, \text{Market conditions}_i) + \varepsilon_i \quad (2.1)$$

The spreads are calculated as the differences between the yields to maturity of sub-debt at launch of issuance and the yield to maturity of corresponding currency Treasury security with a similar maturity. Maturity, amount and currency are sub-debt features. The maturity measured as the time to maturity (in years) of issue, the amount in the log of the US dollar equivalent amount of issue, and the currency adopted is the currency of denomination of issuance. The risk includes two alternative measures of

the default risk of the issuing banks: rating risks and bank risks, where:

$$\text{Rating Risk}_i = (\text{S\&P ratings}_i, \text{Moody's ratings}_i, \text{Fitch ratings}_i, \text{Moody's Long Term ratings}_i) \quad (2.2)$$

$$\text{Bank Risk}_i = (\text{Leverage}_i, \text{Profitability}_i, \text{Asset Quality}_i, \text{Liquidity}_i) \quad (2.3)^6$$

The following bank-specific accounting variables are employed: LEV is the ratio of total (book) liabilities to the book value of equity. Higher leverage indicates higher default risk. ROA is the ratio of annual net income to the average of the preceding and current year-end total assets. NLTA is the ratio of net loans to total assets. EITA is the ratio of equity investments to total assets. LIQ is the ratio of liquid assets to customers' deposits and short term funding. LLRGL is the ratio of loan loss reserves to total loans.

We also adopt Z-Score and the interest coverage ratio as one of measures to bank risk, as these two measures have been widely used in banking studies of risk assessment (e.g. Jostarndt and Sautner, 2008; Uhde and Heimeshoff, 2009). We construct Z-score per firm and time by aggregating the banks' consolidated balance sheet data, define Z-score as the ratio of the sum of equity capital to total assets and ROAA (return on average assets before taxes) to standard deviation of ROAA. Initially, the Z-score measures banks' attitude to risks and the probability of a bank becoming insolvent (Uhde and Heimeshoff, 2009), therefore, higher Z-score implies a lower probability of insolvency risk. As a measure of banks' financial distress, interest coverage ratio is calculated as EBIT (earnings before interest and taxes) over total interest expenses.

[6] Similar as Sironi (2003) and Caldwell (2005).

The following market-index variables are employed: The FTSE 100 market index on the day of bond issuance. The FTSE 100 index is a share index of the 100 most highly capitalized UK companies listed on the London Stock Exchange. It is the most widely used of the FTSE Group's indices and is frequently reported (e.g., on UK news bulletins) as a measure of business propriety. The FTSEuro first 300 index is part of the FTSEuro first Index series and the FTSEuro first 300 index on the day of bond issuance has been adopted. FTSEuro first 300 indices are tradable indices measuring the performance of European portfolios. It is a capitalization-weighted price index which uses free-float. It measures the performance of Europe's largest 300 companies by market capitalization.

Nikkei is the Nikkei 225 index on the day of bond issuance. Nikkei 225 is a stock market index for the Tokyo Stock Exchange (TSE). It is a price-weighted average (the unit is Yen) and the components are reviewed once a year. Currently, the Nikkei 225 is the most widely quoted average of Japanese equities, similar to the Dow Jones Industrial Average. NASDAQ is the NASDAQ index on the day of bond issuance. The National Association of Securities Dealers Automated Quotations (NASDAQ) is an American stock exchange. It is the largest electronic screen-based equity securities trading market in the United States[7]. LIBOR is the LIBOR 3M index on the day of bond issuance. The London Interbank Offered Rate (LIBOR) is a daily reference rate based on the interest rates at which banks borrow unsecured funds from other banks in the London wholesale money market (or interbank market). It is roughly comparable to the US Federal funds rate. EuroLibor is London Interbank Offer Rate, which is denominated in euro, indicating the interest rate that banks offer each other for large short-term loans in euro.

[7] All the definitions of market indices quoted from the Financial Times website: www.ft.com/markets

FEST 100, FTSEuro, Nikkei, NASDAQ, Libor3M and Euro Libor 3M are used for market condition variables, to examine whether the blooming of sub-debt is because issuers realize that subordinated debt is a positive potential instrument of market discipline, or simply because the fact that the market is blooming means that issuing banks and investors want some high portfolio investments.

Control variables used in the four alternative specifications. MATU is the time to maturity of issue. AMOUNT is the natural log of the US dollar-equivalent amount of the issue. STG, EURO, USD, OTHERCUR are currency dummies indicating bonds issued by British pounds, Euro, US dollars and other currencies, respectively. Size is a control variable for the size of the issuing bank. It is calculated as a natural log of issuing bank's total assets.

The Standard & Poor, Moody's and Fitch Individual ratings for each single issue as an alternative measure of the default risk: These are the ratings assigned by one or all three rating agencies to a single issue at the time of issuance. Meanwhile, they can also reflect both the issuing bank's default risk and the facility's seniority and security structure. Moody's Long Term issuer ratings, which focus on the role of the issuing banks' default risk, address the possibility that a financial obligation will not be honoured as promised. Such ratings reflect both the likelihood of default and the probability of a financial loss suffered in the event of default. Since Moody's Long Term ratings were introduced more recently, they are only available for a smaller subset of issues. Dummy variables allow more flexibility than would result from imposing a linear specification, therefore, ratings are represented by dummy variables in both two ratings-based specifications, with each dummy variable equal to 1 if the issue or issuer has the corresponding grade and 0 otherwise.

In contrast to most of the studies on market discipline conducted using US banks'

subordinated notes and debentures data, this study is based on primary market spreads in the UK. The liquidity of the secondary market for European banks is quite poor. Therefore, the use of secondary market spreads is avoided. Furthermore, yields on newly-issued bonds can reflect actual transaction prices, rather than 'indicative prices', which are estimated by brokers and derived from pricing matrices or dealers' quotes. At the present time, from a bank's point of view, yields of subordinated debt can provide a more accurate measure of actual cost, and also satisfy investors because of the provision of a more sophisticated measure of the risk premium measure. Another significant reason for using primary market spreads is that the rating reflects the rates' assessment near the time of the initial issuance (Board of Governors of the Federal Reserve System, 1999).

2.4 Data Sources and Sample Characteristics

The data is mainly taken from Moody's Credit Report, Thompson One Banker and Datastream. Spreads of issued subordinated debt are fixed-rate, subordinated notes and debentures issued by UK banks. The sample is collected from data between 1997 and 2009, and includes 631 subordinated notes and debentures.

In this 631 subordinated debt issues sample, two potential selection biases need to be noted. First, in the late 1990s and early 2000s, especially around the period from 1999 to 2001, a relatively large number of subordinated notes and debentures issues were completed, compared with previous years. There are several possible reasons. Partly, the European banks' sub-debt issues showed a general increase in the average number, indicating that European banks tended to issue subordinated debt when the market was more receptive (Sironi, 2003). The Russian financial crisis in 1998 is

another reason for the larger number of issues between 1999 and 2002. Therefore, as a consequence of the low interest rate environment, the issuing numbers are noticeably higher since 1999. However, these biases should not limit the adequacy of the empirical sample as a basis for answering the key question of this study. The second selection bias in particular should not affect the conclusion if the risk profile of UK banks appears to be monitored by private investors.

Sub-debt issuance saw another upsurge around 2005 and 2006. This was largely the consequence of the launch of the New Basel Capital Accords (Basel II), which are recommendations on banking laws and regulations issued by the Basel Committee on Banking Supervision. The initial purpose of Basel II, published in June 2004, was to create an international standard for banking regulators when writing regulations about how much capital banks need to put aside in order to guard against the types of financial and operational risks they face. The status of subordinated debt claims on banks assets after senior debt holders and the lack of upside gain enjoyed by shareholders makes it perfect for researching the significance of market discipline, the third pillar of Basel II. Therefore this bias should be significant in this study.

Moody's rating at issuance for these 631 issues is taken either from Moody's rating watch list, or from Thompson One Banker. The former list is a relatively complete history of Moody's long term rating assignments for both individual bonds and issuers, and for US and non-US corporate and sovereign bonds, including issuer names, locations, ISIN, bond issuance dates, maturity dates, ratings and coupons. The latter list provides detailed reports about subordinated bond issues in the primary market, including the basic information mentioned above, along with ratings from S&P and Fitch II, yields of new issuance, basis point spreads between benchmark securities (such as UKGILT), underwriters, etc. The market-index data is from

DataStream, which provides a complete list of all index variables which have been employed for the sample period. Rating classifications is shown in Table 2.2, and detailed information on sample characteristics is provided in Table 2.3-2.5.

Table 2.2 Rating Classes

Table 2.2 reports the rating classification based on Moody's, Standard & Poor (S&P), Fitch and Moody's Long Term issuer ratings (MLTR). Ratings are sorted out from 1 to 5 according to the rating scales where rating 1 represents the highest rating while rating 5 refers to the lower ratings.

Rating	Moody's	S&P	Fitch	MLTR
1	Aaa	AAA	AAA	Aaa
2	Aa1,Aa2,Aa3	AA+,AA,AA-	AA+,AA,AA-	Aa1,Aa2,Aa3
3	A1,A2,A3	A+,A,A-	A+,A,A-	A1,A2,A3
4	Baa1,Baa2, Baa3	BBB+,BBB,BBB-	BBB+,BBB,BBB-	Baa1,Baa2,Baa3
5	Lower ratings	Lower ratings	Lower ratings	Lower ratings

Table 2.3 Sample Descriptive Statistics Summary by Rating Classes

Table 2.3 shows the sample descriptive statistics distributed by rating classes over the period 1997-2009. Panels A, B, C and D indicate statistics summaries for Standard & Poor's issue ratings at launch, Moody's issue ratings at launch, Fitch issue ratings at launch and Moody's long term issuer rating, respectively.

		Spreads (b.p)					Amount (USD mil)	
Rating Classes	No. of issuance	Mean	Median	Min	Max	Standard Deviation	Total	Average
Panel A. Standard & Poor's issue ratings at launch								
1	19	50.50	35.00	0.00	325.00	73.59	5442.85	286.47
2	111	74.14	48.00	0.00	290.00	69.58	55811.58	502.81
3	279	112.37	94.00	0.00	659.00	103.34	156007.83	561.18
4	98	158.28	162.50	0.00	565.00	104.77	18017.16	183.85
5	124	181.27	99.00	0.00	933.00	212.43	22227.59	180.71
Panel B. Moody's issue ratings at launch								
1	15	50.73	29.00	0.00	325.00	83.30	5815.61	387.71
2	212	99.07	72.50	0.00	659.00	92.31	131176.57	618.76
3	182	106.51	85.00	0.00	633.00	100.56	80438.86	444.41
4	96	145.30	141.50	0.00	565.00	110.08	18147.54	189.04
5	126	185.94	117.50	0.00	933.00	209.37	21928.42	175.43
Panel C. Fitch issue ratings at launch								
1	8	78.44	35.75	0.00	315.00	104.22	3563.76	445.47
2	137	111.74	67.50	0.00	659.00	113.78	108220.84	789.93
3	75	106.80	100.00	0.00	438.00	81.97	27796.63	370.62
4	57	167.44	165.00	0.00	491.00	106.34	7566.64	132.75
5	354	127.23	83.50	0.00	933.00	150.68	110359.13	313.52
Panel D. Moody's long term issuer rating								
1	34	72.29	55.00	0.00	236.00	71.54	14713.20	432.74
2	288	110.46	75.00	0.00	659.00	111.14	154079.54	536.86
3	177	114.85	95.00	0.00	633.00	106.69	68685.99	390.26
4	30	201.17	175.00	0.00	933.00	199.77	5862.89	195.43
5	98	175.14	120.00	0.00	896.00	193.66	13749.99	140.31

Table 2.4 Sample Descriptive Statistics Summary by Year and Currency

Panel A and B in Table 2.4 report the descriptive statistics of alternative measurements of the default risk: S&P, Moody's, Fitch and MLTR distributions are sorted out by year and currency, respectively.STG is a dummy variable and equals to one if the issue currency is Sterling; USD is a dummy variable and equals to one if the issue currency is US dollar while EURO is also a dummy variable and equals to one if Euro is the issue currency.

		Average rating at launch				Spreads(b.p)				Amount (USD mill)	
Panel A. Distribution by Year											
Year	No.	S&P	Moody	Fitch	MLTR	Mean	St.dev	Min	Max	Total	Average
1997	24	3.71	3.42	5.00	3.04	109.25	127.47	0.00	550.00	3894.50	162.27
1998	23	3.83	3.48	4.87	3.00	202.30	249.01	0.00	933.00	3363.95	146.26
1999	42	3.38	3.31	4.79	3.17	198.16	176.58	0.00	707.00	13219.75	314.76
2000	71	3.31	3.32	4.28	2.77	127.63	108.41	0.00	445.00	11282.15	158.90
2001	106	2.96	3.23	4.01	2.96	117.14	108.34	0.00	515.00	25897.54	244.32
2002	97	3.33	3.29	3.94	2.86	110.23	122.62	0.00	896.00	17451.70	179.91
2003	46	3.13	2.59	3.83	2.65	76.88	87.57	0.00	445.00	25048.79	544.54
2004	33	3.30	3.09	3.97	2.55	94.00	122.76	0.00	594.00	20849.39	672.56
2005	44	3.64	3.32	2.93	2.67	97.27	117.56	0.00	450.00	24419.68	554.99
2006	50	3.48	3.12	3.58	2.66	94.43	85.50	0.00	315.00	26008.99	520.18
2007	57	3.39	3.00	3.33	2.68	130.73	132.14	0.00	659.00	44998.29	789.44
2008	30	2.93	2.53	2.67	2.20	184.47	131.87	0.00	450.00	35121.39	1170.71
2009	8	3.88	3.88	4.00	3.00	266.75	265.05	0.00	633.00	5950.89	743.86
Panel B. Distribution by Currency											
Currency	No.	S&P	Moody	Fitch	MLTR	Mean	St.dev	Min	Max	Total	Average
STG	288	3.35	3.31	4.17	2.96	147.16	121.56	0.00	638.00	89008.13	309.06
USD	152	3.36	3.05	3.73	2.68	137.81	172.43	0.00	933.00	85880.45	565.00
EURO	156	3.31	3.19	3.86	2.65	87.13	106.03	0.00	600.00	77014.49	493.68
Others	35	2.80	2.43	3.86	2.51	45.83	45.32	0.00	225.00	7605.35	217.30

Table 2.5 Sample Summary Statistics

Table 2.5 shows the summary statistics for sub-debt characteristics, accounting variables and market conditions of the whole sample. Panel A refers to the variables of sub-debt characteristics. MATU is the time to maturity of issue; AMOUNT is the natural log value of the US dollar-equivalent amount of issue; SPREAD is the difference between the yields to maturity of sub-debt at launch of issuance and the yield to maturity of corresponding currency Treasury security with a similar maturity. Panel B shows the relevant accounting variables. LEV is the ratio of total liabilities to the book value of equity; NLTA is the ratio of net loans to total assets; EITA is the ratio of equity investments to total assets; LIQ is the ratio of liquid assets to customers' deposits and short term funding; LLRGL is the ratio of loan loss reserves to total loans; ROA is the ratio of annual net income to the average of the preceding and current year-end assets; SIZE is the natural log value of issuing bank's total assets; coverage is the interest coverage ratio; Z-score is the ratio of the sum of equity capital to total assets and ROAA (return on average assets before taxes) to standard deviation of ROAA. FTSE100, FTSEURO, NASDAQ, NIKKEI, LIBOR and EUROLIBOR in Panel C are market condition variables to examine whether the booming of sub-debt is caused by the market discipline effect.

Variable	No.	Mean	Median	Min	Max	St.dev	25th Percentile	75th Percentile	Skewness	Kurtosis
Panel A. Sub-debt Characteristics										
MATU	631	14.65	10.15	0.16	42.68	10.80	6.09	20.30	1.10	3.01
AMOUNT	631	5.17	5.52	-0.98	8.05	1.59	3.92	6.46	-0.74	2.98
SPREAD	631	124.45	90.00	0.00	933.00	133.05	30.00	175.00	2.06	9.15
Panel B. Accounting Variables										
LEV	523	22.44	20.86	0.20	404.42	26.79	13.79	26.99	11.16	158.85
NLTA	507	0.55	0.58	0.00	8.43	0.78	0.31	0.65	8.28	84.27
EITA	523	0.13	0.05	0.00	0.87	0.19	0.03	0.07	2.16	6.47
LIQ	504	2.33	0.02	0.00	305.17	19.52	0.01	0.05	11.69	153.33
LLRGL	401	0.01	0.01	0.00	0.06	0.01	0.01	0.01	2.08	11.95
ROA	469	2.31	1.15	-88.53	31.57	7.66	0.83	3.02	-5.95	88.75
Coverage	505	2.69	0.81	-3	121.5	8.52	0.47	1.29	7.84	87.24
Z-Score	498	20.64	4.64	-1.40	431.99	8.52	1.17	12.65	5.38	39.29
SIZE	523	5.00	5.33	1.08	6.38	1.04	4.54	5.66	-1.46	4.68
Panel C. Market Condition Variables										
FTSE 100	631	5447.86	5430.31	3436.05	6724.54	826.90	4908.40	6170.42	-0.41	2.12
FTSEURO	584	3187.79	3217.27	1824.34	4150.76	543.18	2804.88	3617.96	-0.41	2.38
NASDAQ	542	6081.13	5485.36	3290.41	14759.31	2302.33	4868.94	6332.03	1.89	6.30
NIKKEI	631	13564.59	13175.49	7838.83	20833.21	3131.97	10882.18	16312.61	0.20	1.92
LIBOR	631	5.04	4.98	0.66	7.81	1.10	4.13	5.86	-0.03	3.89
EUROLIBOR	584	3.47	3.42	0.72	5.13	0.97	2.68	4.41	-0.06	2.07

Table 2.6 presents correlations among employed variables. With regard to correlations between subordinated debt characteristics, spreads have low correlations on issuing amount (0.0292) and maturity (0.0681). Correlations between accounting variables are low with the exceptions of the correlation between NLTA (the ratio of net loans to total assets) and EITA (the ratio of equity to total assets) with the value of 0.5576; and correlation between LIQ (the ratio of liquid assets to customers' deposits and short term funding) and ROA with the value of 0.5388; size is also relatively high compared with leverage ratio (0.4282) and ROA (0.5456). Results indicate that S&P ratings and Moody's ratings are comparatively close (0.6816). Also, the correlation between Moody's bond rating and Moody's Long Term rating on Banks is relatively high (0.4347). Market condition variables have relatively higher correlations between variables. This result is not coincidental since stock markets are highly-liquid.

Table 2.6 Correlation

	Amount	Spread	Maturity	S&P	Moody	Fitch	MLTR	LEV	NLTA	EITA	LIQ	LLRGL
Amount	1.0000											
Spread	0.0292	1.0000										
Maturity	-0.1365	0.0681	1.0000									
S&P	-0.2259	0.3165	0.0274	1.0000								
Moody	-0.3637	0.3188	0.0783	0.6816	1.0000							
Fitch	-0.3994	0.0555	-0.0200	0.2100	0.3134	1.0000						
MLTR	-0.3211	0.2070	-0.0541	0.3492	0.4347	0.2703	1.0000					
LEV	-0.1233	0.0127	0.0504	0.0252	0.0041	-0.0013	0.0555	1.0000				
NLTA	0.0778	-0.0335	0.0438	-0.0294	-0.1318	-0.0731	-0.0687	0.1791	1.0000			
EITA	0.0693	-0.0185	0.0452	0.0073	-0.0531	-0.0863	-0.0207	-0.0473	0.5576	1.0000		
LIQ	-0.0369	-0.0348	-0.0221	0.0708	0.1336	0.0773	0.1308	-0.2016	-0.0092	0.0592	1.0000	
LLRGL	0.063	-0.0444	-0.0458	-0.0471	0.0090	0.0268	0.0266	-0.3026	0.0240	0.1143	0.2521	1.0000
Size	-0.1036	0.0582	0.0090	0.0659	0.0882	-0.0258	0.0715	0.4282	0.0088	-0.2747	-0.2895	0.0196
ROA	-0.0658	-0.0312	-0.0044	0.0496	0.0899	0.1142	0.0909	-0.2815	-0.0147	0.1897	0.5388	-0.0303
FTSE100	-0.0048	0.0490	0.0336	0.0143	-0.0119	0.0886	-0.0308	0.1792	0.0110	-0.0313	0.0105	-0.0108
Nikke225	-0.0285	0.0494	0.0316	0.0251	0.0120	0.0597	-0.0340	0.1240	-0.0308	-0.0278	0.0279	-0.0025
LIBOR	0.0432	0.0178	-0.0162	-0.0330	-0.0502	0.0751	-0.0196	0.2338	0.0304	-0.0159	-0.0267	-0.0089
EuroLibor	0.0768	0.0505	0.0150	-0.1212	-0.1035	0.1284	-0.0383	0.1925	0.0556	-0.0831	-0.0667	-0.0400
Coverage	-0.0575	0.1039	-0.0407	0.1724	0.1875	0.0998	0.0499	-0.1352	-0.0207	0.0009	0.0368	-0.1911
Z-score	-0.025	0.0465	0.1142	-0.0129	0.0131	0.0754	-0.0773	0.0423	-0.0144	-0.0853	-0.0544	-0.0564

Table 2.6 *Continued*

	Size	ROA	FTSE100	Nikke225	LIBOR	EuroLibor	Coverage	Z-score
Size	1.0000							
ROA	-0.5456	1.0000						
FTSE100	-0.0074	-0.0044	1.0000					
Nikke225	-0.0323	0.0122	0.8931	1.0000				
LIBOR	0.0550	-0.0874	0.8402	0.7760	1.0000			
EuroLibor	0.0356	-0.0733	0.6463	0.4002	0.7271	1.0000		
Coverage	-0.1376	0.0636	0.1026	0.1180	0.0589	0.0233	1.0000	
Z-score	0.0010	-0.0286	-0.1518	-0.0519	-0.1407	-0.1757	-0.0441	1.0000

2.5 Empirical Results

2.5.1 Impacts of Traditional Rating Agencies on Sub-debt Spreads

This section examines whether the ratings on sub-debt at launch assigned by traditional rating agencies (S&P, Moody's and Fitch in our study) impact on sub-debt spreads. Table 2.7 shows that results of OLS estimations for conventional issue ratings (as scaled in table 2.2) are used as proxies for RISK in equation (2.1) during the period 1997 to 2009. The data is constructed for OLS regression as cross-section because the spreads are fixed on the issuance. Coefficients for estimated parameters are reported, as well as the coefficients for constant terms. Test statistics for model specific and goodness of fit, such as F statistics for testing whether rating coefficients are jointly different from zero, and adjusted R^2, are reported in table 2.7.

Columns (1), (2) and (3) of Table 2.7 estimate the coefficients when conventional issue ratings are used as proxies for rating risks in Equation (2.1). All S&P rating dummies are statistically significant at 1% level with the exception of rating =2 and

rating =3 in the issuing specification (Aaa/AAA is the omitted rating category). Moody's traditional ratings are similar. The monotonic pattern of S&P and Moody's dummy coefficients might due to high correlation between these two ratings (0.6816, as reported in Table 2.6). Fitch rating dummies are also significantly related to the spreads at 1% level, except the AAA rating (BBB-/BBB/BBB+ is the omitted rating category). These results indicate that spreads rise when rating worsen. However, these results might reveal the potential issues of independence and accuracy of rating agencies. Adjusted R^2 of 0.1440 and 0.1375, respectively, indicate that ratings and control variables explain a relative portion of SND spreads' cross-sectional variability.

Table 2.7. Regressions of Spreads on Rating Variables

Table 2.7 reports the standard OLS regression results of spreads on rating variables over the sample period 1997-2009. The data is constructed for OLS regression as cross-section. SPREAD is the difference between the yields to maturity of sub-debt at launch of issuance and the yield to maturity of corresponding currency Treasury security with a similar maturity; R1, R2, R3 and R4 are rating dummies which are defined as shown in Table 1. AMOUNT is the natural log value of the US dollar-equivalent amount of issue; MATU is the time to maturity of issue; STG is a dummy variable and equals to one if the issue currency is Sterling; USD is a dummy variable and equals to one if the issue currency is US dollar while EURO is also a dummy variable equals to one if Euro is the issue currency. All OLS regressions are robust with the White heteroskedasticity estimator of variance. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

Variable	S&P	Moody's	Fitch	MLTR
	(1)	(2)	(3)	(4)
R1	-------	--------	87.8743	-------
			[0.055]*	
R2	55.0128	67.0636	62.9086	67.0636
	[0.072]*	[0.043]**	[0.004]***	[0.043]**
R3	71.6507	76.6832	68.9458	76.6832
	[0.013]**	[0.020]**	[0.002]***	[0.020]**
R4	129.037	133.078	------	133.078
	[0.000]***	[0.000]***		[0.000]***
R5	157.8213	167.788	44.9296	167.788
	[0.000]***	[0.000]***	[0.016]**	[0.000]***
AMOUNT	0.0398	0.0418	0.0212	0.0419
	[0.001]***	[0.001]***	[0.117]	[0.001]***
MATU	0.6251	0.3902	0.2827	0.3902
	[0.203]	[0.047]	[0.584]	[0.427]
STG	70.2045	59.1664	86.6025	59.1664
	[0.003]***	[0.014]**	[0.001]***	[0.014]**
USD	55.5216	49.765	73.2442	49.7655
	[0.024]**	[0.044]**	[0.004]***	[0.044]**
EURO	13.955	3.9679	33.4643	3.9674
	[0.570]	[0.874]	[0.198]	[0.874]
SIZE	12.1951	14.5742	6.8176	14.5742
	[0.016]**	[0.004]***	[0.194]	[0.004]***
CONS	117.765	114.4018	53.3087	114.4018
	[0.000]***	[0.015]**	[0.213]	[0.015]**
N	631	631	631	631
R^2	0.1604	0.1540	0.0800	0.1540
Adj-R^2	0.1440	0.1375	0.0620	0.1374
F	9.78***	9.32***	4.45***	9.32***

The fourth specification of Equation (2.2) uses Moody's Long Term issuer rating to test whether sub-debt investors sense banks' risk profile. Column (4) in Table 2.7 shows the estimated coefficients for MLTR rating dummies. All dummies have positive and statistically significant coefficients (Aaa is omitted). This result indicates when ratings on issuer worsen and spreads rise in correspondence with the results of issue ratings. The correlation between issuer and issue ratings is comparatively high (0.3492, 0.4347 and 0.2703, respectively, as reported in Table 2.6).

MATU has a positive coefficient as expected, but surprisingly without any statistical significance[8]. One possible explanation for this result is based on the nature of SND, which investors usually target as a long-term investment. AMOUNT has positive and statistically significant coefficients in both S&P and Moody's specifications, but insignificant in Fitch ratings regression. The potential reason for this result is that smaller issues are usually issued by smaller banks, which do not issue as frequently as larger banks. Sironi (2001 & 2003) gives an alternative explanation which is related to the rise of European banks sub-debt capital in two principle ways: private retail clients via distribution networks with private placements, which have a smaller average size and less bargaining power; and institutional investors via public issues.

STG (British pound) and USD (US Dollar) are the only currency dummy variables which show a positive and 1% level statistically significant coefficient. These results indicate that sub-debts issued in Sterling and US Dollars have higher

[8] In Sironi (2003), MATU is statistically significant at 1% level with spreads in the case of European banks

spreads than other sub-debts denominated by other currencies. This may be because Treasury security in British pounds and US dollars pay lower yields and result in sub-debt spreads, calculated by subtracting Treasury yields from sub-debt yields which tend to be higher.

2.5.2 Accounting Measures of Bank Risk and Variability of Sub-debt Spreads

Other empirical studies employing accounting variables linked with sub-debt yield spreads do not use the link between sub-debt and accounting-variables as an indicator of market discipline, they may only show that regulators and/or investors pay attention to accounting measures of risk. When comparing banks during different periods, two barriers arise.

First, many of the balance-sheet variables used as proxy for bank risk are not available for all the sub-debt issuing banks in the sample (such as LLRGL) for credit risk proxy. Because of this problem, bivariate linear regressions have been conducted between sub-debt spreads and individual accounting variables. The results are shown in Table 2.8.

Second, banks' accounting data is not available for all observation years in the sample. One possible reason is that a number of banks, building societies and bank holding companies may not have existed. Due to this problem, samples have been selected from 1997 onwards, for which large portions of banks' annual reports are

available. Another reason is that certain banks co-funded a program to raise sub-debt capital. For this reason, the leading bank has been chosen, or the one which invested the most in order to have an absolute control right (over 50%) as the observed bank.

Three important results emerge. First, accounting proxies of bank risk have relatively poor explanatory power regarding the UK banks' sub-debt spreads (estimated coefficients by bivariable OLS regression are reported in panel A, table 2.8). LEV has a positive and 1% level statistically significant coefficient, and the interest coverage ratio has a positive coefficient with 5% level significance. These results indicate that SND investors are more focused on issuers' leverage and capability to pay interest on outstanding debts. NLTA, EITA, LIQ and LLRGL never present statistically significant coefficients, suggesting that sub-debt investors do not consider these variables to be key predictors of bank risk. Unlike our key paper (Sironi, 2003), ROA does not appear to be significantly related to with the spreads, implying that investors in UK sub-debt market are not concerned with this bank risk measure as much as investors in other European markets.

Second, accounting variables do not provide strong joint explanatory power regarding sub-debt characteristics information, with the Adjusted R^2 not increasing significantly in the estimation reported in Column (10) in Table 2.9. The following results emerge as far as specific accounting variables are concerned: (1) Coverage has a positive and statistically significant sign. (2) LEV still has a positive coefficient but not in any reported significant level. (3) NLTA and LIQ have negative coefficients; LLRGL and ROA have positive coefficients, and these variables are never statistically

significant. (4) EITA has a positive coefficient instead of a negative one as reported in Table 2.8. (5) Z-score coefficient's sign is not as expected. These results confirm the interpretation that investors of the UK sub-debt market rarely focus on banks' balance-sheet information, besides the interest coverage ratio, which indicate how easy the issuer can pay interest on outstanding debts.

Third, consistent with the results obtained with the help of the stand-alone accounting measure based specifications (Panel A of Table 2.8), size, a natural log of issuing banks' total assets, fails to display at statistically significant at any reported level (as shown in Table 2.9). One potential explanation for this result is that, besides the economic advantages such as a higher portfolio diversification, more importantly, large banks have regulatory advantages, namely "too-big-to-fail" (TBTF) guarantees (Sironi, 2003; Balasubramnian and Cyree, 2011). Therefore, size fails to be a key factor for market participants.

Table 2.8 Bivariate Linear Regressions on Accounting Measures and Market Condition Variables

Table 2.8 shows the regression results of spreads on bank accounting variables and market condition variables calculated by the traditional OLS regression which is robust with the White heteroskedasticity estimator of variance. The dependent variable is the spreads between yields (at issuance) on SND and a Treasury security of comparable maturity denominated in the same currency. LEV is the ratio of total liabilities to the book value of equity; NLTA is the ratio of net loans to total assets; EITA is the ratio of equity investments to total assets; LIQ is the ratio of liquid assets to customers' deposits and short term funding; LLRGL is the ratio of loan loss reserves to total loans; ROA is the ratio of annual net income to the average of the preceding and current year-end assets; SIZE is the natural log value of issuing bank's total assets. AMOUNT is the natural log value of the US dollar-equivalent amount of issue; MATU is the time to maturity of issue; Coverage is the interest coverage ratio; Z-Score is the z-score of each firm on the date of issuance. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

Variables	Coef. (p-value)	Cons.Coef (p-value)	N	F-statistics (p-value)	R^2	Adj-R^2
Panel A. Accounting measures						
LEV	0.6285	104.3855	523	10.0000	0.0014	0.0005
	[0.002]***	[0.000]***		[0.017]**		
NLTA	-4.4869	129.9521	507	0.8300	0.0016	0.0003
	[0.525]	[0.000]***		[0.364]		
EITA	-34.0297	122.8801	523	0.4300	0.0011	0.0008
	[0.235]	[0.000]***		[0.514]		
LIQ	-0.1584	119.9081	504	0.1500	0.0017	0.0003
	[0.728]	[0.000]***		[0.699]		
LLRGL	-75.7141	127.7221	401	1.0500	0.0026	0.0001
	[0.303]	[0.000]***		[0.307]		
ROA	0.1394	117.9081	469	0.0400	0.0021	0.0001
	[0.849]	[0.000]***		[0.838]		
Coverage	1.3351	115.5014	505	4.37	0.0086	0.0066
	[0.037]***	[0.0000]***		[0.037]		
Z-Score	0.0784	117.6263	498	0.51	0.01	0.01
	[0.476]	[0.000]***		[0.476]		
SIZE	-4.6100	150.2270	523	0.6500	0.0012	0.0007
	[0.421]	[0.000]***		[0.421]		
Panel B. Market condition variables						
FTSE 100	0.0150	43.3800	631	5.4300	0.0086	0.007
	[0.020]**	[0.218]		[0.020]**		
FTSEURO	0.0260	40.7150	584	7.0400	0.0119	0.0103
	[0.008]***	[0.199]		[0.008]***		
NASDAQ	0.0020	109.9500	542	0.9100	0.0017	0.0002
	[0.340]	[0.000]***		[0.340]		
NIKKEI	0.0030	81.8110	631	3.4600	0.0055	0.0039
	[0.063]*	[0.001]***		[0.063]*		
LIBOR	7.1740	88.2570	631	2.2100	0.0035	0.0019
	[0.138]	[0.000]***		[0.138]		
EUROLIBOR	14.2020	74.1200	584	6.7100	0.0114	0.0097
	[0.010]**	[0.000]***		[0.010]**		

Table 2.9 Linear Regressions of Spreads on Bank Accounting Variables

Table 2.9 shows the regression results of spreads on bank accounting variables calculated by the traditional OLS regression which is robust with the White heteroskedasticity estimator of variance. The dependent variable is the spreads between yields (at issuance) on SND and a Treasury security of comparable maturity denominated in the same currency. LEV is the ratio of total liabilities to the book value of equity; NLTA is the ratio of net loans to total assets; EITA is the ratio of equity investments to total assets; LIQ is the ratio of liquid assets to customers' deposits and short term funding; LLRGL is the ratio of loan loss reserves to total loans; ROA is the ratio of annual net income to the average of the preceding and current year-end assets; Coverage is the interest coverage ratio; Z-Score is the z-score of each firm on the date of issuance; SIZE is the natural log value of issuing bank's total assets. AMOUNT is the natural log value of the US dollar-equivalent amount of issue; MATU is the time to maturity of issue. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

Variable	Models									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
AMOUNT	0.0088	0.0103	0.0109	0.011	0.0117	0.0085	0.0139	0.0124	0.015	0.0097
	[0.461]	[0.385]	[0.367]	[0.364]	[0.345]	[0.518]	[0.261]	[0.332]	[0.229]	[0.509]
MATURE	0.9299	0.9086	0.9988	0.9942	1.1233	0.9531	0.8954	0.9342	0.8165	0.7312
	[0.063]*	[0.068]*	[0.051]**	[0.051]**	[0.030]**	[0.082]*	[0.085]*	[0.073]*	[0.122]	[0.214]
SIZE	9.1235	4.9404	8.0136	8.8364	6.2213	7.676	12.7345	13.7051	13.6232	11.4421
	[0.077]*	[0.354]	[0.172]	[0.193]	[0.340]	[0.364]	[0.104]	[0.060]*	[0.063]*	[0.301]
LEV		0.5778	0.5945	0.6007	0.5933	-0.066	-0.0635	0.1097	-0.1775	0.1568
		[0.006]***	[0.004]***	[0.004]***	[0.005]***	[0.915]	[0.910]	[0.851]	[0.757]	[0.828]
NLTA			-8.2746	-8.9391	-8.434	-6.7119	-5.9591	-5.845	-6.4023	-6.9503
			[0.245]	[0.242]	[0.238]	[0.433]	[0.420]	[0.421]	[0.388]	[0.451]
EITA				8.8164						21.3832
				[0.810]						[0.735]
LIQ					0.0162					-12.4271
					[0.972]					[0.769]

Table 2.9 *Continued*

LLRGL						-6.5978				59.489
						[0.387]				[0.956]
ROA							-0.1345			0.4621
							[0.939]			[0.854]
COVERAGE								2.6223		2.4236
								[0.007]***		[0.043]**
Z-SCORE									0.0623	0.0786
									[0.573]	[0.473]
CON	55.3009	62.9542	49.4475	44.3506	56.8955	75.2469	39.0372	25.0065	36.6566	37.5495
	[0.053]*	[0.028]**	[0.112]	[0.239]	[0.107]	[0.090]	[0.329]	[0.469]	[0.573]	[0.545]
N	523	523	523	507	490	402	481	477	475	523
R^2	0.0124	0.0270	0.0327	0.0328	0.0323	0.0139	0.0168	0.0299	0.017	0.0221
Adj-R^2	0.0067	0.0195	0.0230	0.0212	0.0203	0.0011	0.0043	0.0175	0.0044	0.0089
F	2.18	3.59**	3.38***	2.82***	2.69**	0.93	1.35	2.41	1.35	0.71

2.5.3 Market Conditions and the Issuance of Subordinated Debt

In this section a range of financial variables is employed to capture the influence of general economic and financial market conditions since sub-debt spreads may be affected by business cycles. The FTSE100 index captures the performance of the UK stock market, while the FTSEuro index indicates the European stock markets' fluctuations. Also, the NASDAQ share index is used to represent the US market since the US dollar is one of the main sub-debt issuing currencies, and the NIKKEI index indicates the Japanese market. In addition to this, indexes from stock markets, LIBOR-3M and EuroLibor-3M, are also used to capture interest rates.

Panel B of Table 2.8 shows results of bivariate regressions of spreads on a matrix of market index. All market condition variables have positive impacts on credit spreads. FTSE100 is statistically significant at 5% level and FTSEuro is at significant 1% level, while the coefficient of NIKKEI is at 10% level and NASDAQ does not show any significant signs. As an indicator of interest rates, LIBOR has no significant relation to spreads. However, the coefficient on EuroLibor appears positive with a 5% level statistical significance. These results indicate that spreads are affected by the stock market (another highly-liquid capital market) and when the stock market levels out sub-debt issuing spreads rise. Moreover, spreads of sub-debt issued by UK banks are more sensitive to European financial markets.

To test the appropriate specification of a model by adding one or more explanatory variables, an F-test is conducted and statistics which are reported in Table 2.10 are tested. Adjust-R^2 values are generally greater than the model excluding market conditions. Amount has positive coefficients in most of the models, and negative coefficients in model (6) and (7). FTSE 100 has a positive and statistically significant coefficient at 5% level in model (1), and similar results as FTSEuro index.

These results indicate that stock market has positive and significant impact on SND spreads. When stock market booming, the spreads rose. Also, EuroLibor shows positive and 5% level statistically significant relation with the SND spreads. However, as a similar and alternative specification, LIBOR fails to show significant efficient as expected. Recent LIBOR scandal may explain this result, since the LIBOR has been manipulated by large banking groups and it failed to be an effective market risk indicator. Besides FTSE100, FTSEuro and EuroLibor, there is no strong evidence that other market condition variables provide additional information to investors over sub-debt's own characteristics. The possible reason for this may be that the sub-debt market is less liquid than stock markets. Therefore, this result can be interpreted as market investors considering sub-debt as a highly-diversified investment instrument. Since most sub-debts are long term, investors are sensitive to issuers' risk portfolios and take yield spread as an effective instrument for monitoring issuing banks.

Table 2.10 Regression Estimations of Spreads on Market Condition Variables

Table 2.10 reports the linear regressions of spreads on market condition measurements. The results are calculated under the traditional OLS regression which is robust with the White heteroskedasticity estimator of variance. The dependent variable is the spreads between yields (at issuance) on SND and a Treasury security of comparable maturity denominated in the same currency. FTSE100, FTSEURO, NASDAQ, NIKKEI, LIBOR and EUROLIBOR are market condition variables that mainly represent worldwide stock market indexes. AMOUNT is the natural log value of the US dollar-equivalent amount of issue; MATU is the time to maturity of issue; P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Models						
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AMOUNT	0.0012	0.0021	0.0089	0.0068	0.0015	-0.0012	-0.0004
	[0.928]	[0.874]	[0.950]	[0.962]	[0.914]	[0.927]	[0.980]
MATURE	0.2162	0.2988	0.3328	0.3435	0.3548	0.3561	0.3984
	[0.700]	[0.595]	[0.571]	[0.552]	[0.546]	[0.527]	[0.499]
SIZE	-5.1168	-3.1068	-4.1964	-4.1074	-3.4304	-4.492	-3.2868
	[0.371]	[0.388]	[0.512]	[0.521]	[0.597]	[0.435]	[0.612]
FTSE100	0.017		0.0162	0.0289	0.0343		0.0254
	[0.018]*		[0.507]	[0.299]	[0.236]		[0.397]
FTSEuro		0.028	0.0189	0.0178	0.0174		0.0082
		[0.011]**	[0.614]	[0.634]	[0.643]		[0.832]
NASDAQ			-0.0047	-0.0035	-0.0027		-0.0026
			[0.221]	[0.401]	[0.533]		[0.545]
NIKKEI				-0.0046	-0.0043		-0.0006
				[0.342]	[0.377]		[0.920]
LIBOR					-8.1701	-5.6068	16.8713
					[0.491]	[0.524]	[0.238]
EUROLIBOR						19.6228	13.3581
						[0.022]**	[0.274]
CON	56.3607	46.6181	24.0317	10.4726	9.664	102.436	32.0611
	[0.253]	[0.335]	[0.646]	[0.847]	[0.859]	[0.014]**	[0.581]
N	523	494	461	461	461	494	481
R^2	0.0122	0.0146	0.0186	0.0206	0.0216	0.0157	0.0242
Adj-R^2	0.0046	0.0065	0.0057	0.0054	0.0043	0.0056	0.0047
F	1.6	1.81	1.44	1.36	1.25	1.55	1,24

2.6 Conclusion

There are four main conclusions which emerge from the empirical work presented in this chapter. Firstly, traditional rating agencies, such as Moody's, S&P and Fitch have a significant impact on sub-debt issuing and issuing banks. When ratings worsen, the spreads rise. Secondly, sub-debt investors act rationally when discriminating between different risk profiles of UK banks and price them accordingly. Thirdly, some bank risk accounting measures have little explanatory power regarding variability in sub-debt spreads, but provide additional joint explanatory power over sub-debt's own characteristic information. Fourthly, market conditions, especially stock market conditions, have a significant impact on sub-debt yield spreads. Moreover, stock indexes, such as FTSE100 and FTSEuro, interest rate indicators such as EuroLibor have strong influence power to spread, indicating that the motivation of market participants investing in sub-debt is rational.

These findings have important implications for using the measurement of yield spreads as an effective method for disciplining issuing banks from the market and for further subordinated debt research in addition to mandatory subordinated debt policy. The correct and unbiased ratings issued by rating agencies are always of intense interest to academics and practitioners. The influences of ratings agencies have been aggrandized, and it does not seem possible to challenge their authority. However, this raises another question: who will supervise the rating agencies?

In addition, as can be seen from these findings, spread is an effective indicator because it contains timely and useful information on issuing financial institutions' risk portfolios and performance. Furthermore, sub-debt issuance in the UK is more active and more liquid than in the European markets. In addition, sub-debt investors use

yield spread as an instrument to monitor and control issuers' risk taking incentives, hence achieving stronger market discipline. However, there are obstacles for the UK sub-debt market as it becomes more powerful and a more effective instrument for market discipline. One major barrier is the TBTF effect. Although empirical analysis shows the absence of significant TBTF effect, in our sample, 72.27% of subordinated debts are issued by median- or large-sized financial institutions. The magnitude of coefficient on the log of total assets (Size) increases indicates that size affects all banks, and yield spreads reflect the market's perception that all large banks will be bailed out when default occurs.

Chapter 3 The Impacts of Subordinated Debt on Bank Efficiency

3.1 Introduction

As discussed in the previous chapter, subordinated debt provides reasonably reliable market signals, and investors are sensitive to issuing banks' risk portfolios. The main objective of this chapter is to investigate whether the issuing banks take these market signals and the pressure from investors seriously, or whether subordinated debt has forced market discipline upon issuing banks.

Morgan and Stiroh (2001), Sironi (2003) and Covizt et al. (2004b), employing cross-sectional data, have discovered that subordinated debt can constrain banks' risk-taking activities. Other scholars, such as Krishnan et al. (2005), argue that there is no evidence that subordinated debt can provide effective market discipline to banks' risk-taking motivations. To fill lacunae left by previous studies, panel data sets have been used, including subordinated debt issued by banks, bank holding companies and building societies in the UK in the period between 1997 and 2009, in order to examine the effects of changes in subordinated debt market signals (e.g. amounts and interests) on the performance of banks. Furthermore, checks have been made on whether market discipline has greater effect on bigger banks, and whether market discipline has increased during the financial crisis.

The potential contributions of this chapter are: first, to complement the plethora of empirical studies that focus mainly on the US subordinated debt market with a comprehensive analysis of the UK market; second, to investigate from a unique angle whether market discipline actually functions. Not only proxies of market discipline have been applied, but also changes in proxies. Furthermore, a consideration has been made as to whether issuing banks' size could affect market discipline over sub-debt's characteristics. Finally, lessons are drawn from the global financial crisis by

comparing the strength of market discipline just before and after the crisis.

The remainder of the chapter is organized as follows: Section 3.2 reviews existing studies on theoretical frameworks; section 3.3 briefly reviews literature on empirical studies; section 3.4 explains the methodology; section 3.5 reports the data and sample and section 3.6 interprets the empirical results and findings. Conclusions are presented in section 3.7.

3.2 Theoretical Literature Review

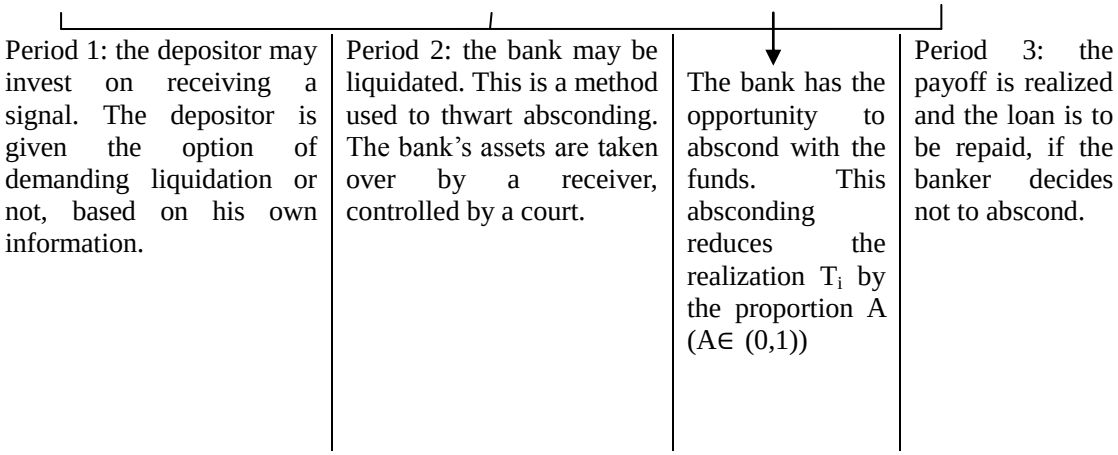
There has been vehement theoretical debate about whether subordinated debt can constrain banks' excessive risk-taking incentives and, hence, engender capacity to discipline banks. Previous studies outline three major approaches whereby debt holders (both junior and senior debts) can affect banks' risk-taking incentives. In the first approach (valuation effects) the issuing of bonds and debentures is a popular means to acquire capital, enlarge issuing banks' capital ratio, control leverages and portfolios, and affect banks' performance on capital adequacy and risk management. Requiring banks to issue a certain level of subordinated debt, or to convert a portion of assets to subordinated debt is one possible approach to efficient market discipline (Calomiris and Kahn, 1991; Kupiec 2002; Gorton and Santomoro, 1990).

In a second approach (cost effects) the market can discipline the banks by demanding higher or lower risk premiums of subordinated debt (e.g. Blum, 1999 &2002; Repullo 2004). With the third approach which addresses competition effects, the issuing of subordinated debt could increase or decrease the market value of banks' assets, hence enhancing or damaging banks' reputations and market competitiveness (Levonian, 2001; Niu, 2008 a&b).

3.2.1 Valuation Effects

The Contingent Claims valuation model, derived by Black and Sholes (1973), has been well expanded and applied. For example, Merton (1974) applies the valuation model to liability pricing in the case of a single issue of nonconvertible debt; Black and Cox (1976) expanded the model to consider multiple debt claimants.

The works by Gorton and Santomero (1990) and Calomiris and Kahn (1991) form one of the precursors that examine how debt can discipline banks by explaining that demandable debt has advantages in an incentive scheme for disciplining the banker, since the depositors can withdraw their deposits to punish a bank if they are unsatisfied with the bank's behaviour. Depositors assume that bankers are taking advantage of information asymmetry problems, since bankers can determine which projects are most worthy of financing. Gorton and Santomero (1990) and Calomiris and Kahn (1991) propose two models: a single deposit model, and a model for multiple depositors with independent signals. The timeline of these two models is as follows:



In period 0, the banks offer a profit-maximizing contracted deposit rate and the optimal contract can take one of the following four forms:

1) A simple non-liquidating contract
2) A simple liquidating contract; in this case, $AT_1 < P \leq M$.
3) A compound contract composed of two simple non-liquidating contracts ($\Lambda_b = \Lambda_g = 0$); in this case, $P_b \leq AT_1$ and $AT_1 < P_g \leq AT_2$
4) A compound contract composed of one simple liquidating contract and one simple non-liquidating contract ($\Lambda_b = 1, \Lambda_g = 0$); in this case, $AT_1 < P_b < P_g \leq AT_2$

T_1 and T_2 are two values of investment opportunity, and $T_2 > T_1$, A is the proportion that absconding reduces the realization value T_i, and $A \in (0,1)$. AT_i represents the "tax" on absconding. P is the amount that the banker promises pay to depositors. M is the value of assets reduced by liquidation in proportion L. b and g represent "bad" and "good" respectively.

If a compound contract has been chosen, then the depositor invests in the signal, otherwise he would not. If the depositor receives a bad signal, he liquidates the bank. If he receives a good signal, he will not liquidate the bank, but needs to run the risk of the banker's absconding. In other words, when the depositor invests in demandable debt, he can observe the risk-taking behaviour of banks. If he observes that banks have incentives to gamble, he can withdraw his deposit immediately to avoid loss. If he does not observe the banks, the banks may invest in gambling assets. If the depositor keeps his deposit in banks and obtains interest from the bank, he needs to be prepared to take the bank's insolvent risk. If there are multiple depositors entering into contracts with the banker, optimal contracts for the banker can maximize the banker's profitability.

For low-cost-information depositors, how demandable debt maintains incentives to invest in signals and report truthfully must be questioned. Calomiris and Kahn

(1991) assume that there is a sufficient amount of potential depositors and potential monitors, the cost of monitoring is low, the probability of monitors receiving a bad signal is slight, and there is little possibility of the value of the contract becoming a bad realization. From the viewpoint of individual depositors, the contract must have some constraints. High-cost-information depositors require receiving higher than expected return announcements and are willing to report signals truthfully in order to participate in the contract. Truthful reports give a higher return than untrustworthy reports. In the former case individual depositors are willing to invest, monitor and report observations. If a bank chooses to hold reserves (prudent assets), a small number of monitors can receive early payment without the bank being forced into receivership, hence optimal outcome can be achieved with a simple demandable-debt contract.

Levonian (2001) also proposes a contingent claims valuation model which models the subordinated debt as a contingent claim on the issuing bank's assets. Decreasing the value of the subordinated debt claim can affect the asset volatility and market value, and raise the bank's risks due to the increasing probability of default losses; therefore the bank's competitive advantage will be lower. Levonian (2001) employ the basic form is as follows:

$$\frac{ds}{d\partial} = DN'(z-\partial) - (B+D)N'(x-\partial) \qquad (3.1)$$

The first positive term on the right indicates that increased asset volatility will make the subordinated debt more likely to be fully paid. The negative second term signifies that in case of a rise in risk, the value of subordinated debt decreases. Overall, it shows that the value of subordinated debt falls when risk increases, as long as the bank remains solvent.

Kupiec (2002) proposes a modified credit VaR model, and claims that mandatory subordinated debt can help implement an internal model approach for regulatory capital requirements for credit risk:

$$E^{\eta}[Max[Min(A_1 - De^{rf}, Par_F), 0]]e^{-r_f M} \geq \beta A_0 \quad (3.2)$$

This gives the capital requirement when the minimum portion of a bank's assets is in subordinated debt. Therefore, if a bank overstates loan values, it is required to issue more subordinated debt, thus offering a larger buffer for the deposit insurer.

3.2.2Cost Effects

Many researchers use cost effects to examine relations between banks and subordinated debt.

Blum (1999&2002) provides a dynamic framework demonstrating whether subordinated debt can constrain the banks' risk-taking incentives, and concludes that the effect is ambiguous. If banks can commit a credible level of risk after debt issuance, subordinated debt can reduce the banks' risk-taking behaviour. On the assumption that banks cannot commit a level of risk, or creditors cannot accept a risk level that banks are given because the interest rate of subordinated debt is contracted, and banks' liability is limited, banks are easily induced to take excessive risks to gain higher profits and reduce costs. In this eventuality, rational debt holders ask for higher risk premiums as compensation. At the same time, heavy interest burdens force banks to choose high risk financial derivative products to earn more money in order to pay interest. In this case, subordinated debt cannot restrict the banks' risk-taking incentives and may even push the banks towards a riskier situation.

Blum (1999 & 2002) considers a single, risk-neutral bank, which only has one type of liability which is deposit and follows a simple time structure:

At time 0, a bank can invest its available funds. It has w_0 amount of initial stock of equity, supplies D_0 amount of deposit and two investment opportunities, a safe asset with (gross) return r_f ($r_f > 1$) and a risky asset with return rate $\tilde{r}$, $\tilde{r}$ within a two-point distribution:

$$\tilde{r} = \begin{cases} X & \text{with probability } p(X) \\ 0 & \text{with probability } 1-p(X) \end{cases}$$

At time 1, returns are realized, the bank is obliged to pay the cost of $C(D_0)$. Subsequently, a bank can invest in another asset.

At time 2, all investments are mature and final returns are realized.

Assuming that a bank raises a fraction ($\lambda, \lambda \in (0,1]$) of its capital via issuing subordinated debt, which is not covered by an insurance or safety net, Blum (2002) considers two eventualities: a bank can commit to any level of risk, or a bank cannot commit to any level of risk.

If a bank can credibly commit to a level of risk, then the subordinated debt creditor could charge high compensation for the banks' gambling incentives and the promised return (r_D) that the debt holders require satisfies:

$$P(X)r_D = r_f, \text{ or } r_D(X) = \frac{r_f}{p(x)} \tag{3.3}$$

which indicates that the higher the interest rate that the bank is promised, the higher the level of risk that the bank chooses. According to Blum (2002), the optimal level of risk that a bank needs to solve is as follows:

$$\max_x p(X)[XD - (1-\lambda)r_f D - \lambda r_D D] - (1 - p(X))C_B \tag{3.4}$$

s.t. $r_D = \frac{r_f}{P(X)}$

Formula (3.4) suggests that a bank's default cost with subordinated debt is higher than the default cost with deposit insurance. Market discipline through the use of subordinated debt leads to a lower risk than deposit insurance. This indicates that subordinated debt indeed reduces a bank's risk-taking incentives.

Conversely, a bank cannot commit to a level of risk. To change risk profiles quickly and substantially, a bank should replace its safety assets with highly flexible financial derivative products after the interest rate of subordinated debt is contracted. The subordinated debt creditors are hypothetically rational and can perfectly observe and anticipate the bank's risk choice. Therefore, the creditors will require a promised return rate due to the optimal risk level that a bank sets, and two conditions must pertain: subordinated debt creditors require expected returns to be at least equal to the risk-free interest rate, and banks always try to reach profit maximization. Where a bank chooses an increased risk level, subordinated debt holders require the promise of a higher interest rate, whereas an increased interest rate raises a bank's preferred risk level. Thus, these two conditions can influence and restrict each other, and the result yields the optimal risk level on which market discipline could work through subordinated debt. In case of a bank that cannot commit to a credible level of risk, market discipline through the use of subordinated debt (in the case of a bank being unable to commit to a reasonable risk level), is more risky than market discipline through the use of deposit insurance.

From the analysis above, it can be seen that Blum (1999 &2002) suggests the problematic incentive effects of subordinated debt. The fundamental reason for failure of market discipline through subordinated debt is lack of commitment to a risk level.

Because banks have a limited liability to investors, there is always the temptation to gamble for high profits. If banks cannot commit to a level of risk after issuing subordinated debt equal to the higher risk premium asked by creditors, banks are compelled to invest in risky financial products. Consequently, subordinated debt can foster banks' risk taking incentives.

3.2.3 Competition Effects

Employing competition effects to examine the relationship between banks and market discipline has recently become more prominent. Boot and Schmeits (2000) established a model to analyze the optimality of conglomeration. Both scholars show that conglomeration has benefits that compensate for ineffective market discipline. Repullo (2004) provides a dynamic model of imperfect competition in banking where banks can invest either in a prudent or in a gambling asset.

Based on this model, Caldwell (2007) develops a dynamic model of banking competition to determine which capital instrument is most effective in controlling banks' risk choices. Boyd et al. (2009) adopt the symmetric Cournot-Nash competition models to analyze in what way banks may invest in a riskless asset and how they may compete in deposit and risky loan markets.

Niu (2008 a&b) extends previous studies by introducing subordinated debt in a dynamic model of banking which examines whether a certain range of subordinated debt can constrain banks' risk-taking incentives. His papers show that a small amount of subordinated debt can reduce banks' gambling incentives. Compared with equity capital, subordinated debt costs much less. Due to limited liability, banks have incentives to chase higher profits, but higher profits also lead to higher risks.

In cases where subordinated debt creditors make investment decisions, they should check banks' risk portfolio. If debt holders consider portfolios too risky, they

should ask for a higher interest rate as risk premium for compensation. To avoid a higher interest payment, banks could change and smooth their risk portfolio, investing in safe assets instead of risky ones. Therefore, subordinated debt can constrain banks' risk-taking incentives.

Niu (2008 a) claims that a bank invests in two safe assets only if the regulator sets the amount of subordinated debt within a range. With the increase of the costs occurring only if the bank invests in risky assets after debt issuance, the lower bound on sub-debt decreases and whereas the upper bound on subordinated debt increases. In other words, a bank is less likely to invest in risky assets after it has issued a large amount of subordinated debt.

Niu (2008a)'s model shows that requiring banks to issue subordinated debt within a range motivates them to invest in safe assets before debt issuance, although the range may vary across countries depending on a number of factors such as the return of the safe asset and creditors' ability to assess banks' riskiness.

To support this theory, Niu (2008 b) studies a dynamic model of banking showing that subordinated debt can constrain banks' risk-taking incentives. At the stage of mobilizing deposits, if banks offer a deposit rate higher than the expected return of prudent assets, this situation might be observed by subordinated debt holders to push banks to invest in gambling assets after debt issuance. To compensate for risk, subordinated creditors would require a risk premium from a bank. At the stage of allocating assets, paying off debt could reduce a banks' solvency. Since the interest rate of subordinated debt would have been contracted, the larger the amount of subordinated debt, the stronger the incentives for banks' gambling.

When the regulator imposes both a subordinated debt requirement and a capital requirement, the prudent equilibrium exists only if the capital requirement is set

within a range. Two bounds of capital requirements decrease if a profit margin decreases. Hence the more profitable banks are the lower capital requirements should be set. At the same time, bounds have a positive correlation with the spread between successive returns of gambling assets and that of prudent assets. Therefore, the higher the returns of a gambling asset are, the higher the capital requirement should be set; the higher the probability of gambling asset failing is, the lower the capital requirement needed.

Another vital question concerns how subordinated debt requirement and equity capital requirement can be balanced. Niu (2008 b) proposes that the critical amount for subordinated debt. When the critical amount of subordinated debt is greater than the minimum amount of subordinated debt bank issues, subordinated debt requirement reacts to equity capital requirement. That means that an increase of subordinated debt requirement decreases capital requirement. When the minimum amount of subordinated debt that a bank issues equals or is greater than the critical amount, the two requirements have a positive correlation and an increase of subordinated debt requirement increases capital requirement. Regulators are inclined to adopt a two-tier capital structure.

The majority of banks believe that the cost of subordinated debt is lower than equity capital. One reason for this is that issuing subordinated debt could lead to a tax reduction on the interest paid to creditors. Furthermore, according to certain empirical studies from the USA during the 1990s, the cost of raising equity capital is higher than the cost of raising subordinated debt. Besides, issuing subordinated debt does not involve cash transactions and could therefore help to reduce agency costs. Thus, empirical evidence (e.g. Bank for International Settlements, 2001) shows that banks consider subordinated debt to be a better funding instrument than equity capital.

3.3 Empirical Literature Review

Previous empirical studies produce conflicting results on the issue of subordinated debt. Certain researchers employ cross-sectional data, and find that subordinated debts can constrain banks' risk taking (Morgan and Stiroh, 2001; Sironi, 2003; Coviz et al, 2004b). Other scholars find that there is no change to banks' risk-taking behaviour before and after debt issuance. For example, the Board of Governors of the Federal Reserve System (1999) finds that subordinated debt's reflection on risk-taking behaviour of banking organizations fades as time goes by, and does not have a significant effect on accounting measures. Krishnan et al. (2005) also find no evidence that subordinated debt can control risk taking; neither the raw risk characteristics nor the risk-matched-firm adjusted characteristics change significantly after a banking firm first issues subordinated debt. This section summarises empirical literature which addresses the different effects that subordinated debt can have on banks, i.e. quantity effects, cost effects and competition effects.

3.3.1Quantity Effects

Because quantity always gives the most intuitive illustration, researchers (e.g. Sironi, 2003; Covitz et al, 2004b; etc.) and policy makers (e.g. Board of Governors of the Federal Reserve System (1999), US Shadow Financial Regulatory Committee (2000), Basel I (1988) and Basel II (2004)) tend to use amounts as the essential parameter. Most recently, Pop (2009 a) employs a bivariate analysis to examine whether requirements for some large banks to issue a minimum amount of subordinated debt might enhance market discipline.

By conducting statistical tests on panel data sets, the results are inconsistent.

Comprising the largest European banks, Pop (2009 a) finds that there are stronger market discipline forces after a minimum-amount of mandatory subordinated debt is enforced as a policy: firstly, the sub-debt issues are, in general, issued by the most profitable banking organizations; furthermore, voluntary sub-debt improves issuing banks' overall capitalisation and reduces their Tier 1 capital ratios. Moreover, the amount of sub-debt has a negative relation with the quality of the credit portfolio and is correlates positively with total loans reserves ratio.

Cebenoyan and Cebenoyan (2008) investigate market discipline in the US banking system through analyzing both uninsured depositors and subordinated debt holders, the two potential sources of market discipline. Using a panel data set of US banks and bank holding companies, Cebenoyan and Cebenoyan did not, however, find encouraging results. Although uninsured depositors provided strong monitoring, there was no response from bank to investors' pressure. Changes in subordinated debt's quantity and decrease in sub-debt amounts have little influence on market discipline. Therefore, Cebenoyan and Cebenoyan conclude that high expectations for market discipline on banking system's stability are premature.

3.3.2 Cost Effects

Certain researchers have highlighted cost effects by investigating market discipline in banks (Blum,1999 & 2002; Niu, 2008 a&b, etc). The range of empirical literature adds to the studies performed mainly on US data (Avery et al, 1988; Gorton and Santomero, 1990; Flannery and Sorescu, 1996; etc.).

There are researchers who claim that requiring higher or lower costs of subordinated debt has very limited discipline effects on banks. Cebenoyan and Cebenoyan (2007) also employ the changes in interests charged by the subordinated

debt holders of US banks for the period between 1996 and 2005 to test whether an increase in interest costs could increase market discipline. However, no strong evidence was found to support the hypothesis that changes in interest payments can affect US banks' risk behaviour and performances.

On the contrary, Imai (2007) uses a unique panel data set of Japanese banks to show that subordinated debt investors punish weak banks by requiring a higher interest rate. Therefore, subordinated debt can make market discipline more efficient by increasing or decreasing banks' interest costs.

Furthermore, Pop (2009 b) employs secondary market prices and finds contradictory results in European banks. His hypothesis is that if the pricing of a bank debt in the secondary market is accurate and can convey to supervisors and other market participants a reliable signal of a bank's financial conditions and default risk, then the market can discipline the bank. When market participants receive the signal, they will punish riskier banks by raising financing costs or by restricting business opportunities. By analyzing price formation in the European secondary bank debt market, Pop (2009 b) concludes that secondary market signals do contain valuable information, and that issuing subordinated debt does improve the effectiveness of market discipline in the European banking sector.

3.3.3 Competition Effects

Recently, literature on market discipline has extensively analysed the use of competition effects to discipline banks. The incentive for competition may put banks in a risky situation, and the greater the competition, the riskier the situation becomes. On the other hand, market discipline can reduce risks in an environment where there is greater competition. Therefore, in the absence of market discipline, competition in

the banking industry can put the stability of the banking system at risk (Mendonca and Loures, 2009).

However, we find conflicting results. Supporters, such as Morgan and Stiroh (2001), use spreads on nearly 500 bank bond issues between 1993 and 1998 to investigate the relationship between the spreads on those bonds and the full portfolio of assets held by the issuing bank. They find that bond spreads reflect not only the overall mix of banks' assets at the time of issuance, but also control risks and performance. Therefore, riskier activities are expected to pay higher spreads and become more attractive and competitive to investors.

Furthermore, Santos (2009) investigates whether the bond market disciplines all banks equally in the sense of demanding the same relative risk premium across banks of different levels of risk over time. His results show that the market does not discipline all banks equally; for riskier banks, market discipline is tougher. Thus, market discipline does exist and subordinated debt provides market discipline for risky financial institutions. Mendonca and Loures (2009) examine the Brazilian banking industry and conclude that market discipline is weak in Brazil.

On the contrary, Krishnan et al (2005) apply the credit-spread curve on subordinated debt. However, they do not find strong evidence that changes in credit spreads reflect changes in bank risk variables, nor do they not find evidence that the first issue of subordinated debt changes risk-taking behaviour. Mendonca and Loures (2009) examine the Brazilian banking industry and conclude that market discipline is weak in Brazil.

The analysts referred to above suggest that for most studies of the US, subordinated debt produces less effective market discipline in that country than in Europe. Many mandatory subordinated debt proposals which use quantity control or

interest restrictions as paths to an efficient market discipline do not seem to work as well as expected.

However, case studies of European countries show that quantity and costs affect banks' risk-taking incentives and behaviour and that subordinated debt has recently been playing a greater role as an efficient instrument of market discipline. Empirical investigations of the banking industry of several non-European countries, such as Japan and Canada, have also shown that subordinated debt provides effective market discipline to banking industries. There is no strong evidence that the spreads which have been considered contain timely and accurate information indicating that issuing banks work significantly as a proxy of competition effects. Moreover, the market does not discipline all banks equally. For the riskier banks, the market discipline is tougher and subordinated debt works better.

3.4 Methodologies

The main goal of this chapter is to investigate banks' responsiveness to disciplinary action by subordinated debt holders. In particular, whether banks follow the market's action, and remedy their overly risk-taking behaviour efficiently will be examined. The previous chapter has already demonstrated that in the UK market subordinated debt investors do have concerns about issuing banks' performance. However, if banks did not take the market signals seriously in their risky business ventures, market discipline would not be a useful mechanism after all. Although subordinated debts are not directly involved in the day-to-day management of banks, they are responsible for risky decisions made by bank managers, and so indirectly play an important role in the banks' performance. Therefore, subordinated debt is a good tool for measuring market discipline on banks.

Inspired by previous studies (e.g. Cebenoyan and Cebenoyan (2008)), the following equation as a work-horse model is proposed:

$$\text{Rank}\,(Y_{i,t}) = a_0 + a_1 Y_{i,t-1} + a_2 MD_{i,t} + a_3 MD_{i,t-1} + a_4 X_{i,t} + \varepsilon_{i,t} \qquad (3.1)$$

where rank ($Y_{i,t}$) is a rank order of critical indicators of banks' fundamentals.$Y_{i,t-1}$ is the one-year lagged value of $Y_{i,t}$, $MD_{i,t}$ is a vector of information related to subordinated debt, X is a control variable, ε is an ordinary error term following a normal distribution, a_0 is the intercept, and a_1, a_2, a_3 and a_4 are vectors of parameters to be estimated.

The performance of a bank is measured by four aspects: capital adequacy and earnings, quality of loans and investment securities, management quality, and liquidity. We use Capital Ratio (CR), which is the ratio of equity to total assets, and Return on Average Assets (ROA), which is the ratio of net income to average assets to measure

issuing banks' capital adequacy and earnings. There are four ratios adopted to examine the quality of loans and investments: Residential Real Estate Loans Ratio (RRELR), which is the ratio of residential real estate loans to total assets; Commercial and Industrial Loans Ratio (CILR), which is the ratio of commercial and industrial loans to total assets; Individual Loans Ratio (ILR), which is the ratio of loans to individuals to total assets; Investment Securities Ratio (ISR), which is the ratio of investment securities to total assets. Inefficiency ratio (IR), the ratio of net non-interest expense to total assets is employed as an indicator of management. Three variables are used as indicators of liquidity: Liquidity ratio, the ratio of liquidity assets to total assets; Loans to Deposits Ratio (LTDR), the ratio of total loans and leases to total deposits; and Deposit Ratio (DR), the ratio of total deposits to total liabilities.

The equity level of a bank is a good indicator of its health and its ability to sustain future financial distress. Equity over the total asset ratio is used as a capital adequacy measure, and it is expected that subordinated debt has a positive influence on capital ratio. The earnings component is measured by returns to assets (ROA) with an expected positive relationship with sub-debt's amount and interest. However, some empirical studies (e.g. Balasubramnian and Cyree, 2011) also employ ROA as a proxy for operational efficiency. In this case subordinated debt should have a negative influence on the ROA.

After considering capital adequacy and earning, it is also necessary to consider the quality of loan portfolios. The ratios of residential real estate loans to total assets, commercial and industrial loans to total assets, and loans to individuals are used. In previous studies, sub-debt's influence on residential real estate loans has proved ambiguous. Since residential real estate loans are mostly mortgage loans with collateral, they are considered safer. However, after the subprime crisis occurred in

2007, this loan was considered to be a risky loan because of its high concentration of real estate. Since these ratios measure the quality of loan assets, ideally they would be expected to have positive relationships with subordinated debt.

Management quality and liquidity also need to be examined. Management quality is measured as the ratio of non-interest expense to total assets. Inevitably, as liquidity is one of the critical proxies of banking operations, three ratios are employed to measure liquidity: the liquidity ratio, which is liquid assets divided by total assets, total loans and leases divided by deposits, and deposit ratio. In addition to all these bank characteristics, the size (natural log of total assets) of the bank as a control variable is adopted.

Subordinated debt characteristics variables are considered as indicators of market discipline. SND amount level (SDTL) is the ratio of SND amount to total liabilities, and Interest level (INTELEV) is the ratio of interest on SNDs to total amount of SND. A summary of variable definitions is presented in Table 3.1.

Table 3.1 Variable Definitions

Variable	Definition
Bank Characteristics **Capital Adequacy and Earnings:**	
Capital Ratio(CR)	Equity / Total Assets (TA)
Return on Average Assets(ROA)	Net Income / Average Assets
Quality of loans and investments:	
Residential Real Estate Loans Ratio(RRELR)	Residential Real Estate Loans / TA
Commercial and Industrial Loans Ratio(CILR)	Commercial and Industrial Loans / TA
Individual Loans Ratio(ILR)	Loans to Individuals / TA
Investment Securities Ratio (ISR)	Investment Securities / TA
Management:	
Inefficiency Ratio (IR)	Net Non-interest Expense / TA
Liquidity:	
Liquidity Ratio (LR)	Liquidity Assets /TA
Loans to Deposits Ratio(LTDR)	Total Loans and Leases (TLL) / Deposits
Deposit Ratio (DR)	Total Deposits / Total Liabilities
Subordinated Debt Characteristics **Market Discipline variables**	
SDTL	Levels of SND = Amount of SND/ Total Liabilities
Intelev	Interest level of SND = interest on SNDs/amount of SNDs
Other Market discipline variables	
DSDTL	A dummy indicator which takes the value of 1 when the change in level of SNDs is positive from time t-1 to t
DIntelev	A dummy indicator which takes the value of 1 when the change in the interest level of SNDs are positive from time t-1 to t.
Control Variables	
Size	Log of TA

3.4.1 The Impacts of Sub-debt Characteristics on Banks' Performance

Based on this baseline model, the following models for each SND group, the quantity of the debentures and the interest are estimated:

$$Y_{i,t} = a_0 + a_1 Y_{i,t-l} + a_2 SND_{i,t} + a_3 SND_{i,t-1} + a_4 X_{i,t} + \varepsilon_{i,t} \quad (3.2)$$

$$Y_{i,t} = a_0 + a_1 Y_{i,t-l} + a_2 Interest_{i,t} + a_3 Interest_{i,t-1} + a_4 X_{i,t} + \varepsilon_{i,t} \quad (3.3)$$

Equations (3.2) and (3.3) capture the reaction of fundamentals to the levels of sub-debt amount and the interests at both the time t and t-1. If disciplinary action taken by the market is efficient in influencing banks' fundamentals, a_2 and a_3 should be statistically significant. In other words, current and lagged sub-debt amount levels should be one of the significant factors that affect bank characteristics.

3.4.2 The Impacts of Sub-Debt Changes on Banks' Performance

The possible effectiveness of market discipline is also tested by examining the changes in firm-specific characteristics at time t, following the changes in the quality levels and interest levels of subordinated debt at both time t and t-1. The regressions are expressed as:

$$\Delta Y_{i,t} = a_0 + a_1 \Delta Y_{i,t-l} + a_2 \Delta SND_t + a_3 \Delta SND_{t-1} + a_4 X_{i,t} + \varepsilon_{i,t} \quad (3.4)$$

$$\Delta Y_{i,t} = a_0 + a_1 \Delta Y_{i,t-l} + a_2 \Delta Interest_t + a_3 \Delta Interest_{t-1} + a_4 X_{i,t} + \varepsilon_{i,t} \quad (3.5)$$

Equations (3.4) and (3.5) capture the reaction of fundamentals to changes in the levels of amount and interest of sub-debts. However, the changes used in these two equations do not distinguish between positive and negative changes in sub-debt signals and assume that bank managers respond similarly to these two types of market signals. Now, whether market discipline is affected by the sub-debt holders through credit rationing or higher interest demand is examined. Two dummy variables are set: one for positive changes in levels of sub-debt amount (D_1 and D_2), and the other is for positive changes in interest levels of sub-debt (D_3 and D_4) to show additional powers of disciplining variables in explaining changes in bank fundamentals. The models are

specified as follows:

$$\Delta Y_{i,t} = a_0 + a_1 \Delta Y_{i,t-l} + a_2 \Delta SND_{i,t} + a_3 \Delta SND_{i,t} * D_1 + a_4 \Delta SND_{i,t-1} + a_5 \Delta SND_{i,t-1} * D_2 + a_6 X_{i,t} + \varepsilon_{i,t} \quad (3.6)$$

$$\Delta Y_{i,t} = a_0 + a_1 \Delta Y_{i,t-1} + a_2 \Delta Interest_{i,t} + a_3 \Delta Interest_{i,t} * D_3 + a_4 \Delta Interest_{i,t-1} + a_5 \Delta Interest_{i,t-1} * D_4 + a_6 X_{i,t} + \varepsilon_{i,t} \quad (3.7)$$

3.5 Data and Sample

This study is mainly based on data derived from Thompson One Banker, a database which includes subordinated debt market data and the issuing banks and building societies accounting data. For subordinated notes and debentures, the debt issued by banks, building societies and bank holding companies in the UK has been chosen. The data sample period runs from 1997 until the end of 2009. The Thompson One Banker provides essential information such as issuing date, issuer, amount, currency, coupon rate, spread, maturity, call date, and minimum life. Thompson One Banker further provides information like ISIN, package number and book runner with which we can track down the debt. Moreover, it provides details about issuing subordinated debt and issuers (e.g., target market and description), which proves very useful in this empirical investigation.

The accounting data is taken from World Scope, provided by Thompson One Banker. This database provides annual accounting data and financial ratios for all issuing financial institutions. Accounting variables used in this study include data from the annual balance sheet, such as equity, total assets, total loans, total investment securities, residential real estate loans, commercial and industrial loans, loans to individuals, deposits, and subordinated debt amount. Data is also collected from the

annual income statement as it appears in this database, such as net income, net non-interest expense, interest charged on subordinated debt, etc. All numerical data is measured in million GBP.

After collecting original data from the banks' annual reports, financial ratios have been calculated to examine banks' performance from many perspectives. These include capital adequacy, profitability, asset quality, loan quality, investment quality, management and liquidity. Definitions of variables are shown in Table 3.1, and descriptive statistics of variables are shown in Table 3.2. The sample starts with over a thousand firms' annual observations, but later, some observations had to be deleted due to missing information. For example, issuing companies which only existed for a few years and/or only issued a couple of sub-debts were dropped. Secondly, non-financial-related companies depending on company description were abandoned. The final sample includes pooled 912 (annual) observations for 76 firms for over twelve years from January 1997 to December 2009.

3.5.1 Data and Hypothesis Tests for Regressions Two and Three

As shown in Table 3.2, the sample size for each bank characteristic variable is not the same. This is because the data is not available for some issuing banks for certain particular factors. The sample period is from 1997 to 2009. Table 3.2 illustrates descriptive statistics for banks' performance variables and subordinated debt characteristics variables. There are in total 76 banks, building societies, insurance companies and other bank holding companies issuing subordinated debt during the sample period 1997 to 2009. Many big banks, such as The Royal Bank of Scotland Group, HSBC, and Lloyds Banking Group have issued sub-debt regularly and disclosure clearly, being the largest number of sub-debt issuing firms. Medium and

small businesses, generally speaking, only hold few numbers of sub-debts.

Figure 3.1 illustrates the consistency of the data sample for regressions two and three. The panel data sample is collapsed into time series on the basis of the mean for each variable. The capital ratio (CR), the liquidity ratio (LR) and the deposit ratio (DR) move smoothly in the sample period, while the ROA is increasing in the first half of the sample period but dramatically falling later, similar to the loans to deposit ratio (LTDR). Loans portfolios and investment securities have a smooth performance. The management index (IR) consists of a series of undulating inflexions.

During 1998-2003, sub-debts amount levels rapidly increased but they also decreased sharply later. However, during the late 2000s, it can be seen that the SDTL began to rise again. On the other hand, the interest level of sub-debts has not changed much except for a transitory period. A bank's size, as a control variable, has been trended up, but it also, very recently, began to drop.

Figure 3.2 shows the correlations and covariance within the group. The control variable Size has significant negative correlations with capital ratio (CR), inefficiency ratio (IR) and deposit ratio (DR), and a relatively greater positive correlation with investment securities ratio (ISR). Capital ratio is positively correlated to inefficiency ratio (with the value of 0.7891), indicating when capital ratio and inefficiency ratio increase, Loans to deposits ratio has a positive correlation with residential real estate ratio (with the value of 0.5385), and a negative correlation with deposit ratio (with the value of 0.5586).

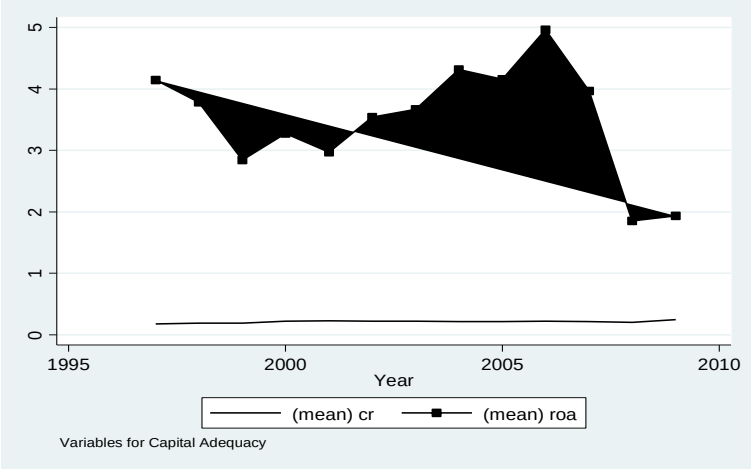
Table 3.2 Sample Summary Statistics

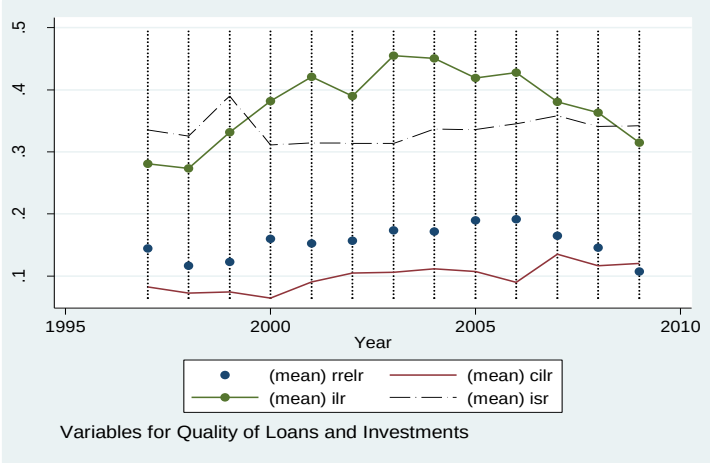
Table 3.2 shows the summary statistics for accounting variables and sub-debt characteristics for the whole sample used in regression (3.2) and (3.3). CR is the ratio of equity to total assets, ROA is the ratio of net income to total assets, RRELR is the ratio of residual real estate loans to total assets, CILR is the ratio of commercial and industrial loans to total assets, ILR is the ratio of loans to individuals of total assets, ISR is the ratio of investment securities to total assets, IR is the ratio of net non-interest expense to total assets, LR is the ratio of liquidity assets to total assets, LTDR is the ratio of total loans and leases to deposits, DR is the ratio of total deposits to total liabilities, SDTL is the ratio of SND amount to total liabilities, INTELEV is the ratio of interests on SND to SND amounts. SIZE is the log of total assets.

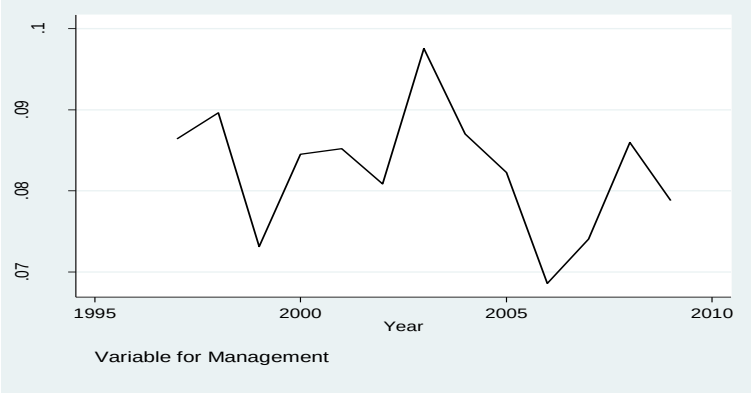
Variable	No.	Mean	Min	Max	st.dev	Skeness	Kurtosis
CR	852	0.1212	-0.9473	0.9976	0.2427	1.1583	4.4062
ROA	776	3.5181	-35.61	70.46	6.6131	2.3322	25.8462
RRELR	381	0.1549	0	0.8859	0.2105	1.7364	5.0753
CILR	229	0.1001	0	0.5881	0.1303	1.5082	4.638
ILR	191	0.3855	0	3.8251	0.2844	-0.0384	1.8287
ISR	789	0.3356	0	3.8251	0.3358	1.0399	16.3462
IR	833	0.0826	-0.1966	1.029	0.1417	3.0556	14.0937
LR	596	0.3436	-0.2593	5.6503	0.3942	5.3635	63.988
LTDR	300	1.4293	0.0276	55.1547	3.2314	15.4605	255.7498
DR	355	0.448	0	0.91	0.2538	-0.3533	2.2216
SDTL	395	0.1797	-0.2723	8.1784	0.8492	6.5253	47.9829
INTELEV	400	0.0581	-0.4489	0.8473	0.0545	5.828	130.8856
SIZE	855	4.0314	0.4472	6.3792	1.3077	-0.5478	2.3688

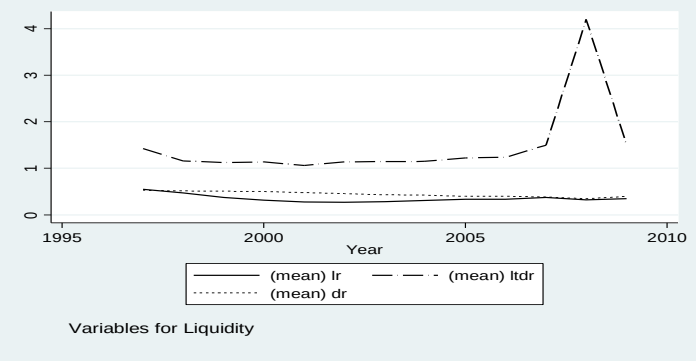
Figure 3.1 Graphs of Panel Data Collapsed to Time

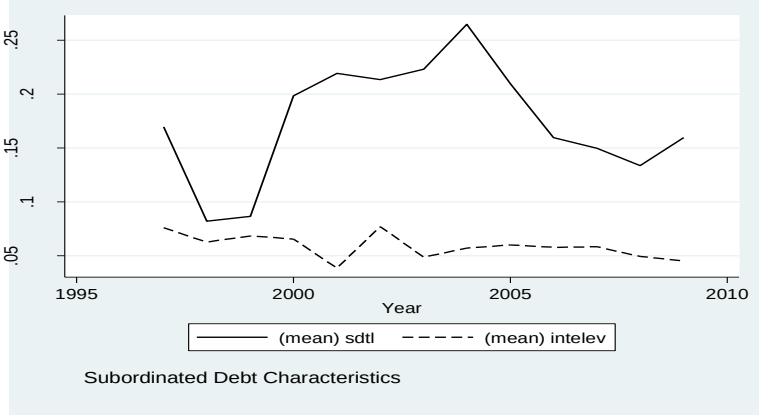
This graph illustrates the consistency of our data sample for regressions two and three. We collapse the panel data sample into time series on the basis on the mean for each variable.











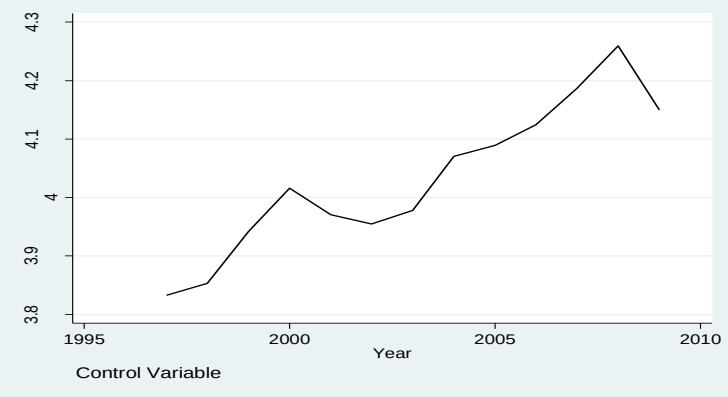


Figure 3.2. Correlation and Covariance within the Data Sample for Regressions 2 and 3

	size	cr	rrelr	cilr	roa	ilr	isr	ir	lr	ltdr	dr	sdtl	intelev
size	1.0000												
cr	-0.7299	1.0000											
rrelr	-0.1535	0.0455	1.0000										
cilr	-0.0506	-0.0363	-0.1337	1.0000									
roa	0.1407	-0.3950	0.2563	0.2588	1.0000								
ilr	0.0039	-0.2211	0.0909	-0.1671	0.1162	1.0000							
isr	0.4027	-0.1697	-0.3481	-0.2281	-0.2200	-0.1429	1.0000						
ir	-0.6779	0.7891	-0.1102	-0.0476	-0.3031	-0.1371	-0.1665	1.0000					
lr	-0.2886	0.3773	-0.0196	-0.0757	-0.0077	0.2484	0.0415	0.2769	1.0000				
ltdr	0.1855	-0.3532	0.5385	-0.0930	0.3256	0.3652	-0.2193	-0.3809	-0.2348	1.0000			
dr	-0.4153	0.4263	-0.1133	0.3120	-0.0238	-0.1139	-0.2861	0.3084	0.3829	-0.5586	1.0000		
sdtl	-0.3330	0.3324	0.0579	0.1934	0.1530	0.0437	-0.1718	0.2891	0.0913	-0.1358	0.1242	1.0000	
intelev	0.0737	0.0847	-0.1989	-0.2780	-0.1592	0.1488	0.0564	0.0148	0.0754	-0.0841	0.1344	-0.2979	1.0000

Definitions of variables are shown in Table 3.1.

3.5.2 Data and Hypothesis Tests for Regressions Four to Seven

These regression models require calculating the changes of bank characteristic variables and the subordinated debt characteristic variables from year t-1 to t. Therefore the sample size is smaller due to a one-year shorter sample period. There are, in total, 912 observations for 76 firms during the period of 1998-2009. Table 3.3 illustrates the descriptive statistics for the changes of variables each year.

Figure 3.3 shows the consistency of the data sample used for regressions four to seven. The changes of the capital ratios (CR) from the years 1998 to 2009 appear to be smooth. However, the ROA display dramatic fluctuations. The changes of three loan portfolios seem to have similar patterns, while investment securities ratios have sharp changes during the earlier sample period but tend to die-down later. Correspondingly, variables for liquidity have similar trends but total loans to deposits (LTDR) display striking changes at a later period. The change of the management efficiency variable, IR, has anomalous shapes. Furthermore, the subordinated debt amount levels and the interest levels change quite dramatically.

Figure 3.4 reports the correlations and covariance within the group for data used in the rest of the regression models. Consistent with Figure 3.2, Size is negative and correlates with capital ratio (CR) and inefficiency ratio (IR) with relatively smaller values. However, deposit ratio (DR) has a positive correlation with Size, rather than a negative value as shown in Figure 3.2. This result suggests that an increase in Size (issuing bank's total assets) has a positive influence on the increase of the deposit. Changes in capital ratio affect positively changes on individual loans ratio (ILR), with the value of 0.5523, and still positively affect changes on inefficiency ratio (IR). Changes in ROA have positive correlations with changes on residential real estate loans ratio (RRELR) (with the value of 0.5292), individual loans ratio (ILR) (with the

value of 0.5247), and liquidity ratio (LR) (with the value of 0.5855). Similarly, changes in residential real estate loans ratio (RRELR) have positive correlations with changes in liquidity ratio and loans to total deposits ratio (0.4459 and 0.4117, respectively). Changes in individual loans ratio also significantly affect the changes in deposit ratio (0.4206), and changes in ratio of loans to total deposit are negatively correlated with deposit ratio (0.4753).

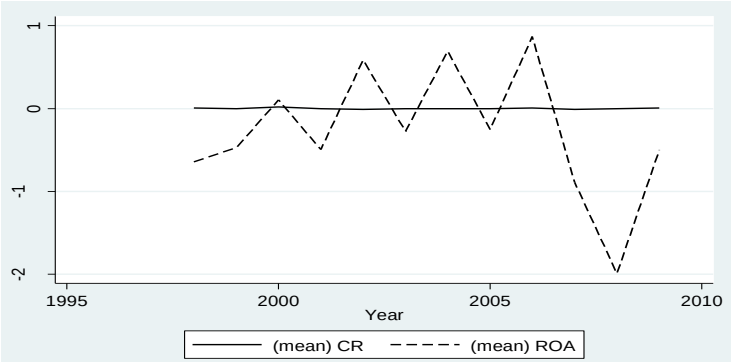
Table 3.3 Sample Summary Statistics

Table 3.3 shows the summary statistics for the changes of accounting variables and sub-debt characteristics for the whole sample used in regression 4,5,6 and 7 from time t-1 to t. CR is the ratio of equity to total assets, ROA is the ratio of net income to total assets, RRELR is the ratio of residual real estate loans to total assets, CILR is the ratio of commercial and industrial loans to total assets, ILR is the ratio of loans to individuals to total assets, ISR is the ratio of investment securities to total assets, IR is the ratio of net non-interest expense to total assets, LR is the ratio of liquidity assets to total assets, LTDR is the ratio of total loans and leases to deposits, DR is the ratio of total deposits to total liabilities, SDTL is the ratio of SND amount to total liabilities, INTELEV is the ratio of interests on SND to SND amounts. SIZE is the log of total assets.

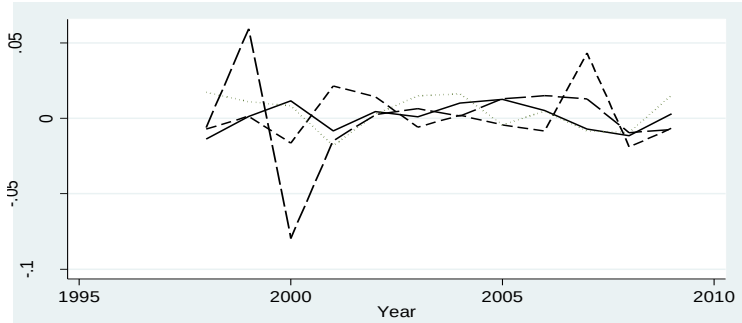
Variable	No.	Mean	Min	Max	st.dev	Skeness	Kurtosis
CR	773	-0.0085	-0.6945	0.8442	0.073	1.5235	50.0227
ROA	691	-0.2684	-43.51	43.27	5.2403	-0.3789	29.4691
RRELR	341	0.0009	-0.2337	0.5183	0.0488	2.9995	43.6655
CILR	202	0.0012	-0.588	0.5881	0.0771	0.2743	36.7521
ILR	161	0.0029	-0.3295	0.3731	0.0657	0.9147	16.4779
ISR	713	-0.0005	-3.4336	3.4659	0.2092	0.0731	20.9037
IR	754	-0.0016	-0.8903	0.4788	0.0758	-3.7922	49.9521
LR	521	-0.0071	-3.1114	3.4659	0.2249	-6.6711	90.2866
LTDR	268	0.1988	-5.1333	53.3788	3.2989	1.5171	25.3922
DR	316	-0.0146	-0.4608	0.1749	0.0659	-2.2082	14.227
SDTL	334	-0.0119	-1.8975	1.9728	0.2379	-0.4263	43.1492
INTELEV	341	-0.0015	-0.9085	1.2962	0.0968	4.2629	121.1493
SIZE	792	4.0472	0.4472	6.3793	1.3084	-0.5496	2.3792

Figure 3.3 Graphs of Panel Data Collapsed to Time for Regressions Require Change Values

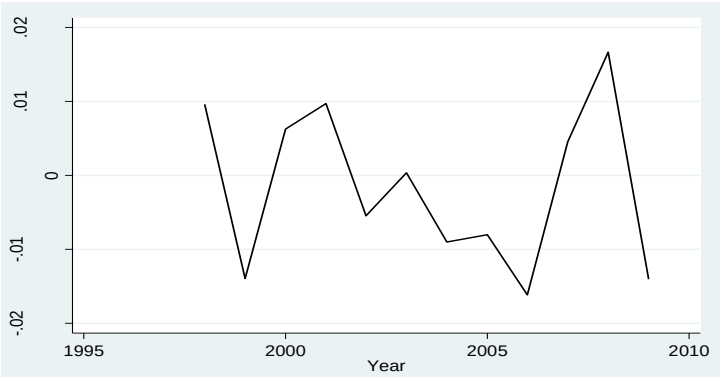
This graph illustrates the consistency of our data sample for regressions four to seven. We collapse the panel data sample into time series on the basis of the mean for each variable.



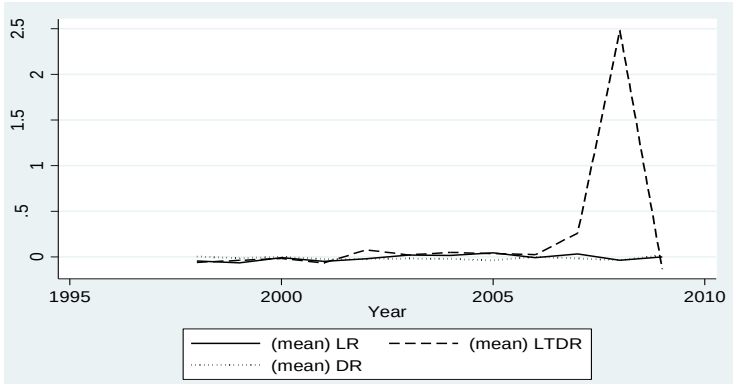
Variables for Capital Adequacy



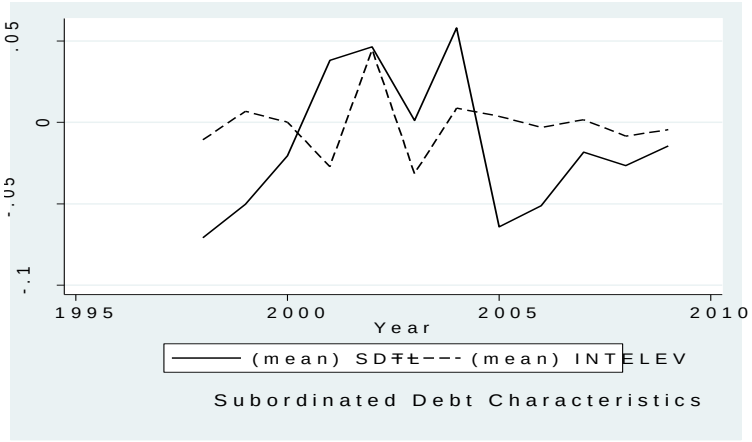
Variables for Quality of Loans and Investments



Variable for Management



Variables for Liquidity



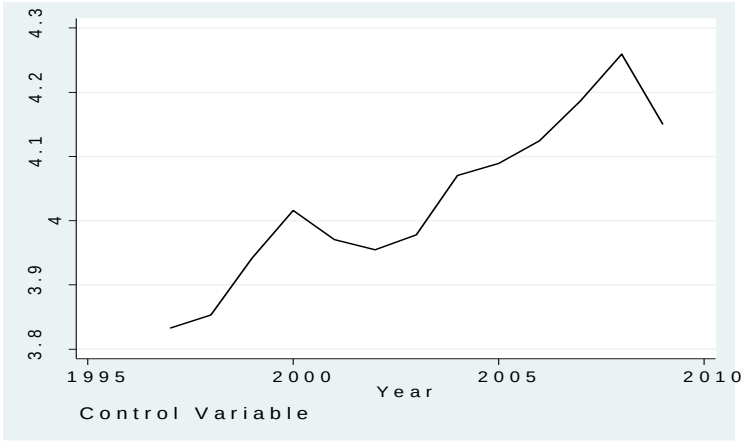


Figure 3.4 Correlation and Covariance for the Changes of Variables

	cr	roa	rrelr	cilr	ilr	isr	ir	lr	ltdr	dr	sdtl	intelev	size
cr	1.0000												
roa	0.1724	1.0000											
rrelr	0.0197	0.5292	1.0000										
cilr	0.0132	-0.0592	-0.0717	1.0000									
ilr	0.5523	0.5347	0.4295	0.0178	1.0000								
isr	-0.1960	0.0354	-0.1711	-0.2113	-0.2087	1.0000							
ir	0.2618	-0.1582	-0.2971	0.0244	0.0310	-0.2961	1.0000						
lr	-0.1366	0.5855	0.4459	0.0167	0.1649	0.2293	-0.2869	1.0000					
ltdr	0.0608	0.4266	0.4117	0.0445	0.3115	-0.0972	-0.0084	-0.0620	1.0000				
dr	0.2312	0.1662	0.1139	-0.0190	0.4206	-0.0494	-0.0347	0.3446	-0.4753	1.0000			
sdtl	0.0968	0.0077	-0.1240	0.1808	0.1721	-0.1421	0.1046	-0.1695	-0.0255	0.1732	1.0000		
intelev	0.2163	0.2217	0.1998	-0.0176	0.2061	0.0922	-0.1466	0.0320	0.1907	-0.0374	-0.2062	1.0000	
size	-0.4440	0.1034	0.2108	-0.1296	-0.1699	0.2697	-0.3894	0.3408	0.0057	0.0181	-0.0350	-0.0858	1.0000

Variables are defined in Table 3.1.

3.6Result Interpretations

3.6.1 Bank Performance and the Sub-debt Market Signals

The results in Table 3.4 show whether sub-debt's quantities have any effects on bank fundamentals. Most of the fundamental variables are significantly related to their own one-year-lagged value, except Investment Securities Ratio (ISR) and Inefficiency Ratio (IR). The statistics of the Hausman test suggest that for these two regressions estimations with fixed effects are more appropriate than with random effects.

The capital ratio has a negative and 10% level significant coefficient with the bank-held sub-debt amount levels at year t (with the value of 0.0344). Similarly, the liquidity ratio has a negative and 1% level significant coefficient with the sub-debt amount level at the same year (with the value of 0.7502). These results indicate that in the case of an increase of the SND amount level, banks' financial health and liquidity decrease. This is because SND is commonly used as a long-term risky investment in the year of investment, banks' equity and liquidity assets drop. With a one-year-lagged SND amount level value, coefficients are positive. Particularly, the coefficient between liquidity ratio and one-year-lagged SND amount is statistically significant at 1% level. This result supports our hypothesis that SND increases issuers' financial health, liquidity and ability to sustain future distress in the long run and with time hysteresis. ROA has a positive and 5% level statistically significant coefficient with an SND amount at time t, whereas a 1% level significant and negative coefficient with an SND amount at time t-1.

Table 3.4 Effects of Sub-debt Amount on Bank Fundamentals

Table 3.4 shows the regression estimations of bank fundamentals on the Sub-debt amount with both fixed effects (FE) and random effects (RE). The panel sample period is from 1997 to 2009. SND is the ratio of the SND amount to total liabilities, SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Yi,t-1	-0.2968	-0.0774	0.319	0.5239	0.6536	0.9667	0.5909	0.8995	0.3091	0.9461	0.0121	0.5892	-0.0964	-0.0006
	[0.014]**	[0.246]	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.008]***	[0.000]***	[0.849]	[0.000]***	[0.171]	[0.999]
SNDi,t	-0.0344	-0.0338	1.1152	2.0477	-0.0122	-0.0122	0.0175	0.0052	0.0639	0.1539	0.0636	0.021	-0.0007	-0.0029
	[0.067]*	[0.000]***	[0.035]**	[0.000]***	[0.265]	[0.265]	[0.247]	[0.728]	[0.865]	[0.681]	[0.317]	[0.755]	[0.906]	[0.443]
SNDi,t-1	0.0032	0.0037	-2.2025	-1.8778	0.0021	0.0087	-0.0081	-0.0069	0.0397	0.0646	-0.0314	-0.0195	0.0011	-0.0021
	[0.847]	[0.737]	[0.000]***	[0.000]***	[0.847]	[0.414]	[0.589]	[0.638]	[0.906]	[0.844]	[0.619]	[0.772]	[0.843]	[0.498]
SIZE	-0.1256	-0.1419	-3.2355	-0.2779	0.0323	0.0069	0.0192	-0.0105	-0.1012	-0.0127	0.1029	0.0284	-0.012	-0.0115
	[0.000]***	[0.000]***	[0.000]***	[0.077]*	[0.166]	[0.092]	[0.571]	[[0.115]	[0.057]*	[0.152]	[0.217]	[0.139]	[0.020]**	[0.005]***
CONS	0.6449	0.8186	17.4682	2.0574	-0.0987	-0.0284	-0.036	0.0602	0.7621	0.0876	-0.1904	0.0146	0.0517	0.0814
	[0.000]***	[0.000]***	[0.000]***	[0.026]**	[0.361]	[0.231]	[0.819]	[0.119]	[0.005]***	[0.149]	[0.624]	[0.895]	[0.193]	[0.004]***
N	989	989	819	819	520	520	390	390	403	403	780	780	871	871
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.8054	0.7737	0.2908	0.1848	0.4773	0.4598	0.4714	0.4538	0.1979	0.1339	0.0634	0.0141	0.2346	0.1178
R^2- Between	0.685	0.8009	0.2149	0.6545	0.9593	0.9948	0.8924	0.9683	0.6895	0.9969	0.0162	0.9766	0.0009	0.2704
R^2-Overall	0.726	0.7687	0.1726	0.3941	0.9251	0.9659	0.7747	0.8287	0.7081	0.9501	0.0438	0.3819	0.0605	0.1643
F	13.24***	-	6.12***	-	9.8***	-	6.06***	-	1.69	-	1.1	-	1.39	-
Wald-chi	-	372.29***	-	174.31***	-	549.284***	-	594.95***	-	236.151***	-	177.32***	-	23.79
Hausman χ^2	40.8***	-	56.89***	-	46.69***	-	32.61***	-	36.72***	-	198.8***	-	22.18*	-

Table 3.4 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	Fixed	Random	Fixed	Random	Fixed	Random
Yi,t-1	0.2009	0.8417	0.3957	0.8565	0.6334	0.9406
	[0.004]***	[0.000]***	[0.497]	[0.043]**	[0.000]***	[0.000]***
SNDi,t	-0.7502	-0.3021	0.2909	0.0812	-0.0147	0.0103
	[0.005]***	[0.234]	[0.797]	[0.937]	[0.371]	[0.528]
SNDi,t-1	1.6158	0.6447	-0.7444	-0.2982	0.0112	-0.0036
	[0.000]***	[0.017]**	[0.948]	[0.770]	[0.490]	[0.824]
SIZE	0.0456	0.0085	-2.3358	-0.5109	-0.1174	-0.0027
	[0.345]	[0.574]	[0.398]	[0.269]	[0.003]***	[0.734]
CONS	0.0352	-0.0022	11.9976	2.9365	0.7512	0.0578
	[0.877]	[0.982]	[0.359]	[0.286]	[0.000]***	[0.264]
N	845	845	559	559	546	546
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.0885	0.0885	0.0668	0.0567	0.6764	0.624
R^2- Between	0.2117	0.9317	0.0102	0.2232	0.8258	0.9826
R^2-Overall	0.3873	0.7413	0.0237	0.0765	0.7851	0.9109
F	3.23***	-	0.75	-	23.13***	-
Wald-chi	-	667.63***	-	15.15	-	198.356***
Hausman χ^2	135.79***	-	-	3.43	129.68***	-

Table 3.5 shows the results of the third regression model which calculates the relationship between sub-debt's interests and banks' performance. Similar to Table 3.4, nearly all bank fundamental variables are significantly related to their own one-year-lagged value, besides the investment securities ratio (based on estimations with fixed effects) and the inefficiency ratio (based on estimations with random effects). A-year-lagged interest rate has a positive and statistically significant affect on the capital ratio at 1% level (the value of coefficient is 1.1725).

The liquidity ratio has a positive and 1% level statistically significant coefficient with the SND interest at year t (with the value of 1.6358), and a negative and 1% level statistically significant coefficient with the SND interest at year t-1 (with the value of 2.5318). This is easy to understand, as issuing banks need to pay interest from the second year of issuing onwards, and a possibly larger amount of interest for riskier banks. The remaining liquidity variables represent deposit-related characteristics. We

find there is no strong evidence for the SND interest (at both year t and year t-1) to have significant impacts on banks' deposits. One potential reason is that in the UK deposits are covered by the government's safety net, hence depositors are not sensitive to banks' risk taking behaviour. These results indicate that the SND interest has constraining effects on the operation of banks, especially on capital health and liquidity.

Overall, the regression results shown in Table 3.4 and Table 3.5 suggest that the subordinated debt amount level affects issuing banks' capital adequacy, liquidity and profit-earning capability. We also find significant evidence that sub-debt interest provides strong and effective market discipline to issuing banks' capital adequacy and liquidity, without significantly affecting deposits. There is no strong evidence for loan portfolio items, such as residential real estate loans, commercial and industrial loans, individual loans and investment securities to have been affected by the SND amount and interest significantly. Results in this section support the conclusion that the SND amount and interest are significant factors in disciplining banks' capital adequacy and liquidity. They actively provide information that is monitored by market participants and control banks' risk taking.

Table 3.5 Effects of Sub-debt Interest on Bank Fundamentals

Table 3.5 shows the regression estimations of bank fundamentals on the Sub-debt Interest with both fixed effects (FE) and random effects (RE). The panel sample period is from 1997 to 2009. Interest is the ratio of the SND interest on the SND amount, SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Yi,t-1	-0.4352	-0.2256	0.3051	0.5123	0.6619	0.9652	0.6016	0.8878	0.3155	0.9499	0.0142	0.5793	-0.1117	0.003
	[0.000]***	[0.001]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.007]***	[0.000]***	[0.823]	[0.000]***	[0.122]	[0.954]
Interesti,t	-0.2301	0.1513	-1.0155	0.2754	0.0267	0.0298	0.0397	-0.0656	0.0499	0.189	-0.1368	0.0962	-0.0873	0.0407
	[0.645]	[0.681]	[0.762]	[0.931]	[0.561]	[0.520]	[0.785]	[0.641]	[0.874]	[0.498]	[0.589]	[0.729]	[0.577]	[0.734]
Interesti,t-1	1.1725	0.8188	-5.9958	-4.7754	0.0183	0.0252	0.1122	-0.0159	-0.1257	-0.3052	-0.1005	0.1137	-0.955	0.0515
	[0.007]***	[0.022]**	[0.270]	[0.343]	[0.692]	[0.586]	[0.437]	[0.906]	[0.811]	[0.504]	[0.689]	[0.681]	[0.551]	[0.639]
SIZE	-0.1047	-0.1239	-3.2045	-0.3366	0.0377	0.0052	0.0078	-0.0098	-0.1016	-0.1308	0.0925	0.035	-0.0116	-0.0108
	[0.000]***	[0.000]***	[0.000]***	[0.041]**	[0.102]	[0.159]	[0.817]	[0.104]	[0.060]*	[0.139]	[0.262]	[0.058]*	[0.012]**	[0.004]***
CONS	0.7085	0.6827	17.4514	2.5104	-0.1302	-0.0221	0.0074	0.0619	0.7696	0.1024	-0.1279	-0.0379	0.1127	0.0721
	[0.000]***	[0.000]***	[0.000]***	[0.015]**	[0.221]	[0.315]	[0.962]	[0.111]	[0.006]***	[0.088]	[0.738]	[0.736]	[0.003]***	[0.013]**
N	989	989	819	819	520	520	390	390	403	403	780	780	871	871
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.8178	0.7774	0.2464	0.1541	0.4729	0.4601	0.4672	0.4512	0.1976	0.1331	0.0606	0.0136	0.2392	0.1081
R^2- Between	0.653	0.7737	0.2623	0.6023	0.9628	0.9925	0.941	0.9671	0.692	0.9967	0.0666	0.9715	0.0001	0.2838
R^2-Overall	0.7041	0.7568	0.1907	0.3644	0.9326	0.9657	0.7993	0.8286	0.7121	0.9502	0.0616	0.3764	0.0536	0.1591
F	15.56***	-	4.88***	-	9.63***	-	5.96***	-	1.69	-	1.05	-	1.45	-
Wald-chi	-	351.7	-	141.82***	-	54.643***	-	594.46***	-	236.428***	-	172.60***	-	23.09
Hausman χ^2	72.72***	-	36.69***	-	37.59***	-	-	-	-	2.53	165.73***	-	-	19.21

Table 3.5 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	Fixed	Random	Fixed	Random	Fixed	Random
Yi,t-1	0.4876	0.8751	0.4042	0.8915	0.6459	0.9431
	[0.000]***	[0.000]***	[0.487]	[0.035]**	[0.000]***	[0.000]***
$INTEREST_{i,t}$	1.6358	1.7806	0.7543	0.8405	-0.0006	-0.0133
	[0.000]***	[0.000]***	[0.874]	[0.854]	[0.993]	[0.854]
$INTEREST_{i,t-1}$	-2.5318	-3.063	0.7544	0.7853	0.0061	-0.0049
	[0.000]***	[0.000]***	[0.874]	[0.863]	[0.928]	[0.945]
SIZE	-0.0068	-0.0011	-2.5087	-0.3385	-0.1117	-0.0078
	[0.873]	[0.921]	[0.359]	[0.396]	[0.004]***	[0.277]
CONS	0.2508	0.1378	12.7643	1.8605	0.7161	0.0866
	[0.205]	[0.057]*	[0.322]	[0.437]	[0.000]***	[0.074]
N	845	845	559	559	546	546
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.391	0.3589	0.0665	0.0563	0.6748	0.6245
R^2-Between	0.9305	0.9497	0.0137	0.2329	0.8375	0.9812
R^2-Overall	0.7715	0.8029	0.0263	0.0736	0.7944	0.9099
F	8.22***	-	0.75	-	22.97***	-
Wald-chi	-	969.70***	-	14.54	-	195.849***
Hausman χ^2	53.19***	-	-	3.85	77.76***	-

The main concern with separate explanatory variables in different regression models is that we may suffer a model-biased problem or misspecification. Therefore we combine all explanatory variables in one regression as an alternative robust check. Calculated estimations are presented in Table 3.6. The results are similar to Table 3.4 and Table 3.5. The capital ratio has a negative and 5% level statistically significant coefficient with an SND amount, and a positive and 1% level significant coefficient with a one-year-lagged interest. ROA has a positive and significant coefficient with a SND amount at year t, and a negative and significant coefficient with one-year-lagged interest value. The inefficiency ratio fails to show a statistically significant coefficient with its own lag value. The liquidity ratio has a negative and 1% level significant coefficient with an SND amount at year t, a positive and significant coefficient with a one-year-lagged SND amount value, as well as with Interest at year t and year t-1.

Table 3.6 Impacts of SND Amount and Interest on Bank Fundamentals

Table 3.6 shows the regression estimations of bank fundamentals on the Sub-debt amount and interest with both fixed effects (FE) and random effects (RE). The panel sample period is from 1997 to 2009. Interest is the ratio of the SND interest on the SND amount, SIZE is the natural log of issuing banks' total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Yi,t-1	-0.278	-0.1107	0.3115	0.5214	0.6562	0.9671	0.5868	0.8969	0.3134	0.9482	0.0098	0.5778	-0.1132	0.0036
	[0.013]***	[0.102]	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.008]***	[0.000]***	[0.877]	[0.000]***	[0.113]	[0.947]
$SND_{i,t}$	-0.04	-0.0363	1.1043	2.0443	-0.0119	-0.0057	0.0184	0.0049	0.0748	0.1636	0.0628	0.0229	-0.0008	-0.0028
	[0.019]**	[0.000]***	[0.037]**	[0.000]***	[0.279]	[0.594]	[0.228]	[0.744]	[0.845]	[0.664]	[0.326]	[0.735]	[0.891]	[0.474]
$SND_{i,t-1}$	0.0042	0.0062	-2.2204	-1.8853	0.0023	0.0087	-0.0075	-0.0067	0.0309	0.0402	-0.0323	-0.0183	0.0014	-0.0021
	[0.770]	[0.535]	[0.000]***	[0.000]***	[0.835]	[0.414]	[0.618]	[0.649]	[0.928]	[0.904]	[0.612]	[0.786]	[0.813]	[0.516]
$INTEREST_{i,t}$	0.1713	-0.0619	-1.1662	0.5656	0.0222	0.0324	0.0631	-0.0654	0.0475	0.1879	-0.1269	0.0998	-0.0932	0.0391
	[0.744]	[0.858]	[0.721]	[0.855]	[0.631]	[0.484]	[0.669]	[0.645]	[0.881]	[0.503]	[0.617]	[0.721]	[0.563]	[0.747]
$INTEREST_{i,t-1}$	1.3619	1.1211	-6.5629	-4.169	0.015	0.0285	0.1255	-0.0174	-0.1339	-0.2771	-0.0959	0.1149	-0.0978	0.0392
	[0.002]***	[0.001]***	[0.214]	[0.398]	[0.746]	[0.539]	[0.389]	[0.897]	[0.802]	[0.552]	[0.704]	[0.680]	[0.552]	[0.727]
SIZE	-0.1236	-0.1431	-3.1966	-0.2929	0.0323	0.0069	0.0155	-0.0109	-0.1025	-0.0125	0.1059	0.0363	-0.0123	-0.0114
	[0.000]***	[0.000]***	[0.000]***	[0.068]*	[0.168]	[0.088]*	[0.654]	[0.108]	[0.060]*	[0.161]	[0.208]	[0.068]*	[0.019]**	[0.006]***
CONS	0.7319	0.7687	17.6548	2.2958	-0.1018	-0.0321	-0.0324	0.0663	0.7736	0.0922	-0.1936	-0.0453	0.0669	0.0759
	[0.000]***	[0.000]***	[0.000]***	[0.023]**	[0.350]	[0.186]	[0.840]	[0.108]	[0.007]***	[0.139]	[0.621]	[0.706]	[0.143]	[0.014]**
N	988	988	819	819	520	520	390	390	403	403	780	780	871	871
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.8499	0.8196	0.2957	0.1894	0.4781	0.461	0.4756	0.4522	0.1986	0.1337	0.0645	0.0141	0.2405	0.1137
R^2- Between	0.7297	0.8272	0.2108	0.6508	0.96	0.9928	0.8996	0.9688	0.6866	0.9968	0.0471	0.9712	0.0001	0.2774
R^2-Overall	0.7681	0.8064	0.1738	0.3958	0.9262	0.966	0.7823	0.829	0.7067	0.9503	0.0533	0.3749	0.053	0.1658
F	14.99***	-	5.48***	-	8.57***	-	5.34***	-	1.47	-	0.98	-	1.23	-
Wald-chi	-	441.56***	-	174.23***	-	545.377***	-	586.59***	-	233.513***	-	169.76***	-	23.65
Hausman χ^2	24.59*	-	65.58***	-	39.75***	-	33.20***	-	33.75***	-	177.82***	-	72.55***	-

Table 3.6 Continued

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	FE	RE	FE	RE	FE	RE
Yi,t-1	0.3115	0.8791	0.3943	0.8585	0.6333	0.9407
	[0.000]***	[0.000]***	[0.501]	[0.044]**	[0.000]***	[0.000]***
SNDi,t	-0.6831	-0.3074	0.2984	0.0826	-0.0147	0.0103
	[0.003]***	[0.152]	[0.794]	[0.936]	[0.373]	[0.532]
SNDi,t-1	1.2459	0.535	-0.0665	-0.2984	0.0112	-0.0036
	[0.000]***	[0.019]**	[0.954]	[0.771]	[0.491]	[0.826]
INTERESTi,t	1.8969	1.8699	0.844	0.8039	-0.0016	-0.0113
	[0.000]***	[0.000]***	[0.861]	[0.861]	[0.981]	[0.876]
INTERESTi,t-1	1.8707	-3.0941	0.8237	0.7046	0.0061	-0.0026
	[0.000]***	[0.000]***	[0.864]	[0.878]	[0.982]	[0.971]
SIZE	0.0314	0.0065	-2.3701	-0.5149	-0.1174	-0.0026
	[0.453]	[0.616]	[0.395]	[0.268]	[0.004]***	[0.741]
CONS	0.0936	0.0636	12.0651	2.8914	0.7511	0.0579
	[0.634]	[0.458]	[0.361]	[0.298]	[0.000]***	[0.265]
N	845	845	559	559	546	546
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.4107	0.3008	0.0671	0.0567	0.6765	0.6242
R^2- Between	0.6498	0.9422	0.0098	0.2254	0.8257	0.9826
R^2-Overall	0.6365	0.8167	0.0231	0.0767	0.785	0.9109
F	7.62***	-	0.66	-	20.17***	-
Wald-chi	-	102.986***	-	15.03	-	196.34***
Hausman χ^2	98.32***	-	-	3.68	66.24***	-

3.6.2 The Effects of Changes in Sub-debt Market Signals on Changes in Bank Fundamentals

In regressions reported in Table 3.7 we explore whether sub-debts' market signals, such as changes in quantities and interests, affect changes in issuing banks' fundamentals. We begin by studying the effects of changes in the subordinated debt amount levels on changes in the banks' performance. ROA has a negative and 1% level statistically significant coefficient with its one-year-lagged value, and a positive coefficient with changes in SND amount with 5% level statistically significance, providing strong evidence that the changes of the sub-debt amount levels have positive effects on issuing banks' capital adequacy.

The inefficiency ratio is negatively related to its own lag value with a 10% level statistically significance. At the mean time, changes in SND amounts at year t-1 have a positive and significant relation with the changes in the inefficiency ratio from year t-1 to year t. The liquidity ratio is affected by its own lag value positively and significantly, in the same way as by changes in the SND amount from year t-2 to t-1. This result suggests that changes in the SND amount have a positive influence on banks' management and liquidity with time hysteresis. On the other hand, we cannot find strong support for the dynamic amount level effect quality of other loans and securities investments.

Table 3.7 Effects of Changes in SND Amount on Bank Fundamentals

Table 3.7 shows the regression estimations of changes in bank fundamentals on changes in the Sub-debt amount level with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. SND is the ratio of the SND amount to total liabilities, SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	Fixed	Random	Fixed	Random	Fixed	Random	fixed	random	Fixed	Random	Fixed	Random	Fixed	Random
△Yi,t-1	-0.194	-0.0734	-0.3706	0.1273	-0.1832	-0.1069	0.2078	0.4479	-0.4778	-0.0101	-0.2387	0.0098	-0.3282	0.0019
	[0.174]	[0.307]	[0.010]***	[0.111]	[0.246]	[0.413]	[0.763]	[0.439]	[0.140]	[0.951]	[0.050]**	[0.715]	[0.098]*	[0.989]
△SNDi,t	-0.0076	0.0022	2.6135	3.7814	-0.0092	-0.0127	-0.1827	-0.0549	2.1527	1.4619	0.0299	0.0124	0.0271	0.0025
	[0.809]	[0.833]	[0.036]**	[0.000]***	[0.754]	[0.550]	[0.659]	[0.848]	[0.469]	[0.358]	[0.356]	[0.643]	[0.603]	[0.934]
△SNDi,t-1	0.0161	0.0112	0.2291	0.0099	0.0018	0.0041	-0.048	-0.0077	-0.4523	0.1876	0.0138	0.0064	0.0642	0.0023
	[0.722]	[0.713]	[0.819]	[0.988]	[0.953]	[0.852]	[0.337]	[0.857]	[0.906]	[0.920]	[0.796]	[0.880]	[0.089]*	[0.929]
SIZE	0.007	-0.0055	-0.344	-0.199	0.001	0.0092	-0.0552	-0.0471	0.0068	-0.0117	0.0228	0.0255	-0.0092	-0.0051
	[0.314]	[0.103	[0.390]	[0.438]	[0.909]	[0.195]	[0.350]	[0.231]	[0.901]	[0.669]	[0.089]*	[0.022]**	[0.470]	[0.560]
CONS	-0.0528	0.0343	2.5094	1.0271	-0.0231	-0.036	0.2067	0.2413	-0.0097	0.0648	-0.0641	-0.1126	0.0805	0.0324
	[0.324]	[0.234]	[0.346]	[0.533]	[0.693]	[0.425]	[0.436]	[0.285]	[0.971]	[0.635]	[0.460]	[0.093]*	[0.535]	[0.704]
N	912	912	756	756	480	480	360	360	372	372	720	720	804	804
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.3749	0.1416	0.3475	0.108	0.3077	0.1975	0.2357	0.1319	0.3129	0.1005	0.1924	0.1358	0.3979	0.209
R^2- Between	0.0235	0.2262	0.1833	0.3405	0.112	0.0477	0.0196	0.1186	0.0289	0.1244	0.0044	0.1554	0.1467	0.0104
R^2-Overall	0.0244	0.1699	0.0215	0.2273	0.0998	0.1681	0.0545	0.1309	0.0238	0.0722	0.0168	0.1267	0.0402	0.0929
F	1.33	-	1.68	-	1.24	-	0.64	-	0.38	-	1.5	-	1.56	-
Wald-chi	-	18.02	-	25.86	-	13.94	-	6.33	-	2.96	-	18.57	-	8.4
Hausman χ^2	83.65***	-	26.4**	-	-	14.98	-	2.38	-	4.79	-	3.22	24.78**	-

Table 3.7 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	Fixed	Random	Fixed	Random	Fixed	Random
△Yi,t-1	0.2185	0.1024	-0.0256	-0.0108	-0.123	-0.0306
	[0.507]	[0.059]*	[0.334]	[0.613]	[0.315]	[0.653]
△SNDi,t	0.4326	-0.6941	-3.3867	-3.7043	1.1304	1.0472
	[0.854]	[0.387]	[0.205]	[0.075]*	[0.207]	[0.117]
△SNDi,t-1	-1.0062	0.6091	0.0857	0.0467	-0.0071	0.017
	[0.598]	[0.088]*	[0.307]	[0.480]	[0.808]	[0.378]
SIZE	-0.0216	-0.0078	0.0252	0.0105	-0.0104	-0.0122
	[0.657]	[0.609]	[0.579]	[0.779]	[0.435]	[0.235]
CONS	0.0586	0.0391	-0.0372	-0.1401	0.027	0.0747
	[0.757]	[0.630]	[0.907]	[0.601]	[0.718]	[0.316]
N	780	780	516	516	504	504
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.6491	0.2407	0.2372	0.1994	0.2435	0.1845
R^2- Between	0.003	0.3464	0.0107	0.1003	0.0135	0.0192
R^2-Overall	0.0697	0.3576	0.0871	0.1452	0.0729	0.1246
F	0.62	-	0.93	-	0.87	-
Wald-chi	-	21.15*	-	13.45	-	9.97
Hausman χ^2	-	9.75	31.22**	-	-	9.25

We also explore whether the changes on sub-debt interests affect bank fundamentals. The results are shown in Table 3.8. We cannot find strong evidence to substantiate the notion that the dynamics of sub-debt interest levels affect banks' capital ratio significantly. However, we find that changes in ROA are positive and significantly affected by changes in interest. Moreover, sub-debt interest dynamics have negative and statistically significant effects on the deposit ratio. We can conclude that the dynamics of sub-debt interest levels have a strong disciplinary force upon issuing banks' deposit-related liquidity characteristics and capital adequacy.

Table 3.8 Effects of Changes in SND Interest on Bank Fundamentals

Table 3.8 shows the regression estimations of changes in bank fundamentals on changes in the Sub-debt amount level with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. Interest is the change in the SND interest level from time t-1 to t, SIZE is natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
△Yi,t-1	-0.1116	-0.0697	-0.4636	0.0944	-0.2045	-0.1187	0.2736	0.3701	-0.4768	0.0131	-0.2499	0.0097	-0.3192	0.0018
	[0.407]	[0.311]	[0.001]***	[0.266]	[0.172]	[0.351]	[0.697]	[0.511]	[0.146]	[0.934]	[0.043]**	[0.718]	[0.122]	[0.990]
△Intersti,t	0.235	0.0036	10.7529	4.5528	-0.0469	-0.0108	0.4122	0.2083	0.2182	0.1559	-0.0464	-0.014	-0.1213	-0.0057
	[0.244]	[0.950]	[0.196]	[0.346]	[0.257]	[0.745]	[0.377]	[0.461]	[0.863]	[0.713]	[0.551]	[0.800]	[0.627]	[0.891]
△Intersti,t-1	0.053	0.0634	13.5163	11.8175	-0.0086	0.0388	0.0223	-0.2086	-0.6868	-0.7435	-0.0602	-0.0289	0.0271	0.0885
	[0.251]	[0.054]	[0.094]*	[0.025]**	[0.849]	[0.270]	[0.922]	[0.161]	[0.607]	[0.263]	[0.445]	[0.590]	[0.960]	[0.787]
SIZE	0.0069	-0.0063	-0.4476	-0.1549	0.0009	0.0105	-0.0399	-0.0339	-0.0097	-0.0185	0.022	0.0253	-0.0059	-0.0054
	[0.262]	[0.053]*	[0.275]	[0.583]	[0.922]	[0.141]	[0.413]	[0.379]	[0.872]	[0.504]	[0.107]	[0.023]**	[0.666]	[0.530]
CONS	-0.0497	0.0373	1.4957	0.8644	-0.0276	-0.0436	0.1057	0.1726	0.1136	0.0987	-0.1065	-0.1118	0.0636	0.0319
	[0.304]	[0.180]	[0.574]	[0.633]	[0.629]	[0.337]	[0.611]	[0.441]	[0.677]	[0.471]	[0.168]	[0.098]*	[0.639]	[0.706]
N	912	912	756	756	480	480	360	360	372	372	720	720	804	804
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.4149	0.1716	0.3391	0.0247	0.3289	0.2039	0.2291	0.1309	0.2976	0.0866	0.1949	0.1332	0.3468	0.2038
R^2-Between	0.0034	0.2383	0.1595	0.1811	0.1228	0.0579	0.0007	0.4149	0.0003	0.1769	0.0067	0.1513	0.0756	0.0084
R^2-Overall	0.0343	0.197	0.0022	0.0964	0.0953	0.1794	0.0658	0.178	0.0309	0.0832	0.0144	0.1262	0.0396	0.0938
F	1.72	-	1.62	-	1.37	-	0.62	-	0.35	-	1.38	-	1.25	-
Wald-chi	-	22.37	-	9.38	-	15.09	-	9.1	-	3.45	-	18.34	-	8.6
Hausman χ^2	32.01***	-	40.20***	-	-	16.79	-	7.03	-	5.03	-	7.85	-	16.86

Table 3.8 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	FE	RE	FE	RE	FE	RE
△Yi,t-1	-0.13	0.0784	-0.0285	-0.0064	-0.1929	0.09
	[0.788]	[0.096]*	[0.327]	[0.774]	[0.108]*	[0.288]
△Interesti,t	0.8895	-0.2755	0.0236	-0.3337	-0.9191	-0.2557
	[0.594]	[0.588]	[0.971]	[0.458]	[0.078]*	[0.033]**
△Intersti,t-1	-2.2976	-0.0822	-1.6606	-1.3916	-1.1778	-0.0863
	[0.482]	[0.867]	[0.402]	[0.322]	[0.035]**	[0.837]
SIZE	0.0406	-0.0066	0.0373	0.0161	-0.0068	-0.0151
	[0.622]	[0.667]	[0.460]	[0.683]	[0.592]	[0.136]
CONS	-0.1774	0.0401	-0.1157	-0.1267	0.0038	0.0847
	[0.792]	[0.625]	[0.726]	[0.641]	[0.957]	[0.247]
N	780	780	516	516	504	504
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.658	0.324	0.1961	0.1623	0.3245	0.1201
R^2 -Between	0.0652	0.2438	0.0106	0.0986	0.1376	0.21
R^2 -Overall	0.017	0.3188	0.0772	0.1266	0.0581	0.1428
F	0.89	-	0.73	-	1.3	-
Wald-chi	-	20.13	-	11.14	-	11.66
Hausman χ^2	-	10.62	27.91**	-	-	14.38

As a robust check we combine all explanatory variables (both changes in SND amounts and interests) in one regression model, and results are shown in Table 3.9. Consistent with previous results, ROA has a positive coefficient with changes in the amount with a 5% level significant sign. The inefficiency ratio is positively and statistically related to changes in the amount from year t-2 to t-1. Deposit-related liquidity variables are also affected by changes in SND. The loans to the deposit ratio has a negative and statistically significant relation with amount changes from the previous year, and the deposit ratio also shows a negative coefficient with changes in interest level with a 10% level statistically significance. There is no strong evidence to argue that changes in SND market signals have significant impacts on loan portfolio variables. The investment securities ratio show a positive and statistically significant coefficient with size, as well as in Table 3.7 and 3.8, implying investment securities are more sensitive to banks' size than other fundamentals.

Surprisingly, the capital ratio has a positive and statistically significant coefficient with the changes in interest from time t-2 to t-1, indicating interest changes enhance issuing banks' capital adequacy. The statistically significant coefficients on the dynamic amount (with the value of 5.2198), the changes in interest from year t-1 to t (with the value of 7.9272), and the interest dynamic from t-2 to t-1 (with the value of 8.7876) suggest that the liquidity ratio is significantly affected by changes in SND amounts and interests. The deposit ratio has a negative coefficient with changes in interest from year t-2 to t-1 with a 5% level statistically significant sign. These results indicate that changes in SND market signals, particularly interests, have both a long-term and short-term influence on banks' liquidity and deposit-related characteristics.

Table 3.9 Effects of Changes in SND Amount and Interest on Bank Fundamentals

Table 3.9 shows the regression estimations of changes in bank fundamentals on changes in the Sub-debt amount level and interest level with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. SND is the changes in the SND amount from time t-1 to t, Interest is the changes in the SND interest level from time t-1 to t , SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
$\triangle Y_{i,t-1}$	-0.0699	-0.0736	-0.4099	0.124	-0.19	-0.1044	0.2563	0.3386	-0.3927	0.0344	-0.2479	0.0097	-0.3222	0.0011
	[0.641]	[0.302]	[0.004]***	[0.116]	[0.235]	[0.427]	[0.722]	[0.561]	[0.288]	[0.840]	[0.048]**	[0.721]	[0.117]	[0.994]
$\triangle SND_{i,t}$	-0.0231	-0.0004	2.6414	3.6069	-0.0097	-0.0118	0.0554	0.0964	1.9525	1.1999	0.0319	0.0122	0.0239	0.0013
	[0.466]	[0.967]	[0.032]**	[0.000]***	[0.744]	[0.582]	[0.916]	[0.780]	[0.548]	[0.465]	[0.336]	[0.652]	[0.658]	[0.965]
$\triangle SND_{i,t-1}$	0.0199	0.0126	0.6294	0.011	-0.0003	0.0042	-0.0569	-0.0114	-2.8362	-0.6419	0.0115	0.0056	0.0638	0.0022
	[0.651]	[0.674]	[0.527]	[0.987]	[0.999]	[0.847]	[0.275]	[0.791]	[0.607]	[0.752]	[0.833]	[0.895]	[0.102]*	[0.926]
$\triangle Interst_{i,t}$	0.0263	0.003	12.5678	4.9009	-0.0474	-0.0111	0.5333	0.2667	0.2918	0.1071	-0.0465	-0.0134	-0.1011	-0.0058
	[0.214]	[0.959]	[0.127]	[0.266]	[0.267]	[0.741]	[0.317]	[0.446]	[0.832]	[0.806]	[0.554]	[0.811]	[0.683]	[0.892]
$\triangle Interst_{i,t-1}$	0.0772	0.0661	11.7384	9.0658	-0.0104	0.0379	0.0347	-0.2104	-1.1975	-0.7853	-0.0608	-0.0287	0.0951	0.0864
	[0.142]	[0.052]*	[0.136]	[0.061]*	[0.962]	[0.287]	[0.888]	[0.167]	[0.526]	[0.285]	[0.444]	[0.596]	[0.860]	[0.797]
SIZE	0.0073	-0.0069	-0.5382	-0.3146	0.0004	0.0105	-0.0364	-0.0281	-0.0042	-0.0166	0.0213	0.0254	-0.0114	-0.0055
	[0.276]	[0.044]**	[0.184]	[0.226]	[0.962]	[0.148]	[0.585]	[0.518]	[0.951]	[0.561]	[0.126]	[0.028]**	[0.419]	[0.537]
CONS	-0.0548	0.0412	2.0856	1.6465	-0.0255	-0.0436	0.084	0.1411	0.0672	0.0876	-0.0584	-0.1125	0.0928	0.0324
	[0.292]	[0.153]	[0.422]	[0.320]	[0.669]	[0.343]	[0.790]	[0.570]	[0.833]	[0.537]	[0.513]	[0.106]	[0.496]	[0.708]
N	912	912	756	756	480	480	360	360	372	372	720	720	804	804
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.4557	0.18	0.414	0.1574	0.3309	0.2035	0.2691	0.1433	0.3533	0.1226	0.2011	0.139	0.402	0.2107
R^2-Between	0.0025	0.2407	0.0541	0.3437	0.131	0.0627	0.0047	0.3907	0.0001	0.1561	0.0054	0.144	0.1021	0.0093
R^2 Overall	0.0284	0.2049	0.0484	0.2673	0.0949	0.1832	0.059	0.1809	0.0469	0.101	0.016	0.1279	0.0384	0.0939
F	1.52	-	1.84	-	1.14	-	0.6	-	0.31	-	1.31	-	1.3	-
Wald-chi	-	22.18	-	31.38**	-	15.03	-	8.84	-	4.05	-	18.19	-	8.29
Hausman χ^2		6.62	28.71**			15.55		12.48		4.45		3.32	22.78*	

Table 3.9 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	FE	RE	FE	RE	FE	RE
$\triangle Y_{i,t-1}$	-1.8249	0.1089	-0.0264	-0.006	-0.1853	0.085
	[0.153]**	[0.065]*	[0.358]	[0.785]	[0.128]	[0.317]
$\triangle SND_{i,t}$	1.3928	-0.7686	-4.0024	-3.5722	0.6626	1.1065
	[0.481]	[0.367]	[0.159]	[0.096]*	[0.446]	[0.091]*
$\triangle SND_{i,t-1}$	-5.2198	0.5815	0.0859	0.0512	-0.0232	0.0168
	[0.123]**	[0.121]	[0.314]	[0.442]	[0.425]	[0.373]
$\triangle Interst_{i,t}$	7.9272	-0.2215	0.3635	-0.1167	-0.9409	-0.2535
	[0.135]**	[0.723]	[0.585]	[0.799]	[0.087]*	[0.026]**
$\triangle Interst_{i,t-1}$	-8.7876	0.0215	-1.9032	-1.5704	-1.1716	-0.0554
	[0.133]**	[0.968]	[0.335]	[0.261]	[0.041]**	[0.894]
SIZE	0.1055	-0.0108	0.0458	0.022	-0.0087	-0.0156
	[0.271]	[0.552]	[0.361]	[0.574]	[0.505]	[0.123]
CONS	-0.32	0.0545	-0.1046	-0.1596	0.0048	0.0898
	[0.312]	[0.570]	[0.750]	[0.556]	[0.948]	[0.220]
N	780	780	516	516	504	504
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.9203	0.2464	0.2596	0.2226	0.3518	0.1605
R^2-Between	0.0797	0.3391	0.019	0.1047	0.1327	0.2335
R^2-Overall	0.0266	0.3598	0.0971	0.1526	0.0598	0.1862
F	1.65	-	0.86	-	1.22	-
Wald-chi	-	20.24	-	14.93	-	15.56
Hausman χ^2	31.90***	-	-	4.99	23.78*	-

Table 3.10 shows the results of regression 6 investigating the dummy variables that represent the increase of sub-debt amount levels. D1 takes 1 if SND amount levels increase from t-1 to t, 0 otherwise. D2 takes 1 if SND amount levels increase from t-2 to t-1. D1 has a negative and 10% level significant coefficient with the changes of investment securities ratio (with the value of 0.0321). D2 has a negative and 5% level significant coefficient with changes in the individual loans ratio. These results indicate that the increase of SND amount levels negatively affect issuing banks' loan portfolio and investment securities. Furthermore, changes in the liquidity ratio also have a negative coefficient with D2, with 5% level statistical significance, suggesting that an increase of the SND amount negatively affects liquidity. All estimations are calculated with random effects (RE), as suggested by the statistic of Hausman tests.

Table 3.10 Results of Amount Change Dummy Variables Estimation

Table 3.10 shows the regression estimations of changes in bank fundamentals on changes in the Sub-debt amount level and dummy variables with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. SND is the change in the SND amount from time t-1 to t, D1 takes 1 if the SND amount increases from t-1 to t, 0 otherwise; D2 takes 1 if the SND amount increases from t-2 to t-1, 0 otherwise; SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
$\triangle Y_{i,t-1}$	-0.1879	-0.0801	-0.3866	0.1289	-0.1768	-0.1076	0.5707	0.4234	-0.4359	-0.0152	-0.2289	0.0168	-0.3368	-0.0044
	[0.194]	[0.264]	[0.008]***	[0.107]	[0.287]	[0.417]	[0.426]	[0.482]	[0.162]	[0.924]	[0.068]*	[0.530]	[0.091]*	[0.976]
$\triangle SND_{i,t}$	-0.0264	-0.0029	1.9056	3.4633	-0.0116	-0.0092	-0.4406	-0.0828	2.8157	1.6769	0.0462	0.0278	0.0507	-0.0032
	[0.457]	[0.781]	[0.143]	[0.000]***	[0.724]	[0.688]	[0.323]	[0.791]	[0.479]	[0.431]	[0.174]	[0.316]	[0.371]	[0.920]
D1	0.0147	0.0113	1.326	0.7257	0.0032	-0.0029	0.0567	0.0083	-0.0429	-0.0088	-0.0257	-0.0321	-0.0395	0.0048
	[0.226]	[0.096]*	[0.116]	[0.169]	[0.883]	[0.828]	[0.113]	[0.743]	[0.566]	[0.815]	[0.230]	[0.055]*	[0.148]	[0.770]
$\triangle SND_{i,t-1}$	0.002	0.0004	0.0929	0.1895	0.002	0.0094	-0.0816	0.0016	5.4447	3.6886	0.0227	0.0036	0.0636	-0.0022
	[0.967]	[0.991]	[0.929]	[0.785]	[0.950]	[0.685]	[0.174]	[0.971]	[0.248]	[0.123]	[0.674]	[0.933]	[0.106]*	[0.927]
D2	0.0042	0.0054	0.4817	-0.4022	-0.0027	-0.0096	0.0364	-0.0145	-0.1563	-0.0812	-0.0309	-0.0129	-0.0019	0.0102
	[0.736]	[0.435]	[0.529]	[0.443]	[0.902]	[0.448]	[0.358]	[0.587]	[0.064]**	[0.027]**	[0.163]	[0.439]	[0.939]	[0.530]
SIZE	0.0067	-0.0049	-0.3858	-0.1976	0.0011	0.0097	-0.0714	-0.0463	0.0265	0.0022	0.0223	0.0243	-0.0072	-0.0052
	[0.376]	[0.139]	[0.334]	[0.440]	[0.902]	[0.181]	[0.228]	[0.253]	[0.602]	[0.935]	[0.097]*	[0.027]**	[0.574]	[0.553]
CONS	-0.0566	0.0232	1.6192	0.8559	-0.0235	-0.033	0.4627	0.2528	-0.0647	0.0502	-0.0323	-0.0749	0.0487	0.0231
	[0.344]	[0.431]	[0.551]	[0.615]	[0.716]	[0.475]	[0.172]	[0.275]	[0.845]	[0.714]	[0.715]	[0.285]	[0.712]	[0.793]
N	912	912	756	756	480	480	360	360	372	372	720	720	804	804
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.4063	0.1684	0.3895	0.1347	0.3091	0.1972	0.3223	0.1374	0.5643	0.305	0.2187	0.1627	0.4425	0.1994
R^2-Between	0.0025	0.251	0.1261	0.4017	0.1291	0.0706	0.0442	0.0968	0.0064	0.084	0.0041	0.1357	0.2057	0.0044
R^2 -Overall	0.0423	0.2017	0.0259	0.2503	0.1014	0.1752	0.0189	0.1386	0.1024	0.1834	0.0249	0.1533	0.0341	0.0979
F	1.24	-	1.66	-	1.03	-	0.78	-	0.74	-	1.49	-	1.54	-
Wald-chi	-	21.73	-	28.71**	-	14.23	-	6.43	-	8.09	-	22.81	-	8.69
Hausman χ^2	43.66***	--	27.83*	-	-	14.03	-	16.38	-	7.91	-	5.79	29.34**	-

Table 3.10 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	FE	RE	FE	RE	FE	RE
△Yi,t-1	0.2809	0.1031	-0.0209	-0.0085	-0.0809	-0.0261
	[0.593]	[0.061]	[0.451]	[0.694]	[0.516]	[0.707]
△SNDi,t	-2.4868	-0.3828	-5.7168	-6.2609	-0.5586	0.6633
	[0.623]	[0.650]	[0.191]	[0.032]**	[0.665]	[0.455]
D1	0.076	-0.0063	0.0453	0.0617	0.0403	0.0089
	[0.506]	[0.728]	[0.508]	[0.205]	[0.089]*	[0.547]
△SNDi,t-1	-0.3907	0.9492	0.0868	0.0471	-0.0055	0.0192
	[0.924]	[0.011]**	[0.325]	[0.490]	[0.850]	[0.340]
D2	-0.0195	-0.0394	-0.0148	-0.0054	0.0043	-0.0025
	[0.860]	[0.011]**	[0.772]	[0.885]	[0.790]	[0.825]
SIZE	0.0036	-0.0052	0.0236	0.0068	-0.0051	-0.0111
	[0.959]	[0.720]	[0.611]	[0.855]	[0.704]	[0.287]
CONS	0.3208	0.0489	-0.1591	-0.1177	0.0144	0.0708
	[0.793]	[0.525]	[0.580]	[0.664]	[0.865]	[0.354]
N	780	780	516	516	504	504
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.7447	0.398	0.2474	0.2125	0.3057	0.2165
R^2-Between	0.04	0.4109	0.0385	0.1248	0.0104	0.003
R^2- Overall	0.0688	0.455	0.1135	0.1669	0.0674	0.1308
F	0.42	-	0.81	-	0.99	-
Wald-chi	-	30.05**	-	14.9	-	10.33
Hausman χ^2	-	8.09	-	4.13	-	20.53

Compared with the changes of the sub-debt amount levels, the increase of the interest levels has more disciplining power upon the capital, loans and liquidity. Table 3.11 shows the results of regression 7 investigating the dummy variables that represent the increase of SND interest levels. D3 has a positive and statistically significant coefficient with the changes of capital ratio (with the value of 0.0182), as well as with the changes of Residential Real Estate Loans ratio (with the value of 0.0399). On the contrary, D3 has a negative coefficient with changes in the liquidity ratio, showing a 10% level statistical significance. D4, which represents the increase of the SND interest from year t-2 to t-1, has negative and 5% level statistically significant coefficients with the changes of ROA and the loans to the deposit ratio (with the values of 1.9871 and 0.1215, respectively). These results indicate that an

increase of the SND interest has timely disciplinary effects on the capital adequacy and some loan portfolios, and a negative influence on liquidity.

In sum, the one-year-lagged increases of subordinated debt amount levels and interest levels have significant effects on changes in the issuing banks' liquidity. A surge in the SND amount has more disciplinary power on issuing banks' quality of loans and securities investments than on other fundamentals. The increases in the SND interest, on the other hand, has more influence on the issuing banks' capital adequacy, residential real estate loans and deposit-related liquidity characteristic than on other fundamentals. Changes in both SND market signals provide long-term and short-term discipline.

Table 3.11 Results of Interest Change Dummy Variables Estimation

Table 3.11 shows the regression estimations of changes in bank fundamentals on changes in the Sub-debt interest level and dummy variables with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. Interest is the change in SND interest from time t-1 to t, D3 takes 1 if the SND interest increases from t-1 to t, 0 otherwise; D4 takes 1 if the SND interest increase from t-2 to t-1, 0 otherwise; SIZE is the natural log of issuing bank's total assets, Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively. Some results are omitted because of collinearity.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
△Yi,t-1	-0.0829	-0.0789	-0.5283	0.0925	-0.2059	-0.1188	0.2736	0.3701	-0.4768	0.0131	-0.2522	0.0096	-0.3467	0.0107
	[0.534]	[0.253]	[0.000]***	[0.278]	[0.153]	[0.354]	[0.697]	[0.511]	[0.146]	[0.934]	[0.044]**	[0.724]	[0.115]	[0.940]
△$Interst_{i,t}$	0.0547	0.0041	6.6344	3.8339	-0.0628	-0.0191	0.4122	0.2083	0.2182	0.1559	0.0361	0.0392	-0.1376	0.0005
	[0.815]	[0.945]	[0.449]	[0.470]	[0.123]	[0.575]	[0.377]	[0.461]	[0.863]	[0.713]	[0.761]	[0.655]	[0.594]	[0.991]
D3	0.0182	0.0053	-0.3345	0.0407	0.0399	0.0136	Omitted	Omitted	Omitted	Omitted	-0.2058	-0.1189	0.0133	-0.0153
	[0.077]*	[0.416]	[0.656]	[0.948]	[0.030]**	[0.284]					[0.358]	[0.433]	[0.674]	[0.338]
△$Interst_{i,t-1}$	0.0397	0.0518	17.2776	13.1558	0.0071	0.0449	0.0223	-0.2086	-0.6868	-0.7435	-0.0384	-0.0335	-0.1822	0.2293
	[0.382]	[0.122]	[0.034]**	[0.016]**	[0.872]	[0.211]	[0.922]	[0.161]	[0.607]	[0.263]	[0.756]	[0.694]	[0.813]	[0.557]
D4	0.0134	0.0084	-1.9871	-0.6652	-0.0002	-0.0024	Omitted	Omitted	Omitted	Omitted	-0.0705	0.011	0.0139	-0.012
	[0.100]	[0.185]	[0.039]**	[0.291]	[0.992]	[0.854]					[0.762]	[0.943]	[0.679]	[0.524]
SIZE	0.0076	-0.0059	-0.1838	-0.1152	0.0002	0.0109	-0.0399	-0.0339	-0.0097	-0.0185	0.0231	0.0259	-0.0053	-0.0055
	[0.219]	[0.066]*	[0.658]	[0.688]	[0.984]	[0.138]	[0.413]	[0.379]	[0.872]	[0.504]	[0.096]*	[0.021]**	[0.711]	[0.530]
CONS	-0.066	0.0296	0.1469	0.6345	-0.0456	-0.0539	0.1057	0.1726	0.1135	0.0986	-0.1079	-0.1152	0.0585	0.0403
	[0.168]	[0.291]	[0.956]	[0.735]	[0.449]	[0.304]	[0.611]	[0.441]	[0.677]	[0.471]	[0.166]	[0.091]*	[0.677]	[0.643]
N	912	912	756	756	480	480	360	360	372	372	760	760	804	804
Fixed Year	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R^2- Within	0.4977	0.2408	0.408	0.042	0.4132	0.2526	0.2291	0.1309	0.2976	0.0866	0.2038	0.139	0.3545	0.1738
R^2-Between	0.0193	0.2111	0.1689	0.1871	0.1714	0.0245	0.0007	0.4149	0.0003	0.1769	0.0051	0.1493	0.0839	0.0002
R^2-Overall	0.0406	0.2117	0.0033	0.1081	0.1062	0.1941	0.0658	0.178	0.0309	0.0832	0.0167	0.1305	0.0308	0.1081
F	1.98	-	1.79	-	1.63	-	0.62	-	0.35	-	1.25	-	1.06	-
Wald-chi	-	24.69	-	10.42	-	16.14	-	9.1	-	3.45	-	18.76	-	9.81
Hausman χ^2	22.67	-	184.79***	-	34.06***	-	-	7.03	-	5.03	-	8.4	-	15.78

Table 3.11 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	FE	RE	FE	RE	FE	RE
△Yi,t-1	0.4395	0.0736	-0.0348	-0.0064	-0.1758	0.089
	[0.435]	[0.128]	[0.239]	[0.773]	[0.152]	[0.290]
△$Interst_{i,t}$	6.2806	-0.1075	0.6291	-0.4654	-0.3998	-0.2109
	[0.132]*	[0.879]	[0.460]	[0.351]	[0.521]	[0.069]*
D3	-0.2014	-0.0074	-0.0971	-0.0325	-0.0288	-0.0173
	[0.136]*	[0.731]	[0.163]	[0.466]	[0.141]	[0.125]
△$Interst_{i,t-1}$	3.2169	-0.4139	-0.4049	2.2601	-0.7354	-0.4382
	[0.464]	[0.549]	[0.887]	[0.207]	[0.288]	[0.465]
D4	-0.0131	0.01712	-0.0326	-0.1215	-0.0211	0.0109
	[0.825]	[0.468]	[0.678]	[0.016]**	[0.270]	[0.483]
SIZE	-0.0863	-0.0041	0.0109	-0.0024	-0.0029	-0.0172
	[0.430]	[0.799]	[0.839]	[0.953]	[0.822]	[0.090]*
CONS	1.152	0.0323	-0.0977	-0.0072	0.0244	0.0962
	[0.277]	[0.707]	[0.774]	[0.978]	[0.746]	[0.189]
N	780	780	516	516	504	504
Fixed Year	Yes		Yes		Yes	
R^2- Within	0.8213	0.2649	0.241	0.1166	0.3763	0.1667
R^2-Between	0.0158	0.287	0.0342	0.3228	0.0984	0.2489
R^2- Overall	0.0001	0.3285	0.1085	0.2158	0.0702	0.1791
F	1.23	-	0.78	-	1.36	-
Wald-chi	-	20.06	-	18.99	-	14.84
Hausman χ^2	24.82**	-	-	12.24	-	21.65

3.6.3 Effects of Sub-debt Market Signals on Fundamentals of Big Banks

In this section, it is examined whether sub-debt can exert stronger market discipline on bigger banks. For this purpose, we introduce the Large Bank dummy, which is a dummy variable that takes 1 if the size (natural logarithm of total assets) for the bank is greater than the median size for the sample. The partial results are reported in Table 3.12. We estimate the parameters with both fixed effects (FE) and random effects (RE), and then adopt a Hausman test to examine the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent. The estimated parameters for one-year-lagged fundamentals, SND characteristics, and Hausman χ^2 are not reported in Table 3.12.

Size has a negative and 1% level statistically significant coefficients with ROA and the individual loans ratio. The size dummy shows positive and significant signs with the individual loans ratio and deposits ratio. These results indicate that individual investors are more sensitive to the banks' size than institution investors. Panel B in Table 3.12 presents the estimated results of the size. The size dummy in the regression of bank fundamentals on SND interests shows similar conclusions. Size is negatively related to capital adequacy, and positively affects other loan portfolios (such as residential real estate loans and individual loans). These results indicate that when large banks issue more subordinated debt and pay higher interest, investors are sensitive to issuers' capital adequacy and earning, and use other loans as alternative portfolios. Surprisingly, the deposit ratio has negative and significant coefficients with size and size dummy, in both regressions on SND amount and interest, suggesting that investors are sensitive to issuers' risk taking behaviour. Therefore the market is taking disciplinary actions.

Table 3.12 Effects of Sub-debt on Fundamentals for Large Banks

Table 3.12 shows the partial regression estimations of bank fundamentals on the Sub-debt amount and interest levels for large banks with both fixed effects (FE) and random effects (RE). The panel sample period is from 1997 to 2009. SIZE is the natural log of issuing bank's total assets; Size Dummy is a dummy variable which takes 1 if the size (natural logarithm of total assets) is greater than the median size for the sample. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent and the result is not reported. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

Variable	Capital Ratio	ROA	Residential Real Estate Loans Ratio	Commercial and Industrial Loans Ratio	Individual Loans Ratio	Investment Securities Ratio	Inefficiency Ratio	Liquidity Ratio	Loans to Deposits Ratio	Deposits Ratio
Panel A	Size dummy in the regression of bank fundamentals on sub-debt amount									
Size	-0.0375	-2.4493	0.0418	0.0249	-0.1563	0.124	-0.0139	0.0862	-0.7722	-0.1174
	[0.154]	[0.001]***	[0.111]	[0.524]	[0.002]***	[0.154]	[0.151]	[0.127]	[0.159]	[0.003]***
Size Dummy	-0.3266	-1.9772	-0.0293	-0.0151	0.3055	-0.0869	0.0054	-0.1253	1.6909	-0.1555
	[0.000]***	[0.100]*	[0.423]	[0.766]	[0.000]***	[0.393]	[0.808]	[0.165]	[0.376]	[0.000]***
CONS	0.0637	15.1473	0.1163	0.0489	0.6481	0.2036	0.0586	0.0369	2.7549	0.7512
	[0.000]***	[0.000]***	[0.292]	[0.766]	[0.008]***	[0.601]	[0.233]	[0.873]	[0.319]	[0.000]***
N	988	819	520	390	403	780	871	845	559	546
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE	FE	FE	RE	FE
R2-Within	0.8511	0.2994	0.4794	0.4719	0.3467	0.0662	0.2353	0.2132	0.0577	0.6764
R2-Between	0.6899	0.2347	0.9611	0.8753	0.7643	0.0292	0.0024	0.3197	0.2379	0.8258
R2-Overall	0.7202	0.1923	0.9238	0.7595	0.7793	0.0523	0.0627	0.4384	0.0804	0.7851
F	17.34***	5.95***	9.21***	5.64***	3.38***	1.08	1.29	3.17***	-	23.13***
Wald	-	-	-	-	-	-	-	-	15.92	-

Table 3.12 *Continued*

Variable	Capital Ratio	ROA	Residential Real Estate Loans Ratio	Commercial and Industrial Loans Ratio	Individual Loans Ratio	Investment Securities Ratio	Inefficiency Ratio	Liquidity Ratio	Loans to Deposits Ratio	Deposits Ratio
Panel B	Size dummy in the regression of bank fundamentals on sub-debt interest									
Size	-0.0386	-2.5514	0.0481	0.0156	-0.1543	0.1259	-0.1356	-0.0318	-0.7799	-0.1118
	[0.107]	[0.001]***	[0.063]*	[0.685]	[0.002]***	[0.150]	[0.164]	[0.565]	[0.155]	[0.004]***
Size Dummy	-0.2479	-1.6982	-0.0335	-0.0241	0.3071	-0.1029	0.0049	0.0657	1.7348	-0.1597
	[0.002]***	[0.187]	[0.369]	[0.665]	[0.000]***	[0.244]	[0.820]	[0.477]	[0.242]	[0.000]***
CONS	0.4118	15.4773	0.1489	0.0077	0.6318	0.1883	0.1168	0.3107	2.688	0.7161
	[0.000]***	[0.000]***	[0.170]	[0.962]	[0.014]**	[0.626]	[0.005]***	[0.150]	[0.281]	[0.000]***
N	988	819	520	390	403	780	871	845	559	546
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE	FE	FE	RE	FE
R2-Within	0.8485	0.2523	0.4756	0.4682	0.3464	0.0659	0.2398	0.3926	0.0576	0.6748
R2-Between	0.6261	0.2788	0.9634	0.9253	0.7708	0.0745	0.0007	0.9086	0.2383	0.8375
R2-Overall	0.6792	0.2019	0.929	0.7833	0.7849	0.0631	0.0562	0.7579	0.0805	0.7944
F	17.86***	4.7***	9.07***	5.56***	3.38***	1.07	1.34	7.72***	-	22.97***
Wald	-	-	-	-	-	-	-	-	15.94	-

Table 3.14 shows the size effects in the regressions of bank fundamentals on the changes in SND amounts and interests. Size has positive and 5% level statistically significant coefficients with the changes in the investment securities ratio, in both regressions on SND amounts and interests. Furthermore, in both of the regressions size dummies have positive and statistically significant coefficients with changes in the liquidity ratio. Besides, size has a negative impact on the liquidity ratio and deposit ratios (with the values of 0.0427 and 0.0255, under the changes in sub-debt amount and interest, respectively). These results indicate that for big banks, the changes in the subordinated debt amount and interest provide greater driving strength to market discipline, especially on investment and deposit-related liquidity.

This analysis is to a large degree consonant with studies on the impact of size on the deposit ratio, as well as with analyzes on the market discipline of the banking industry (e.g. Brown and Dinc (2011)). Hypothetically, size and large size dummy should have positive and significant coefficients with the deposit ratio and changes in the deposit ratio. However, in our results the coefficients are negative. The potential explanation for this unexpected outcome is that in the UK market there are few crucial international banks that need to be concerned.

On one hand, as shown in Table 3.13, these large banks issued a substantial part of the subordinated debt.

RBS Group is the largest group in Scotland, and at its earlier peak it was the second largest in the UK and Europe and the fifth largest in the world by market capitalization. National Westminster Bank was one of the “big four” English clearing banks, and became one of the subsidiaries of RBS Group in 2000. Lloyds TSB is not only one of the “big four” banks in the UK, but also one of the oldest banks in the UK, and merged with HBOS in 2008. Northern Rock is a special case. In the last decade

Northern Rock had converted from a mutual building society whose activities were limited by regulation, to retail deposits and mortgages. In 2007, it suffered the first bank run that the UK had experienced in over 140 years, following problems in the credit markets caused by the US subprime mortgage financial crisis. In 2008, the bank was nationalized.

On the other hand, investors (depositors, loans borrowers, shareholders, etc) who are concerned about these banks' risk-taking behaviour, particularly focus on capital adequacy and liquidity through sub-debt market signals. Therefore, issuing subordinated debt is an effective instrument in the market discipline mechanism, but also a fine tool to eliminate "too-big-to-fail" effects.

Table 3.13 Bank Sizes and Amounts of Subordinated Debt Issued

Banks / Year	Barclays	HSBC	NorthRock	Lloyds	HBOS	RBS
Total Assets (Millions GBP)						
2005	923,671	873.339.2	82,651	309,745	540,873	776,671
2006	996,023	949,092.8	100,951.1	343,598	591,813	871,276
2007	1,225,898	1,180,037.2	109,321	353,346	666,947	1,897,575
2008	2,050,312	175,304.4	104,321	435,200	687,361	2,394,570
2009	1,376,626	1,458,855	NA	1,022,249	NA	1,696,486
SND Amount (Millions GBP)						
2005	8,028	12,383.26	785.3	4,669	22,037	28,274
2006	8,339	13,173.18	762.4	4,252	24,992	27,654
2007	11,494	13,147.82	1,161.8	9,984	32,948	38,043
2008	16,134	5,895.82	1,514.9	11,124	19,371	49,154
2009	25,816	4,408.07	NA	34,727	NA	37,652

Data Sources: Thomason One Banker; Each bank's annual report for amounts of subordinated debt.

Table 3.14 Effects of Changes in Sub-debt on Fundamentals for Large Banks

Table 3.14 shows the partial regression estimations of bank fundamentals on changes in the Sub-debt amount and interest levels for large banks with both fixed effects (FE) and random effects (RE). The panel sample period is from 1998 to 2009. SIZE is the natural log of issuing bank's total assets; Size Dummy is a dummy variable which takes 1 if the size (natural logarithm of total assets) is greater than the median size for the sample. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent and the result is not reported. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

Variable	Capital Ratio	ROA	Residential Real Estate Loans Ratio	Commercial and Industrial Loans Ratio	Individual Loans Ratio	Investment Securities Ratio	Inefficiency Ratio	Liquidity Ratio	Loans to Deposits Ratio	Deposits Ratio
Panel A Size dummy in the regression of bank fundamentals on changes of sub-debt amounts										
Size	-0.0052	0.4097	0.0022	-0.0314	-0.0174	0.0388	0.0034	-0.0427	-0.0694	-0.0209
	[0.658]	[0.568]	[0.885]	[0.571]	[0.584]	[0.039]**	[0.848]	[0.141]***	[0.316]	[0.123]
Size Dummy	0.0312	-2.3097	0.0178	-0.0621	0.0468	-0.0386	-0.0229	0.3438	0.2418	0.0392
	[0.205]	[0.211]	[0.599]	[0.686]	[0.717]	[0.383]	[0.589]	[0.028]***	[0.168]	[0.324]
CONS	0.0141	1.1091	0.0122	0.2106	0.0458	0.1423	0.6949	0.0742	0.0693	0.085
	[0.816]	[0.698]	[0.848]	[0.381]	[0.756]	[0.059]*	[0.943]	[0.429]	[0.822]	[0.259]
N	912	756	480	360	372	720	804	780	516	504
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	RE	RE	RE	RE	RE	FE	RE	RE
R2-Within	0.408	0.3728	0.2146	0.1443	0.1017	0.1391	0.2416	0.9442	0.2108	0.2112
R2-Between	0.0046	0.1251	0.0444	0.0826	0.1309	0.125	0.0163	0.1008	0.1353	0.0035
R2-Overall	0.056	0.0405	0.1714	0.1344	0.0755	0.1319	0.0961	0.1562	0.1732	0.1368
F	1.38	1.7	-	-	-	-	-	3.91**	-	-
Wald	-	-	14.07	6.37	3.02	19.29	8.62	-	15.61	10.93

Table 3.14 *Continued*

Variable	Capital Ratio	ROA	Residential Real Estate Loans Ratio	Commercial and Industrial Loans Ratio	Individual Loans Ratio	Investment Securities Ratio	Inefficiency Ratio	Liquidity Ratio	Loans to Deposits Ratio	Deposits Ratio
Panel B Size Dummy in the regression of bank fundamentals on changes of sub-debt interest										
Size	-0.0039	-0.3089	0.0026	-0.0235	-0.0237	0.0411	0.0025	-0.0172	-0.0571	-0.0255
	[0.710]	[0.678]	[0.863]	[0.660]	[0.467]	[0.046]**	[0.890]	[0.786]	[0.410]	[0.055]*
Size Dummy	0.0273	-0.4058	0.0205	-0.0428	0.0395	-0.0412	-0.0209	0.2481	0.2279	0.0471
	[0.218]	[0.822]	[0.541]	[0.776]	[0.755]	[0.362]	[0.613]	[0.048]***	[0.197]	[0.228]
CONS	0.0141	1.2212	0.0168	0.1538	0.0843	0.1514	0.8261	0.0415	0.0637	0.0963
	[0.799]	[0.680]	[0.791]	[0.515]	[0.564]	[0.060]*	[0.932]	[0.851]	[0.837]	[0.191]
N	912	756	480	360	372	720	804	780	516	504
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	RE	RE	RE	RE	RE	FE	RE	RE
R2-Within	0.4416	0.3399	0.2247	0.136	0.0897	0.1379	0.227	0.8551	0.1732	0.1577
R2-Between	0.0001	0.1608	0.055	0.4002	0.1794	0.121	0.0124	0.0238	0.1331	0.1746
R2-Overall	0.0644	0.0025	0.1839	0.1796	0.0856	0.1319	0.0967	0.1512	0.1503	0.1605
F	1.74	1.47	-	-	-	-	-	2.11	-	-
Wald	-	-	15.32	8.98	3.46	19.15	8.77	-	12.94	13.19

3.6.4 Market Discipline during the Global Financial Crisis

Whether sub-debt provided discipline on banks during the recent global crisis period is further examined. Table 3.15 reports the fixed effects estimations of equation 2, which is the regression of bank fundamentals on the SND amount. Table 3.16 reports the estimated results for equation 3, which is the regression of bank fundamentals on the SND interest. The sample is separated into two-samples, one for the period between 2004 and 2006, and the other for the period from 2007 to the end of 2009. The FE/RE estimations failed to apply on equation 4 to 7 because of insufficient observations.

The capital ratio has negative coefficients with the SND amount at both year t and t-1 during 2004-2006, with the values of 0.018 and 1.0567, respectively. The coefficient with an SND amount at year t-1 become positive and 10% level statistically significant (with the value of 0.2929) in 2007-2009 sample. Also, in the earlier sample period, ROA has a negative coefficient (0.5995) with an SND amount and a positive coefficient (1.7141) with one-year-lagged SND amount. In the later sample period (2007-2009), the coefficient with an SND amount at year t becomes positive and 1% level statistically significant (with the value of 13.3168), and the coefficient with a one-year-lagged SND amount become negative and 1% level statistically significant (with the value of 17.3328). These results indicate that in the post-crisis era sub-debt amounts provide stronger disciplinary force on issuers' capital adequacy and earnings than in the pre-crisis period.

The SND amount has little influence on other loan portfolios besides individual

loans. The coefficient with the individual loan ratio (4.0712) in 2004-2006 has a significant increase (to 6.1721) with a positive and 5% level statistically significant sign. This result suggests that investing SND is an alternative portfolio of individual loan in the post-crisis era. Hence SND provides a strong constrain on individual loans.

However, disciplinary effects SND amount provided on management quality and liquidity have reduced. The inefficiency ratio has a positive and 5% level statistical significant coefficient with the SND amount (2.5216) during 2004-2006, and a positive coefficient (0.2315) during 2007-2009. The SND amount at year t-1 also has a positive and significant coefficient with the inefficiency ratio (2.4169), and becomes 0.1341 in the period of 2007-09. A similar situation applied to the liquidity ratio and deposit ratio. The values of coefficients significantly decreased from the 2004-2006 period to the 2007-09 period.

Table 3.15 Market Discipline in Pre- and Post-Global Financial Crisis Eras (1)

Table 3.15 shows the partial regression estimations of bank fundamentals on the Sub-debt amount level for in two periods (2004-2006, and 2007-2009) with both fixed effects (FE) and random effects (RE). According to Hausman χ^2 we report the results of appropriate estimations. The panel sample period is from 2004 to 2009. SIZE is the natural log of issuing bank's total assets; SND is the SND amount level for bank i at year t. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
Variable	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009
Yi,t-1	-1.3007	-0.1082	0.502	-0.1539	0.0552	-0.2759	-0.4184	0.053	0.5294	-0.2514	0.2961	-0.3478	0.1781	-0.0196
	[0.075]**	[0.193]	[0.000]***	[0.227]	[0.702]	[0.326]	[0.036]**	[0.601]	[0.002]***	[0.749]	[0.011]***	[0.025]**	[0.228]	[0.434]
SNDi,t	-0.018	0.2582	-0.5995	13.3168	-0.0196	-0.0028	0.0166	-0.0232	4.0712	-6.1721	0.0306	0.0109	2.5216	0.2315
	[0.988]	[0.704]	[0.045]**	[0.000]***	[0.115]	[0.962]	[0.422]	[0.560]	[0.050]**	[0.070]**	[0.206]	[0.934]	[0.056]**	[0.275]
SNDi,t-1	-1.0567	0.2929	1.7141	-17.3328	-0.0243	-0.0172	-0.0073	0.0173	-0.1505	1.8096	0.0153	-0.0294	2.4169	0.1341
	[0.776]	[0.139]*	[0.000]	[0.000]***	[0.190]	[0.596]	[0.814]	[0.427]	[0.880]	[0.654]	[0.669]	[0.686]	[0.064]**	[0.010]***
SIZE	-0.4472	-0.0146	-4.7926	-3.8626	0.0163	-0.0007	0.0475	0.0193	-0.0681	-0.1808	0.0942	-0.0684	-0.0294	-0.0016
	[0.001]***	[0.195]	[0.000]***	[0.006]***	[0.818]	[0.986]	[0.707]	[0.516]	[0.701]	[0.605]	[0.166]	[0.464]	[0.047]***	[0.784]
CONS	2.2758	0.1122	23.2679	22.1828	0.1368	0.2344	0.0727	0.0312	0.4621	1.5224	0.2194	0.9266	0.0048	0.0239
	[0.001]***	[0.043]**	[0.000]***	[0.002]***	[0.699]	[0.335]	[0.910]	[0.842]	[0.631]	[0.447]	[0.509]	[0.051]**	[0.958]	[0.448]
N	197	205	245	169	111	99	87	83	90	79	175	160	189	188
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
R^2- Within	0.9996	0.645	0.6941	0.4371	0.1867	0.1069	0.2154	0.064	0.5922	0.3507	0.2115	0.1242	0.8846	0.5484
R^2-Between	0.6788	0.29	0.019	0.0147	0.0859	0.9297	0.7598	0.0001	0.9141	0.0913	0.652	0.7848	0.0417	0.34
R^2-Overall	0.551	0.243	0.1174	0.0561	0.0923	0.8523	0.5606	0.0001	0.8967	0.1296	0.6166	0.6696	0.0798	0.0678
F	88.905***	1.82	17.78***	8.10***	1.38	0.6	1.01	0.44	4.6	0.9	2.32	1.6	6.39	2.63

Table 3.15 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
Variable	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009
Yi,t-1	-0.3696	0.1593	0.2044	-2.0192	0.1549	0.0292
	[0.018]**	[0.364]	[0.011]***	[0.347]	[0.212]	[0.926]
SNDi,t	-5.2119	-0.4906	-0.0193	2.8005	-0.0295	-0.0739
	[0.000]***	[0.073]*	[0.698]	[0.809]	[0.093]*	[0.514]
SNDi,t-1	4.5815	1.7564	-0.0085	0.0903	-0.0422	0.046
	[0.000]***	[0.009]***	[0.907]	[0.989]	[0.102]*	[0.475]
SIZE	-0.5601	0.3945	-0.3216	-12.4737	-0.1818	-0.0977
	[0.000]***	[0.013]***	[0.403]	[0.466]	[0.169]	[0.563]
CONS	3.1631	1.6084	2.6009	67.9971	1.3559	0.9364
	[0.000]***	[0.043]**	[0.177]	[0.452]	[0.046]**	[0.288]
N	186	171	120	114	120	114
Fixed Year	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE
R^2- Within	0.6559	0.4215	0.2698	0.0898	0.3779	0.1442
R^2-Between	0.0518	0.0148	0.2217	0.0093	0.2088	0.2423
R^2-Overall	0.0333	0.0126	0.216	0.0068	0.1496	0.3019
F	13.02***	3.64	2.03	0.43	3.34	0.73

SND interests provide further examples of the dynamic market discipline strength. The results of this investigation are reported in Table 3.16. From the first two columns we are aware that the SND interest produce greater disciplinary strength to the capital ratio in the later sample. Similar conclusions apply to the ROA, which coefficients with SND interests have increased dramatically from 2007 to 2009, and those coefficients are positive and statistically significant. Furthermore, SND interests provide stronger market discipline to the residential real estate loans ratio in the post-crisis period. On the other hand, SND interests no longer provide sufficient market discipline to liquidity.

Table 3.16 Market Discipline in Pre- and Post-Global Financial Crisis Eras (2)

Table 3.16 shows the partial regression estimations of bank fundamentals on the Sub-debt interest level for in two periods (2004-2006, and 2007-2009) with both fixed effects (FE) and random effects (RE). According to Hausman χ^2 we report the results of appropriate estimations. The panel sample period is from 2004 to 2009. SIZE is the natural log of issuing bank's total assets; Interest is the SND interest level for bank i at year t. Year dummies are also included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Capital Ratio		Return on Average Assets		Residential Real Estate Loan Ratio		Commercial and Industrial Loans Ratio		Individual Loan Ratio		Investment Securities Ratio		Inefficiency Ratio	
	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009
$Y_{i,t-1}$	-0.8851	0.1269	0.2699	-0.1646	0.0431	-0.1044	-0.4192	0.0298	0.4929	-0.0537	0.3325	-0.3771	0.0766	-0.0151
	[0.010]***	[0.053]**	[0.026]**	[0.251]	[0.777]	[0.712]	[0.036]**	[0.744]	[0.005]***	[0.954]	[0.005]***	[0.023]**	[0.604]	[0.557]
$Interst_{i,t}$	0.6993	-1.3648	-2.6575	15.6434	0.0685	0.5309	0.1134	-0.1484	-0.6843	0.3809	0.0494	0.3627	0.2031	-0.2479
	[0.042]***	[0.030]***	[0.442]	[0.078]*	[0.599]	[0.067]*	[0.595]	[0.315]	[0.404]	[0.557]	[0.837]	[0.445]	[0.516]	[0.280]
$Interest_{i,t-1}$	0.8432	-0.0683	-5.1995	17.815	0.0039	0.3584	0.1545	0.0276	-0.5665	-0.6817	-0.1867	0.5117	0.2967	-0.0393
	[0.048]***	[0.702]	[0.154]	[0.178]	[0.982]	[0.319]	[0.629]	[0.881]	[0.457]	[0.825]	[0.409]	[0.417]	[0.315]	[0.722]
SIZE	-0.3932	-0.0232	-4.3089	-3.6447	0.0589	0.034	-0.0204	0.0192	-0.2081	-0.1817	0.0939	-0.0174	-0.0294	-0.0077
	[0.001]***	[0.020]***	[0.000]***	[0.040]**	[0.575]	[0.451]	[0.922]	[0.508]	[0.197]	[0.696]	[0.174]	[0.858]	[0.061]**	[0.198]
CONS	1.8872	0.2692	22.1017	18.3251	0.0889	0.0285	0.2589	0.0398	1.3634	1.3849	0.2117	0.6198	0.1381	0.0808
	[0.002]***	[0.003]***	[0.000]***	[0.044]**	[0.863]	[0.914]	[0.803]	[0.801]	[0.108]*	[0.589]	[0.532]	[0.220]	[0.188]	[0.020]**
N	197	205	245	169	111	99	87	83	90	79	175	160	189	188
Fixed Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
R^2- Within	0.9998	0.6936	0.5913	0.2485	0.1028	0.203	0.2037	0.1057	0.5315	0.0763	0.2019	0.1666	0.7971	0.3852
R^2-Between	0.7572	0.4309	0.0074	0.0603	0.0355	0.5017	0.8141	0.0117	0.761	0.1171	0.7234	0.9427	0.0132	0.3301
R^2-Overall	0.645	0.1149	0.1117	0.1069	0.078	0.3379	0.546	0.0064	0.7355	0.0749	0.6915	0.7874	0.1644	0.043
F	91.714***	2.64	11.33***	2.31	0.69	1.27	0.94	0.77	3.59	0.14	2.19	1.4	3.27	1.15

Table 3.16 *Continued*

	Liquidity Ratio		Loans to Deposits Ratio		Deposit Ratio	
	2004-2006	2007-2009	2004-2006	2007-2009	2004-2006	2007-2009
$Y_{i,t-1}$	-0.3574	-0.1267	0.2058	-2.0488	0.1751	0.013
	[0.010]***	[0.415]	[0.015]**	[0.343]	[0.169]	[0.967]
$Interst_{i,t}$	3.0347	-0.3278	1.7236	-5.2132	-0.331	-0.0305
	[0.000]***	[0.705]	[0.355]	[0.905]	[0.961]	[0.943]
$Interest_{i,t-1}$	-0.8589	-1.8191	0.4296	-12.3916	0.5061	0.1682
	[0.175]	[0.336]	[0.674]	[0.830]	[0.151]	[0.765]
SIZE	-0.0488	0.1219	-0.3699	-12.5442	-0.1228	-0.0873
	[0.307]	[0.495]	[0.321]	[0.464]	[0.362]	[0.608]
CONS	0.5269	0.0011	2.7147	7.0054	1.0025	0.8778
	[0.028]**	[0.999]	[0.140]	[0.436]	[0.137]	[0.320]
N	186	171	120	114	120	114
Fixed Year	YES	YES	YES	YES	YES	YES
FE/RE	FE	FE	FE	FE	FE	FE
R^2- Within	0.8547	0.2827	0.2894	0.0888	0.3193	0.1285
R^2-Between	0.4844	0.049	0.1279	0.0163	0.5686	0.2628
R^2-Overall	0.0705	0.0375	0.1269	0.0116	0.5322	0.3271
F	41.17***	2.1	2.24	0.42	2.58	0.64

3.7 Conclusion

In this chapter the relationship between sub-debt market signals and banks' fundamentals was examined as a way to understand whether UK banks utilise market signals to discipline their risk-taking activity. It was discovered that amount levels of sub-debt provide restrictions to banks' capital adequacy and liquidity in both the long term (over a year) and the short term. Sub-debt's interests supply strong market discipline on banks' capital adequacy as well, however, with a one year time lag. Sub-debt amounts and interests also produce strong discipline on issuers' liquidity ratio. We could not find strong evidence that SND market signals to loan portfolios.

Furthermore, the effects of changes in sub-debt market signals on changes in bank fundamentals are investigated. Capital adequacy measures are more sensitive to the changes in sub-debt amount levels than interests. However, changes in sub-debt interests offer more power to discipline the deposit; while the changes in sub-debt amounts offer more constraint on banks' management quality. One year lagged values of changes in sub-debt interests have stronger effects on banks' performance. Increasing subordinated debt amount levels have negative and significant impacts on the issuers' individual loans ratio, investment securities ratio and deposit ratios, while boosts in debt interests have more inflections on capital adequacy proxies, other loan portfolios and on deposit-related liquidity characteristics.

There are two essential counterparts in the process of market discipline, one being the subordinated debt, the other being the issuing banks. In the previous discussion, the market signals that subordinated debt might give were examined. In this chapter, it was investigated whether the size of banks has effects on the reception and reaction of sub-debt market signals. In other words, an analysis was carried out as

to whether subordinated debt provides greater market discipline on the bigger banks. The answer is found to be positive. Market signals provided by subordinated debt have been received well.

Besides banks' size effects, time effects of market discipline were also considered. Two sub-samples were compared, one from before the financial crisis and the other running from the beginning of the crisis. It was examined as to whether banks are more sensitive to market discipline through subordinated debt during global financial crisis. Subordinated debt has provided stronger and more effective market discipline on capital adequacy, earnings and some loans since the financial crisis, but has also provided less influence on issuing banks' liquidity.

Chapter 4 Impacts of Subordinated Debt on Banks' Distress Indicators

4.1 Introduction

In recent years, central banks and multilateral financial institutions have sought to promote the use of forward-looking market-based risk measures to supplement traditional financial statements analysis (Chan-Lau, 2006; Tudela and Young, 2005). Among these measures, the distance-to-default indicator (DD) has received much attention. There is a general agreement on the efficacy of DD as an indicator of financial distress and fragility capable of capturing default risk for commercial banks. In this paper, we study a new dimension of the DD indicator, that is, the role of subordinated notes and debentures (SND) in the efficacy of DD functionality. Based on the UK banking evidence, the aim of this research is to ascertain the extent that the SND market information affects the predictive power of DD in signifying banks' financial distress. To this end, we concentrate on detecting the differences between SND issuing banks and non-SND banks in predicting their financial distress.

We first estimate UK banks' DD using both book- and market-based information including measures of loan quality, earnings, liquidity, capital level and leverage in our estimation. Our sample includes 36 UK banks and financial institutions in the FTSE 100. The baseline estimation supports book-based measures in predicting distance-to-default. However, earnings diversification and leverage are insignificant for the whole sample.

In order to examine the effect of sub-debt issuance, our sample is divided into two sub-groups: SND banks and non-SND banks. We find that in addition to those measures that are significant for the whole sample, earnings diversification and leverage also affect DD for SND banks. On the other hand, the predictive power of most measures is poor for non-SND banks. Our findings imply that the default risk of SND banks is better captured by book- and market-based measures than is the default

risk of non-SND banks. Further, the effect of sub-debt on DD is examined for sub-periods before and after the financial crisis. There is a significant difference between SND and non-SND banks in the estimation of their DD for the pre- and post-crisis periods. We find increasing power of book-and market-based measures on predicting banks' DD from 1997 to 2006, but the explanatory power is lower during the financial crisis. In addition, bank fundamentals can more efficiently predict default risk for those subordinated debt-issuing banks with higher charter values and bank capitalization.

This paper is organized as follows: We briefly review the relevant literature in Section 4.2. In Section 4.3, we define our baseline model for estimating distance-to-default and describe our sample. Section 4.4 discusses our findings from the baseline model and presents the consequent analysis. Finally, we conclude this paper and draw policy implications in Section 4.5.

4.2 Literature Review

An increasing number of papers suggests that bank regulators and supervisors should use distance-to-default as a market-based risk measures for financial institutions. For example, Gropp et al. (2004) conclude that distance-to-default is an efficient market indicator for bank default and fragility, and can be used to prevent supervisors from chasing false leads. Chan-Lau (2006) suggests estimating default probabilities as the first step towards assessing systematic risks and stress-testing financial systems. He also compares the efficiency of different techniques, including distance-to-default, credit default swaps, and bond and equity prices.

Akhigbe et al. (2007) demonstrate that DD is capable of characterizing the

default likelihood of commercial banks. Moreover, DD has links with bank-specific factors. Specifically, the default likelihood is inversely related to the bank's capital, size and growth opportunities, and positively related to financial leverage and return on equity (ROE). In addition, the authors demonstrate that the Federal Reserve System could affect bank distress and default likelihood significantly through monetary policy. For instance, when the Federal Bank increases interest rates, the default likelihood increases, and vice versa.

One strand of existing empirical work focuses on pricing bank default risk with subordinated debt spreads (Evanoff and Wall, 2001; Flannery and Sorescu, 1996; Goyal, 2005). In the event of bank failure, subordinated debt investors will generally bear greater losses than investors of other debt. Therefore, subordinated debt investors have greater incentives to monitor the issuing banks' excessive risk-taking behaviour. The yield spreads, as one of the useable market signals, is considered content-sufficient and provides timely information about issuing firms' default risks. Another strand of empirical study measures market efficiency with the amount of subordinated debt. Uchida and Satake (2009) investigate whether sub-debt investors exert disciplinary pressure on banks' management and improve efficiency. They apply the ratios of the amount of outstanding subordinated liabilities (loans and bonds) to total assets as market disciplinary variables.

However, there are very few studies focusing on the effect of subordinated debt on distance-to-default. Kato and Hagendorff (2010) analyse the degree to which accounting variables can explain market-based DD measures in the US banking industry. They find that the predictive power of bank risk fundamentals is stronger for banks that have issued sub-debt than for those without outstanding sub-debt.

Previous studies (Demsetz, Saidenberg, and Strahan, 1996; Keeley, 1990) agree

that charter value is an effective tool to control moral hazard incentives. Banks with lower charter values have greater incentives to engage in risk taking. Goyal (2005) indicates that investors expect that debt contracts issued by banks with lower charter values would offer higher yield spreads and/or more restrictive covenants. Furthermore, Demsetz, Saidenberg, and Strahan (1996) and Goyal (2005) point out how banks with lower charter values reduce managers' ex-ante incentives for risk taking. Kato and Hagendorff (2010) examine the impact of charter value on banks' fundamentals. For banks issuing subordinated debt, higher charter values indicate that accounting-based measures of bank risk have greater explanatory power of variation in DD.

Several studies employ capital as an important indicator of banks' stability (Chan-Lau and Sy, 2007; Koziol and Lawrenz, 2009). Accordingly, capital reserves are viewed as capital cushions for default. In other words, highly capitalized banks should have a lower default probability than banks with a smaller capital cushion. Flannery and Rangan (2008) study the capitalization of large US banks during the 1990s, establishing that markets can recognize and influence bank default risk. They also find that the book to capital ratio and capital cushions can play a complementary role in disciplining large financial firms. Elyasiani and Jia (2008) find that bank holding companies (BHC) with higher capital ratios have a lower default risk, and are less likely to face intervention from regulators and market monitors.

4.3 Methodology

4.3.1 Baseline Model

We follow the approach adopted by Hillegeist et al. (2004) and Akhigbe, Madura and Martin (2007) to calculate banks' distance-to-default. Market value of assets (V_A) and the volatility of assets (δ_A) are two essential inputs to the calculation. These two values can be obtained by solving the nonlinear system consisting of two equations. The first equation is the description of the value of equity as a call option on firm's assets:

$$V_E = V_A N(d_1) - De^{-rT} N(d_2), \tag{4.1}$$

where V_E is the value of equity, which is proxied by using the market capitalization of the bank. $N(d_1)$ and $N(d_2)$ are the cumulative standard normal distributions of d_1 and d_2, respectively. D is short-term debt and the current portion of long-term debt from the bank's balance sheet. Following the literature, we use the book value of total debt. r is the risk-free rate, which is proxied by the 1-year Treasury bill rate. T is the length of the period. d_1 and d_2 are given by the following equations:

$$d_1 = \frac{\ln \frac{V_A}{D} + \left(r + \frac{\delta_A}{2}\right)T}{\delta_A \sqrt{T}},$$

$$d_2 = d_1 - \delta_A \sqrt{T}.$$

The second equation of the nonlinear system is the optimal hedge condition linking the volatility of equity and that of assets:

$$\delta_E = \frac{V_A}{V_E} N(d_1) \delta_A, \tag{4.2}$$

where δ_A is the volatility of equity. δ_E is estimated using standard deviation of

equity returns in one year. The unknowns in the system of equations (1) and (2) are V_A and δ_A, while all the other elements are known. The system can be solved using Newton iteration. The starting values of iteration can be estimated using the following equations:

$$\delta_A = \frac{\delta_E V_E}{V_E + D},$$

$$V_A = D + V_E.$$

With all these elements obtained, we can then calculate the DD indicator using the following definition:

$$DD = \frac{\ln \frac{V_A}{D} + \left(r - \frac{\delta_A^2}{2}\right)T}{\delta_A \sqrt{T}} \quad (4.3)$$

A branch of literature suggests using fundamentals to estimate banks' distance-to-default or default likelihood (Flannery and Sorescu, 1996; Kato and Hagendorff, 2010; Martinez Peria and Schmukler, 2001). Our model is inspired by this branch and the baseline model is formulated as follows:

$$DD_{i,t} = \alpha_0 + \alpha_1 BankRiskFundamentals_{i,t-1} + \alpha_2 C_{i,t-1} + d_t + \varepsilon_{i,t}, \quad (4.4)$$

where:

BankRiskFundamentals = variables (lagged by 1 year) as defined in Table 1

$C_{i,t}$ = control variables affecting the bank's distance-to-default

d_t = year dummies

i = 1,…, N is the number of banks

t = 1,…,T is the number of years

$\varepsilon_{i,t}$ = error term with assumed Gaussian properties

Table 4.1 Bank Risk Fundamentals

Variable	Definition
CAP	Book value of equity / total assets
NPLTL	Non-performing loans / total loans
RLLA	Reserve for loan losses / total assets
ROA	Profit before interest and tax divided by book value of assets
NIIR	Non-interest income divided by revenues
CSD	Cash and marketable securities / total deposits
LEV	Total book liabilities / total book equity
MKTLEV	Total liabilities / (market value of common stock + book value of preferred stock)
Tobin's Q	(Market capitalization + total assets – total equity)/total assets

Year dummy variables are used to capture the time effects that control for intertemporal variations in macroeconomic conditions such as tax effects. We consider the natural log of total assets that captures the size effects of banks, such as potential diversification benefits or supervisors' too-big-to-fail policies.

Many previous studies have employed book-based measures of banking risk (Demsetz and Strahan, 1997; Elyasiani and Jia, 2008). Indicators such as non-performing loans and reserve for loan losses are commonly used to evaluate loan quality and thus they can affect banks' distance-to-default. Amongst them, non-performing loans divided by total loans (NPLTL) indicates the quality of the loan portfolio. Higher values of this variable suggest lower asset quality (Akhigbe, Madura, and Martin, 2007; Flannery and Sorescu, 1996), and should affect DD negatively. The ratio of reserves for loan losses to total assets (RLLA) is another indicator of loan quality. Higher reserves for loan losses indicate higher capacity for a bank to bear loan losses, and therefore RLLA should have a positive impact on a bank's distance-to-default.

Earnings other than interest incomes provide diversification of bank portfolios and thus reduce the variance of the bank's returns. To capture the diversification effect, we use non-interest incomes divided by revenues (NIIR), which should associate positively with distance-to-default. On the other hand, higher profitability signals

larger portfolio risk undertaken by the bank. Returns on assets (ROA) as the profitability indicator should have negative correlation with distance-to-default.

Larger asset base and liquidity position should ease the financial constraint on the bank. As an index of banks' liquidity position, a higher ratio of cash and marketable securities over deposits (CSD) indicates a higher DD. Similarly, well-capitalized (CAP) banks have a lesser chance of defaulting.

In addition to the book-based measures listed above, market-based measures of bank risk have often been adopted (Evanoff, Jagtiani, and Nakata, 2011; Hancock and Kwast, 2001; Jagtiani, Kaufman, and Lemieux, 2002). Market leverage (MKTLEV) is considered a superior measure of bank risk to risk-based capital ratio, because the market-based measure takes into account banks' credit risks. Market leverage and book-measured leverage (LEV) both have positive effects on banks' liabilities cost, hence negative effects on banks' distance-to-default.

4.3.2 Data and Sample Description

The sample consists of 36 UK banks and financial service institutions listed in the FTSE 100, with annual data from 1997 to 2010. Detailed balanced sheet information for these 36 financial firms was collected from the Thomson One Banker database. Market information, such as stock returns of the firms, was collected from Datastream. Table 4.2 shows the descriptive statistics for the variables.

In our sample, 14 banks or financial institutions have outstanding positions of subordinated debt, while 22 do not. Compared with the samples used in studies on the US market (Elyasiani and Jia, 2008; Flannery and Rangan, 2008), our sample is subordinated debt, the mean value of DD is 7.271. Elyasiani and Jia (2008), using a

sample of 110 subordinated debt-holding banks and financial institutions in the US market, report a mean of 3.376 over the period from 1992 to 2004. Similarly, Kato and Hagendorff (2010) use US bank holding companies' reports to calculate DD for individual firms, and have a mean DD value of 3.913 for the period from 1998 to 2007. The key descriptive statistics for our pooled sample imply that the UK banking system has higher average distance-to-default and more stability than the US financial market. The whole sample has an average DD of 6.396, which is smallerer than the average DD of SND banks, indicating lower default probability of SND banks.

The descriptive statistics for both the whole data sample and the sub-sample of SND banks show that equity volatility is higher than asset volatility. In terms of indicators of loan quality, SND banks have a lower non-performing loan ratio and reserves for loan loss. These imply that SND banks have better management of loan quality and require smaller corresponding buffer stock for loan loss. SND banks have slighter high ROA than sample average and display a tendency to generate more revenue from non-interest incomes than average. SND banks also have higher than average CAP and tend to finance through issuing equity, and therefore they have smaller book and market leverages than sample average. Generally, SND banks demonstrate distinct book and market indicators, a fact that inspires our analysis of the sub-sample of these banks.

Table 4.2 Sample Descriptive Statistics

Table 4.2 shows the sample descriptive statistics. The variable DD is the distance-to-default indicator calculated using equations (1) to (3). Equity volatility (δ_E) is calculated as the standard deviation of daily equity returns multiplied by the square root of the number of trading days in a year. Assets volatility (δ_A) is the volatility of asset returns based on the contingent claims model. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserves for loan losses to total assets, ROA is the ratio of profit before interest and tax divided by the book value of assets, NIIR is the ratio of non-interest incomes divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of market value of common stocks and book value of preferred stocks, Tobin's Q is the ratio of the sum of market capitalization and total assets minus total equity to total assets.

	Whole Sample					SND Banks				
	Mean	Median	Std.Dev	Min	Max	Mean	Median	Std.Dev	Min	Max
DD	6.396	4.440	7.970	0.321	114.594	7.271	5.171	6.860	0.786	52.039
δ_e	0.374	0.313	0.274	0.030	3.418	0.372	0.303	0.309	0.030	3.418
δ_a	0.158	0.116	0.217	0.004	3.173	0.213	0.155	0.261	0.005	3.173
CAP	0.312	0.230	0.312	-2.354	0.996	0.442	0.399	0.341	-2.354	0.996
NPLTL	0.401	0.000	0.903	0.000	6.170	0.126	0.000	0.559	0.000	3.080
RLLA	0.376	0.000	1.303	0.000	17.720	0.057	0.000	0.236	0.000	1.400
ROA	0.040	0.025	0.112	-1.160	0.467	0.042	0.030	0.145	-1.160	0.467
NIIR	0.736	1.000	0.328	0.000	1.000	0.835	1.000	0.293	0.000	1.000
CSD	27.127	0.000	73.683	0.000	710.354	20.613	0.000	80.102	0.000	710.354
LEV	9.165	3.089	17.198	-1.017	239.321	3.138	1.359	7.193	-1.017	91.777
Tobin'sQ	1.542	1.127	1.307	0.453	13.684	1.740	1.189	1.663	0.453	13.684
MKTLEV	5.452	1.389	13.049	0.005	160.838	1.619	0.744	3.713	0.005	44.181
Size	6.957	6.696	1.984	0.693	11.724	5.983	5.926	1.324	0.693	8.981

The correlation matrixes among variables are reported in Table 4.3. The correlation between DD and equity volatility (δ_e) and asset volatility (δ_a) is -0.290 and -0.090, respectively, and smaller volatility implies larger DD. Whereas in similar studies (Kato and Hagendorff, 2010) equity volatility and asset volatility are almost perfectly correlated, in this study the correlation between them for financial firms is 0.702, which indicates that the two variables reflect different firm risk characteristics. Panel B in Table 4.3 presents pair-wise correlation between the book-based accounting variables of bank risks. The pooled sample is also collapsed into time series to examine the time continuity of the data sample.

Table 4.3 Correlations Matrix

Table 4.3 presents the correlation matrix for two groups of variables including distance-to-default, banks' volatility, risk measures, performance and control variables. The variable DD is the distance-to-default. Equity volatility (δ_E) is calculated as the standard deviation of daily equity returns multiplied by the square root of the number of trading days in a year. Assets volatility (δ_A) is the volatility of asset returns based on the contingent claims model. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the ratio of profit before interest and tax divided by book value of assets, NIIR is the ratio of non-interest income divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of market value of common stock and book value of preferred stock, Tobin's Q is the ratio of the sum of market capitalization and total assets minus total equity to total assets.

Panel A Correlation between DD and equity volatility, asset volatility, total liability and total assets

Variable	DD	δ_e	δ_a	Liability
δ_e	-0.290			
δ_a	-0.090	0.702		
Liability	-0.101	0.235	-0.327	
Assets	-0.097	0.186	-0.376	0.957

Panel B Correlation between risk measures, performance and control variables

Variable	CAP	NPLTL	RLLA	ROA	NIIR	CSD	LEV	Tobin's Q	MKTLEV
NPLTL	-0.353								
RLLA	-0.112	0.233							
ROA	-0.005	-0.117	-0.019						
NIIR	0.100	-0.490	-0.318	0.129					
CSD	-0.252	0.413	0.048	-0.082	-0.244				
LEV	-0.407	0.283	0.034	-0.102	-0.289	0.215			
Tobin'sQ	0.050	-0.162	-0.097	0.382	0.275	-0.121	-0.168		
Mktlev	-0.320	0.445	0.047	-0.097	-0.244	0.418	0.590	-0.158	
Size	-0.408	0.608	0.187	-0.001	-0.589	0.399	0.373	-0.096	0.315

4.4 Empirical Results

4.4.1 Estimating the Baseline Model

Our baseline model is first estimated using pooled Ordinary Least Squares (OLS). The results are shown in Table 4.4 Column (1). With the exception of leverage indicators, most indicators display significance. Loan quality (including NPLTL and RLLA), liquidity CSD and capital level CAP are all significant at the 1 per cent level. Profitability indicator ROA has a significant estimated value of -0.540, and this confirms that banks could hold a riskier loan portfolio to generate higher returns. However, the earning diversification NIIR does not display significance even at the 10 per cent level. Further, our estimation does not find significance among the leverage indicators. Both book leverage and market leverage coefficients are negative, but insignificant. The R-square is 0.398 and shows the fitness of our model. Heteroscedasticity is further detected with White's test, where the Chi-square value is 35.37 and significant at the 5 per cent level. This test rejects the null hypothesis and finds that the specification contains unrestricted heteroscedasticity.

Table 4.4 Estimation for the Baseline Models

Table 4.4 reports the regress analysis of DD on lags of bank fundamentals estimated by OLS, fixed effects, random effects. Sample period is from 1997 to 2009. The dependent variable is distance-to-default. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the return on assets, NIIR is the ratio of non-interest incomes to revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the book leverage, MKLEV is the market leverage. Hausman χ^2 is adopted to test the appropriateness of RE estimator with the null hypothesis that the RE estimator is consistent. Year dummies are included to control the year effect. P-values are shown in brackets as ***, **, * indicating significance at the 1%, 5% and 10% levels, respectively.

Variables	(1) OLS	(2) Fixed Effects	(3) Random Effects
$CAP_{i,t-1}$	31.065	25.095	30.710
	[0.000]***	[0.001]***	[0.006]***
$NPLTL_{i,t-1}$	-2.384	-2.034	-2.527
	[0.000]***	[0.026]**	[0.014]**
$RLLA_{i,t-1}$	5.315	3.687	5.598
	[0.000]***	[0.112]	[0.031]**
$ROA_{i,t-1}$	-0.540	-0.572	-0.548
	[0.000]***	[0.000]***	[0.002]***
$NIIR_{i.t-1}$	0.022	0.111	0.024
	[0.334]	[0.367]	[0.494]
$CSD_{i,t-1}$	0.014	0.006	0.014
	[0.006]***	[0.402]	[0.215]
$LEV_{i,t-1}$	-0.029	-0.039	-0.024
	[0.406]	[0.446]	[0.671]
$MKTLEV_{i,t-1}$	-0.024	-0.002	-0.023
	[0.066]*	[0.862]	[0.407]
$SIZE_{i,t}$	0.632	-0.175	0.597
	[0.027]**	[0.801]	[0.045]**
CONS	-5.039	4.536	-4.726
	[0.121]	[0.457]	[0.274]
N	362	362	362
R^2	0.398	0.263	0.052
F		13.85***	
Wald-Chi	35.37**	25.75**	20.16*
Hausman Test		30.19***	

To cope with heterogeneity, we estimate both fixed effects and random effects for the baseline model. Estimated coefficients and p-values are reported in Columns (2) and (3) of Table 4.4. For fixed effects estimation, we find only three significant

coefficients: CAP, NPLTL and ROA. This result implies that the capital level, loan quality and profitability affect the default risk of the banks. RLLA and CSD reflect the reserve buffer for loan losses and the liquidity, but they are no longer significant in the test for fixed effects. Random effect estimation displays similar estimated values and significance, with the exception of the significance of RLLA and SIZE. Generally, both fixed effects and random effects estimations find signs consistent with pooled regression and with our expectation in Section 3.1. We also conduct a Hausman test to examine the appropriateness of the random effects modelled. The results are shown at the bottom of Table 4.4. The random effects estimator is consistent; the Hausman test's null hypothesis is soundly rejected. Therefore the fixed effects estimator is more appropriate to identify banks' DD.

Results in Table 4.4 are also an alternative robust check for the model-bias problem. NPLTL and ROA have negative signs and are statistically significant, and these results are supporting estimated coefficients under other estimators. RLLA and NIIR, consistent with parameters estimated by OLS, fixed effects and random effects, have positive and significant coefficients.

4.4.2 Distance-to-Default for SND and Non-SND Banks

We aim to examine the difference in explanatory power of book-based risk measures for banks' distance-to-default between SND and non-SND banks. To explore this question, the sample is divided into two groups: banks with outstanding sub-debt (173 observations), and banks without sub-debt (225 observations). For each sub-group, we regress banks' distance-to-default on risk fundamentals and control variables. Results of both fixed effects estimation are reported in Table 4.5. We also estimate results from random effects and then conduct a Hausman test. The statistic indicates that the fixed effect is a more appropriate approach.

Results in Column (1) of Table 4.5 reveal that as an indicator of capitalization, CAP enters the model with a positive sign (4.859) and is significant at the 10 per cent level. One possible explanation for this is that well-capitalized banks are less vulnerable to economic or financial shocks. NPLTL has a negative and 5 per cent significant coefficient (-1.161). Lower ratio of non-performing loans in banks' portfolio increases banks' DD. ROA has positive and significant coefficients at the 1 per cent significance level (10.006). Banks with higher profitability tend to be less volatile to financial distress. The NIIR captures banks' earnings diversification. A negative coefficient (-6.453) is consistent with the suggestion that banks with more diversified revenues are more capable to deal with financial distress. As an indicator for liquidity, CSD has a negative and significant coefficient with DD. Consistent with our baseline estimation; both coefficients for book and market leverages are insignificant in the estimation for the subsample of SND banks.

Column (2) of Table 4.5 displays coefficient values and the corresponding p-values using the fixed effects estimation for banks without subordinated debt.

Different from the estimation for the subsample of SND banks, non-SND banks subsample displays insignificant coefficients. R-square for SND and non-SND sub-samples are 0.531 and 0.165, respectively, which implies better fitness for the model to capture SND banks' DD. Also, the model displays total significance based on F-test for SND banks, but it is insignificant as a whole for non-SND subsample estimation.

Different from existing studies (e.g. Kato and Hagendorff, 2010) our study does not deliver strong evidence that there are significant differences in single coefficients between Columns (1) and (2). Column 3 in Table 5 displays the differences between the estimated coefficients in Columns (1) and (2), and the corresponding t-values to test the significance of the differences. Except NIIR and CSD, most t-values of differences between other coefficients are not significant. To further examine the existence of structural break for the two subsamples, we perform Chow test and the F-test statistic is displayed in the second panel in Table 5. The 1 per cent significant statistic implies that the model displays difference as a whole in modelling these two sub-samples. Although we cannot find major difference between the estimated coefficients, the model does show structural break between subsamples for SND and non-SND banks.

Table 4.5 Distance-to-Default for SND and Non-SND Banks

Table 4.5 shows the regression estimations of DD on lags of bank fundamentals with fixed effects. The sample period is from 1997 to 2009, and it is separated into three subsamples based on whether banks issued outstanding SND. The dependent variable DD is the distance-to-default. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the ratio of profit before interest and tax divided by book value of assets, NIIR is the ratio of non-interest incomes divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of the market value of common stocks and book value of preferred stocks. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent, but results are not reported. Year dummies are also included to control the year effect. P-values are shown in brackets [] as ***, **, * indicating significance at the 1%, 5% and 10% levels, respectively. T-values are shown in brackets ().

	Fixed Effects		Differences in coefficients (1)-(2)
Variable	SND Banks (1)	Non-SND (2)	
$CAP_{i,t-1}$	4.859	0.452	4.407
	[0.061]*	[0.900]	(0.996)
$NPLTL_{i,t-1}$	-1.161	2.064	-3.225
	[0.013]**	[0.526]	(-0.897)
$RLLA_{i,t-1}$	2.841	-0.126	2.967
	[0.441]	[0.693]	(0.804)
$ROA_{i,t-1}$	10.006	-2.021	12.027
	[0.000]***	[0.868]	(0.974)
$NIIR_{i,t-1}$	-6.453	24.423	-30.876
	[0.084]*	[0.110]	(-1.970)**
$CSD_{i,t-1}$	-0.006	0.000	-0.007
	[0.020]**	[0.857]	(-2.460)**
$LEV_{i,t-1}$	0.241	0.001	0.240
	[0.278]	[0.957]	(1.079)
$MKTLEV_{i,t-1}$	-0.608	-0.007	-0.600
	[0.166]	[0.874]	(-1.368)
$SIZE_{i,t}$	-1.063	0.738	-1.801
	[0.156]	[0.479]	(-1.406)
CONS	13.465	-17.351	30.816
	[0.058]*	[0.398]	(1.423)
N	173	225	
K	10	10	
RSS	4948	11927	
R^2	0.531	0.165	
F	12.49***	3.86	
Chow test			12.92***

4.4.3 Distance-to-Default Over Time

In this section, we examine the explanatory power of book- and market-based risk measures on bank distance-to-default across the global financial crisis. We divide the whole sample into three sub-periods: 1997 to 2002, 2003 to 2006, which are the periods before the financial crisis, and 2007 to 2010, which covers the crisis period. We estimate both fixed effects and random effects. The Hausman test statistic suggests fixed effects as a more appropriate approach. Table 6 presents the statistics obtained through estimation of the fixed effects model.

In the period 1997-2002, we can see significant differences between the estimated coefficients for SND banks and those for non-SND banks. CAP is positive and significant for both SND and non-SND banks. This tells the importance of equity finance for banks in both sub-samples and inspires our further test with capital adequacy in Section 4.5. The insignificant t-value in Column (1)-(4) also confirms there is no large difference for this coefficient for the two sub-samples. However, we find difference estimated values for other coefficients. ROA, NIIR, LEV are significant for SND banks, but insignificant for non-SND banks. Similar as in Section 4.2, we perform Chow test to detect structural break and find significant statistic at the 1 per cent level. The model is different as a whole for SDN and non-SND banks in the period between 1997 and 2002.

Chow test for the periods 2003-2006 and 2007-2010 also finds structural break between the subsamples of SND and non-SND banks from Chow test. However, individual coefficients display different findings from 1997-2002. For the period between 2003 and 2006, the model has higher predictive power for SND banks than for non-SND banks. CAP, NPLTL, CSN and both leverage indicators are significant at

the 1 per cent level for SND subsample. However, none of the estimators is 1 per cent significant for non-SND banks. Test for difference between individual coefficients for these two subsamples shows similar pattern as 1997-2002. In Column (2)-(5), CSD and both leverage indicators have significant difference for estimated values of the two sub-samples. Moreover, RLLA and ROA are different, which is not observed in 1997-2002.

Table 4.6 Comparison of DD for SND and Non-SND Banks before and after Financial Crisis

Table 4.6 shows the regression estimations of DD on lags of bank fundamentals with fixed effects. The panel data sample period is from 1997 to 2009. The dependent variable DD is the distance-to-default. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the ratio of profit before interest and tax divided by the book value of assets, NIIR is the ratio of non-interest income divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of the market value of common stocks and book value of preferred stocks. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent, but results are not reported. Year dummies are also included to control the year effect. P-values are shown in brackets [] as ***, **, * indicating significance at the 1%, 5% and 10% levels, respectively. T-values are shown in brackets ().

	SND Banks			Non-SND Banks			Differences in coefficients Ho: SND banks=Non-SND banks?		
	1997-2002 (1)	2003-2006 (2)	2007-2010 (3)	1997-2002 (4)	2003-2006 (5)	2007-2010 (6)	1997-2002 (1)-(4)	2003-2006 (2)-(5)	2007-2010 (3)-(6)
$CAP_{i,t-1}$	17.956	2.470	-6.868	25.731	7.599	11.367	-7.775	-5.130	-18.236
	[0.000]***	[0.000]***	[0.547]	[0.000]***	[0.068]*	[0.135]	(-1.116)	(-1.275)	(-1.347)
$NPLTL_{i,t-1}$	1.362	9.476	-3.792	-0.115	-1.332	3.090	1.476	10.809	-6.882
	[0.687]	[0.002]***	[0.319]	[0.456]	[0.033]**	[0.611]	(0.439)	(3.616)**	(-0.969)
$RLLA_{i,t-1}$	-4.029	-30.309	9.383	-0.628	-0.885	0.947	-3.402	-29.424	8.437
	[0.615]	[0.017]**	[0.108]	[0.000]***	[0.027]**	[0.307]	(-0.427)	(-2.419)**	(1.453)
$ROA_{i,t-1}$	3.675	8.074	11.669	-4.315	-0.686	-32.504	7.990	8.760	44.173
	[0.001]***	[0.064]*	[0.009]***	[0.814]	[0.965]	[0.372]	(0.438)	(0.552)	(1.222)
$NIIR_{i,t-1}$	-11.780	1.584	1.635	-1.475	10.476	20.542	-10.305	-8.892	-18.907
	[0.000]***	[0.735]	[0.696]	[0.820]	[0.062]*	[0.377]	(-1.539)	(-1.248)	(-0.810)
$CSD_{i,t-1}$	-0.001	-0.032	0.013	0.097	0.011	-0.003	-0.098	-0.042	0.016
	[0.864]	[0.000]***	[0.183]	[0.026]**	[0.016]**	[0.980]	(-2.311)**	(-4.812)**	(0.150)
$LEV_{i,t-1}$	0.705	-0.389	-0.128	-0.015	0.015	-0.021	0.720	-0.403	-0.108
	[0.000]***	[0.000]***	[0.248]	[0.797]	[0.269]	[0.803]	(4.077)**	(-17.562)**	(-0.783)
$MKTLEV_{i,t-1}$	-1.548	0.291	0.331	-0.363	-0.005	0.208	-1.185	0.297	0.123
	[0.012]**	[0.000]***	[0.173]	[0.001]***	[0.931]	[0.387]	(-1.968)**	(3.968)**	(0.365)
$SIZE_{i,t}$	-2.125	-1.279	4.799	-1.885	0.334	14.743	-0.240	-1.613	-9.943
	[0.006]***	[0.211]	[0.036]**	[0.000]***	[0.708]	[0.186]	(-0.276)	(-1.205)	(-0.892)

Table 4.6 *Continued*

CONS	13.425	15.163	-31.870	19.969	-2.551	-179.206	-6.544	17.713	147.336
	[0.070]*	[0.088]*	[0.018]**	[0.002]***	[0.805]	[0.130]	(-0.698)	(1.323)	(1.269)
N	66	51	56	77	65	83			
K	10	10	10	10	10	10			
RSS	1223	209	1199	84	72	6511			
Chow test							200.747***	763.907***	23.046***
R^2	0.759	0.873	0.602	0.789	0.904	0.500			

In the post-crisis period between 2007 and 2010, we find small predictive power of book- and market-based fundamentals on banks' DD. Except ROA and SIZE for SND banks, none of the rest coefficients displays significance. Also, t-values in Column (3)-(6) find no significant difference for individual coefficients of the two subgroups in this period. In addition, R-square of these three periods confirms the smaller power of the model in the crisis period. SND and non-SND subsample estimations have R-squares of 0.602 and 0.500, respectively, which is much smaller than the other two periods.

In summary, during the period 1997 to 2002, although bank-based accounting variables do not show strong explanatory or predictive power for distance-to-default, there is strong evidence that SND status enhances disciplinary force on banks. In the period between 2003 and 2006, the predictive power of accounting-based variables on distance-to-default increases. However, it is hard to conclude that the disciplinary force on banks' financial distress provided by sub-debt has been enhanced significantly in the post-global financial crisis era.

4.4.4 Distance-to-Default and Tobin's Q for SND Banks

A branch in the literature covers the impact of banks' charter value on managers' risk taking decisions (e.g. Keeley, 1990). Galloway et al. (1997) and Kato and Hagendorff (2010) hold the view that since valuable charters cannot be sold in the event of default, valuable charters curtail bank managers' risk taking. Correspondingly, a lower charter value implies a signal of increased requirement for market monitoring and discipline. In this light, we examine the impact of charter value on the explanatory power of fundamentals on distance-to-default of SND and non-SND banks.

We proxy charter value by Tobin's Q. Banks are assigned to different groups based on average charter value from 1997 to 2010, i.e., the lowest value quintile (Q1), middle value quintiles (Q2-Q4) and the highest value quintile (Q5). We then regress distance-to-default on bank risk fundamentals for these sub-groups. Tobin's Q has been widely adopted in the studies of banks' market value, since it captures market power in terms of investment opportunities relative to equity market participants (Carpenter and Guariglia, 2008). Our estimation finds a few different characters of modelling DD for these subgroups.

Column (1) in Table 4.7 reports the regression results for banks with low Tobin's Q values (Q1). Most coefficients have insignificant estimated values. CAP, CSD and SIZE are significant at the 1 per cent level. Though a few individual coefficients are insignificant, the R-square of the low-quintile estimation is high (0.782), which indicates the high predictive power of the model for banks with lower charter value.

Regression results for banks assigned to middle levels of charter value (Q2-Q4) are presented in Column (2). R-square of the medium charter value banks estimation (0.294) is smaller than the low charter value subgroup. Both profitability and earnings diversification enters the modelling for this quintile. ROA has a small and negative coefficient (-0.407) and is significant at the 5 per cent level. NIIR has a 1 per cent significant coefficient of 23.562. We compare the individual coefficients for Q1 and Q2-Q4 and the t-test statistics are displayed in the Column Medium-Low in Table 4.7. Statistically, only ROA values are different in these two subgroups. Also, Chow test find 1 per cent significant statistic and confirms structural break between low and medium charter value banks in modelling their DD.

Table 4.7 Distance-to-Default and Tobin's Q for Sub-debt Banks

Table 4.7 shows the regression estimations of DD on lags of bank fundamentals with fixed effects. The sample period is from 1997 to 2009, and it is separated into three subsamples based on banks' Tobin's Q. The dependent variable DD is the distance-to-default. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the ratio of profit before interest and tax divided by book value of assets, NIIR is the ratio of non-interest incomes divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of the market value of common stocks and book value of preferred stocks. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent, but results are not reported. Year dummies are also included to control the year effect. P-values are shown in brackets [] as ***, **, * indicating significance at the 1%, 5% and 10% levels, respectively. T-values are shown in brackets ().

	Fixed Effects			Differences in coefficients	
	Low: Q1	Medium: Q2:Q4	High:Q5	Medium-Low	High-Low
CAPi,t-1	44.568	5.238	2.153	(3.195)**	(3.959)**
	[0.000]***	[0.392]	[0.004]***		
RLLAi,t-1	-0.258	4.998		(1.05)	
	[0.775]	[0.311]			
ROAi,t-1	-4.166	-0.407		(1.086)	
	[0.232]	[0.025]**			
NIIRi.t-1	1.438	23.562	7.262	(2.383)	(2.163)
	[0.584]	[0.009]***	[0.000]***		
CSDi,t-1	-5.823	15.239	-4.087	(1.853)	(0.514)
	[0.000]***	[0.179]	[0.201]		
LEVi,t-1	0.016	0.018		(0.065)	
	[0.404]	[0.285]			
MKTLEVi,t-1	0.090	-0.070	0.236	(0.91)	(0.746)
	[0.552]	[0.440]	[0.066]*		
SIZE	-0.063	0.252	-0.547	(0.996)	(1.865)
	[0.007]***	[0.425]	[0.040]**		
CONS	-1.378	1.368	-1.821	(1.102)	(0.207)
	[0.501]	[0.342]	[0.007]***		
N	104	228	66		
K	10	10	10		
RSS	1040	13743	469		
Chow test				16.585***	210.062***
R^2	0.782	0.294	0.493		

Results in Column (3) are for banks allocated to the highest Tobin's Q value quintile. CAP and NIIR have positive coefficients (2.153 and 7.262, respectively) with the 1 per cent level of statistical significance. Market leverage MKTLEV and SIZE also display significance at different levels. R-square for this subgroup is 0.493 and higher than medium quintile. Therefore, for banks that have higher charter values, their accounting-based risk measures explain the variation of DD to a higher degree.

Similarly, the differences between the coefficients of low and high subgroups (Column High-Low in Table 4.7) are mostly insignificant, except for CAP. However, Chow test again finds significant difference between the models of these two subgroups as a whole. Kato and Hagendorff (2010) rationalize their similar finding to be the effect of higher charter values. With higher charter values and more frequent trades, asset values contain more information, and hence reflect fundamentals more efficiently.

4.4.5 Distance-to-Default and Capital Adequacy for SND Banks

This section further analyses how capitalization levels impact on the financial distress sensitivity of accounting measures. As addressed in previous studies, low capitalized financial firms need more discipline from investors and regulators. We separate SND banks into two sub-groups by their average capitalization from 1997 to 2010.

Column (1) in Table 4.8 displays regression results of the sub-sample containing companies with lower than median capitalization. CAP and ROA have positive and 1 per cent significant coefficients (4.539 and 30.371, respectively). Banks with higher capitalization and profitability will be less vulnerable to financial distress. The estimated coefficients for higher-than-median capitalized banks are reported in Column (2) in Table 4.8. In addition to CAP and ROA, NIIR, LEV, MKTLEV and SIZE also have significant coefficients. Not only single coefficient significance finds stronger predictive power of the model for high-capitalized banks, R-square of this subgroups (0.6392) is also higher than the one for the low-capitalized banks (0.1789).

Table 4.8 Distance-to-Default and Capital Adequacy for SND Banks

Table 4.8 shows the regression estimations of DD on lags of bank fundamentals with fixed effects. The sample period is from 1997 to 2009, and it is separated into two subsamples based on banks' capital adequacy. The dependent variable DD is the distance-to-default. CAP is the ratio of equity to total assets, NPLTL is the ratio of non-performing loans to total loans, RLLA is the ratio of reserve loan losses to total assets, ROA is the ratio of profit before interest and tax divided by book value of assets, NIIR is the ratio of non-interest incomes divided by revenues, CSD is the ratio of cash and marketable securities to total deposits, LEV is the ratio of total book liabilities to total book equity, MKLEV is the ratio of total liabilities to the sum of the market value of common stocks and book value of preferred stocks. Hausman χ^2 is adopted to test the appropriateness of the RE estimator with the null hypothesis that the RE estimator is consistent, but results are not reported. Year dummies are also included to control the year effect. P-values are shown in brackets [] as ***, **, * indicating significance at the 1%, 5% and 10% levels, respectively. T-values are shown in brackets ().

	Fixed Effects		Differences in coefficients
	Low Capital<Median	High Capital > Median	
$CAP_{i,t-1}$	4.539	15.928	(-1.740)
	[0.000]***	[0.015]**	
$NPLTL_{i,t-1}$	1.831		
	[0.453]		
$RLLA_{i,t-1}$	-0.177		
	[0.551]		
$ROA_{i,t-1}$	30.371	8.517	(2.258)**
	[0.002]***	[0.000]***	
$NIIR_{i,t-1}$	16.064	-6.825	(1.861)
	[0.178]	[0.032]**	
$CSD_{i,t-1}$	0.009		
	[0.156]		
$LEV_{i,t-1}$	0.005	1.409	(-2.459)**
	[0.711]	[0.015]**	
$MKTLEV_{i,t-1}$	-0.012	-1.218	(2.446)**
	[0.265]	[0.015]**	
$SIZE_{i,t}$	1.248	-1.284	(2.18)**
	[0.231]	[0.015]**	
N	113	82	
K	10	10	
RSS	13325	3219	
Chow test			6.450**
R^2	0.1789	0.6392	

We also perform t-tests to find the differences in estimated coefficients of risk fundamentals on default risk indicators. The results are displayed in Column (3) of Table 4.8. We conclude significant differences between estimated coefficients of two models, and this implies that risk fundamentals of lower-than-median capitalized

banks are more effective in explaining DD and predicting financial distress than are those of higher-than-median capitalized SND banks. Chow test also confirms the findings of individual coefficients.

4.5 Conclusion

In recent decades, the issues of detecting banks' financial fragility and predicting banking crisis have been intensively addressed by market investors and bank regulators. Over the last few years in particular interest in this area has grown, as a result of distress in the funding and money markets. Backward-looking book-based risk measures are considered to have limited predictive power to warn about future events, and therefore market indicators have been widely employed as a complement to traditional accounting data.

We examine the impacts of subordinated debt on the use of market-based measures of default risk for banks, using fundamentals. Our analysis employs distance-to-default as a market-based measure of financial distress. We find that default risk of banks issuing subordinated debt can be better described by book- and market-based measures than can default risk of banks without subordinated debt. Our findings imply that subordinated debt investors have greater incentives to monitor banks and require more information. Therefore, subordinated debts enhance information efficiency and transparency, eliminate information asymmetry and moral hazard problems, and so work as an effective instrument in market discipline mechanisms.

We also find that bank fundamentals can more efficiently predict default risk for banks issuing subordinated debt where they have higher charter values and bank

capitalization. We further examine whether the explanatory power of fundamentals on default risk differs in the periods before and after financial crisis. The results show increasing predictive power of fundamentals on predictive banks' default risk.

Bank regulators undertake on-site and off-site monitoring with large amounts of bank accounting information. Nevertheless, very many bank failures and bailouts are unexpected by regulators and investors, and this suggests that prediction based on accounting information only is not efficient. Our analysis implies that the issuance of subordinated debt to foster greater levels of market discipline improves the informational efficiency of bank fundamentals. Monitoring using fundamental information would be more feasible for SND banks than for non-SND banks.

Chapter 5 Subordinated Debt and Indirect Market Discipline

5.1 Introduction

Government bank supervision is an essential element in the market discipline mechanism, and market discipline potentially assists the regulatory authorities in meeting their goals. Market investors influence banks' risk-taking decisions and performance by using financial instruments such as deposits, equity prices, equity volatility and subordinated debt spread. The disciplinary force from the market fluctuates and only affects a bank's operation for a short period. Conversely, statutory regulation and supervision are more influential, as well as compulsory. Moreover, outcomes from government bank supervisors may be recognized by policymakers, and become an Act or Bill.

However, the monitoring and enforcement of prescriptive regulations and the associated regulatory authorities are insufficient and ineffective in the modern world. Financial institutions have become too complex, and as the marketplace is changing rapidly, bank supervision authority has limited human resources to provide timely and comprehensive on-site monitoring for each firm.

Furthermore, supervisors need to consider the benefits and costs of regulating a bank. If the benefits are greater than the costs, then a supervisory authority will not take any action. Besides, from a personal career perspective, regulating problem financial institutions could be incentive- perverse for bank supervisors. Another flaw is that the supervisory data are private and confidential. The problem of information asymmetry is also the biggest limitation and obstacle of this research.

The recent academic literature has regularly argued that using market information to enhance market discipline will eventually strengthen the banking regulation system. There are two research questions which have been highlighted: does market information reflect information about banks accurately? And does the market

information add information to supervisory assessment in a timely manner?

This chapter aims to analyse the second question with empirical evidence for the UK. Previous studies in this field examine the relationship between changes of government ratings assigned to individual credit institutions and market information. However, the government ratings of each bank in the UK are confidential. Therefore, a dummy variable is used to indicate whether the government supervisors, the Financial Services Authority (FSA) have taken enforcement regulatory actions on observed banks.

Regulatory information, market information and accounting data is acquired from the five largest banks in the UK financial markets over the period of June 2001 to June 2011, and estimated using a bivariate model to determine whether market information has an effect on the FSA's enforcement regulatory actions on observed banks. Both Probit and Logistic models are also used to estimate whether market information adds more value than balance-sheets alone on supervisory assessments. For further investigation into whether market indicators identify problems before supervisors, the case of Royal Bank of Scotland Group (RBS) is studied.

The findings support the conclusion that the market indicators have influences on the FSA's regulatory decisions, but fail to provide additional valuable information to supervisors relative to accounting data. In the case study of RBS, it is shown that market indicators did signal impending problems before the government announced bailout plans for large banks. However, it is difficult to extract clear signals from existing sub-debt spreads data, since they tend to reveal systematic risk rather than bank-specific risks.

The rest of this chapter is organized as follows. Section 2 briefly summarises the banking regulation reforms in the UK and the FSA's supervisory approach. Section 3

demonstrates the theoretical underpinnings of this research, and discusses the relevant literature. Section 4 presents the empirical designs and data; results and interpretations are provided in Section 5. Section 6 concludes this chapter.

5.2 Background

5.2.1 Banking Regulation Reforms in the UK

In the late 20th century, the UK underwent a series of financial reforms, changing the structure of the financial sector to encourage greater competition, but also designing new financial regulations to ensure continued financial stability within a more competitive environment. The Financial Services Act (1986), known as "Big Bang", was one of the foundations of a number of radical reforms. The main objective of this Act was to protect investors during the reforms. This Act introduced a self-regulation two-tier system for all financial firms, the lower tier comprising six self-regulatory organizations (SROs). Each of these was responsible for a different aspect of regulation, and was required to adhere to a number of rules. Additionally, there were three prudential regulators: the Bank of England for banks, the Building Societies Commission for building societies, and the Department of Trade and Industry for insurance regulation. Figure 5.1 shows the organizational structure under this regulation regime.

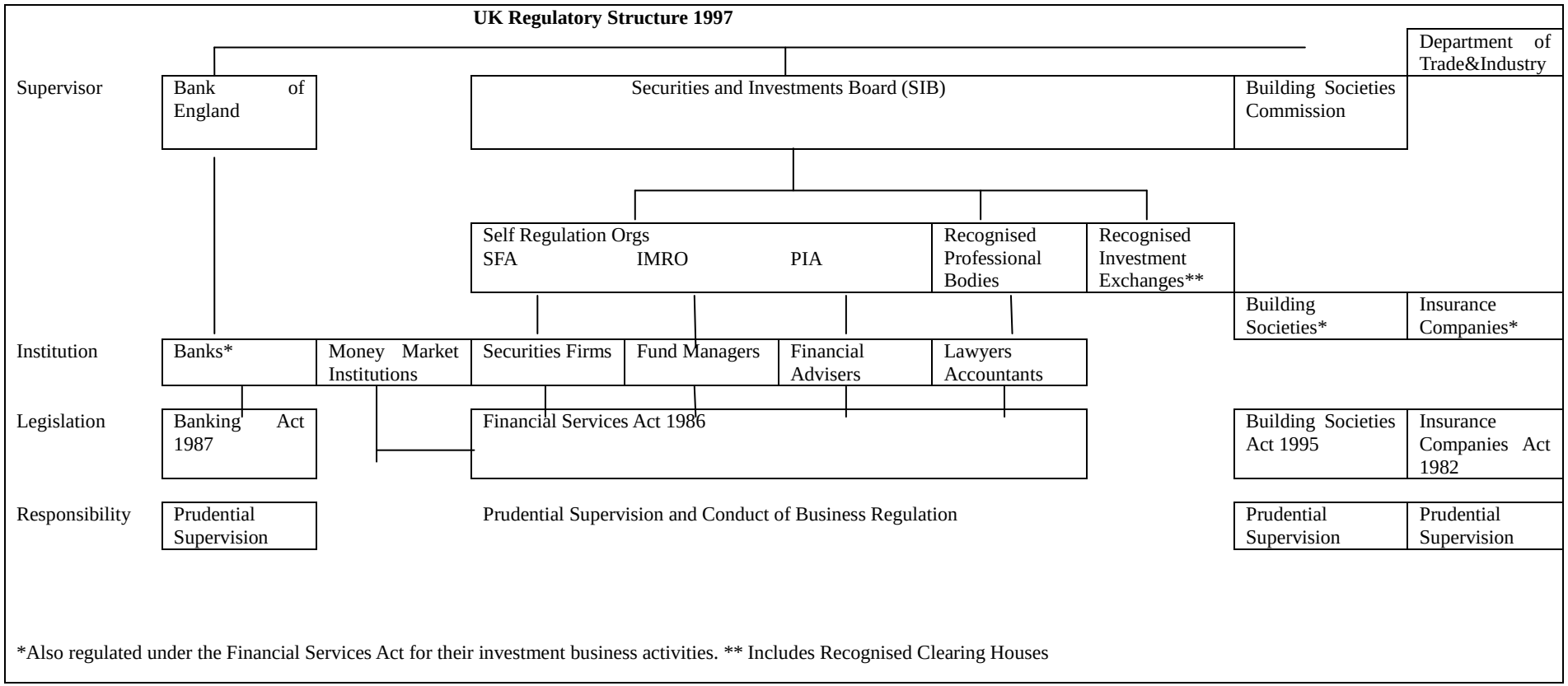
The advantage of this regulatory system was that it could prevent the problem of regulatory forbearance, since the self-regulating bodies had more information and knowledge about the operations of their businesses and the best solutions for problems; therefore they were thought to be the best judges of the standards and rules.

However, there are also negative arguments in respect of this regulatory system. First, there is no substantial evidence to prove that forbearance may not also occur in

self-regulation. Regulatory forbearance is caused by a close relationship between the regulators and the regulated firms. This familiarity could result in a laxity in their enforcement of regulations, even over-protection. There is abundant evidence for this problem occurring among state regulators. But under the self-regulatory Act there were no clear rules that might prevent this problem. Moreover, there are also arguments that self-regulation might encourage collusive behaviour among firms. The practical regulator and the regulated firm also have close connections.

The increasing number of financial conglomerates also justifies the concern as to whether the forbearance problem would occur in the self-regulatory system. These two factors raise other arguments which favour regulation by government bodies. Self-regulation could provide better information, but conglomerates need to face costly compliance procedures. State regulators need to take into consideration extensive expenses if government bodies want to resolve the information problem.

Figure 5.1. UK Self-Regulatory, Functional Regulation (Based on the Financial Services Act 1986)

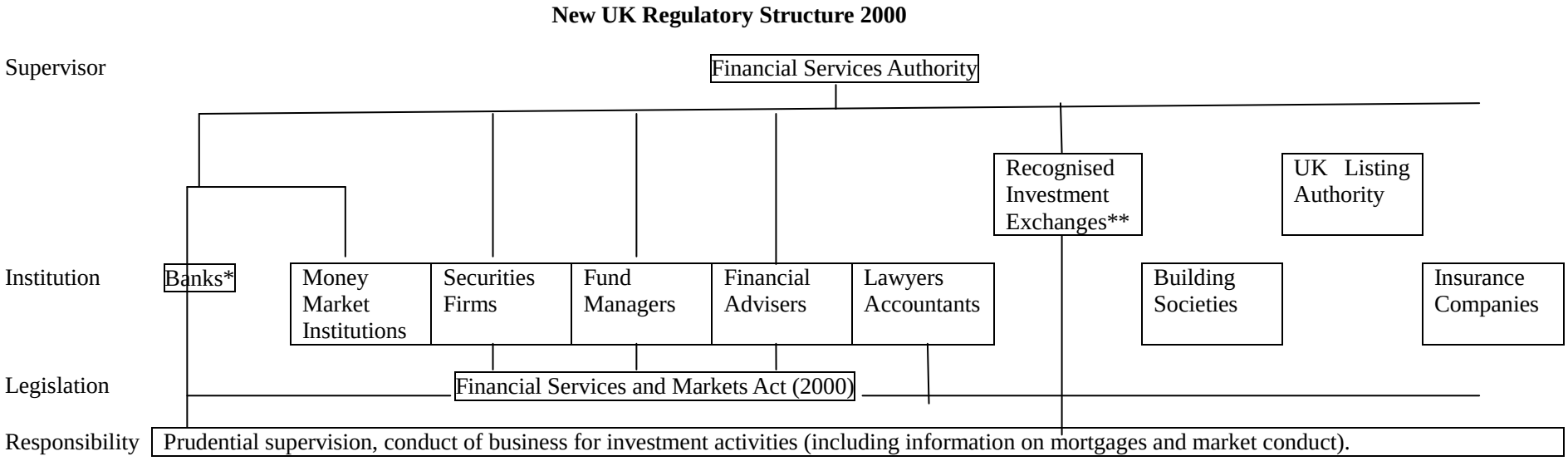


Source: Heffernan, S.,2005. Modern Banking, John Wiley & Sons, Ltd. Page 229.

The 1998 Bank of England Act transferred the Bank of England's supervisory powers to the newly created Financial Services Authority (FSA). In 2000 the Financial Services and Markets Act (FSMA) established the FSA, an independent non-governmental company, as the sole regulator of all financial institutions. To date, FSA rules have focused on four areas: maintaining market confidence in the financial system, protecting the UK financial system and enhancing financial stability, securing the appropriate degree of consumer protection, and reducing the extent of the effects of financial crime on businesses. The new regulatory structure under the FSA is shown in figure 5.2

To achieve these statutory objectives, the FSA adopts a number of standards and imposes additional rules and regulations. However, as the supervisor of all financial institutions, it is impossible for the FSA to introduce a single system of supervision. For example, the prudential concerns relating to banks are mainly issues of illiquidity and insolvency, while for insurance firms the value of customers' policies is the most important concern. For the general regulation of all financial institutions, the FSA has introduced the risk-based approach to regulation.

Figure 5.2. A Single Financial Regulatory in the UK (based on the Financial Services and Market Act, 2000)



** Includes Recognised Clearing Houses.

Source: Heffernan, S., 2005. Modern Banking, John Wiley & Sons, Ltd. Page 233

From 2007 the world's financial system has gone through the greatest crisis in the history of financial capitalism. In 2006, US sub-prime defaults were rising. Shortly afterwards, two large hedge funds failed, leading to spreads in inter-bank funding and other credit products to rise sharply, and the Northern Rock credit squeeze damaged confidence, due to an initial collapse in liquidity. In 2008, markets lost confidence massively: the housing market problems spread widely in many countries, particularly the UK and US. The US government increased support for Fannie Mae and Freddie Mac, while the UK mortgage banks were facing intense funding problems.

Moreover, Lehmans announced bankruptcy in September, AIG raised collateral calls and required a government rescue, and collapses of Washington Mutual, Bradford & Bingley and Icelandic banks occurred. These events reveal a mix of credit problems and major banks as being significantly reliant on central bank support. The UK government began to recapitalise and announced measures to prevent the collapse of banks in October 2008, such as the Asset Protection Scheme (Turner's Review, 2009). Bank supervisors took action in response to the financial crisis, but more importantly, they were aware that banking reform was needed, and a series of fundamental changes in regulatory approach are currently under discussion.

The collapse of Northern Rock, the sub-prime crisis that emerged in the United States in 2007 and a series of events following on reveal the inherent fragility of the UK banking sector, and the flaws in domestic financial regulation also demonstrate the clear need for a drastic overhaul of domestic financial regulation and supervisory arrangements. The emphases of the ongoing reforms focus on strengthening the financial system and reducing the future likelihood and impact of bank failures. In February 2009, the new Banking Act with a new 'Special Resolution Regime' (SRR) was enacted. After that, Lord Turner, the new Chairman of the FSA, published a

detailed review of the necessity of UK financial regulation and supervision reform in March 2009. In July 2009, the Government and the Conservative Party also followed up with their own White Papers on financial reforms.

Concomitant with regular arguments contributed by the Bank of England and the FSA, these documents examine the contributors to the crisis: for example, failings in the regulation of liquidity and the design of failure resolution mechanisms, failings in corporate governance and market discipline, and flaws in consumer protection issues. A comparison of the reform proposals is reported in the Appendix 1.

These documents also display a clear consensus about what should be done in the future. The starting point is to enhance the domestic supervision system, such as having more regulations and tighter monitoring of credit rating agencies, greater use of central counterparty clearing for derivative instruments and exchange trading, improving accounting standards, enhancing market discipline, etc. (FSA, 2009a & 2009b; HM Treasury, 2009a; Conservative Party, 2009).

In addition, Lord Turner (2009) also covers the reform debate in the European dimension. The focus of current debate on the European bank regulatory and supervisory system is 'single market' architecture. Member states of the EU can choose minimum standards, set by the EU Directives. Three national committees (the 'Lamfalussy Committees') entirely control the supervision of financial entities, and co-supervise cross-border activities with host authorities, based on the agreement reached at the Basel Concordat in 1975.

In Turner's review (2009) the author strongly suggests engineering greater co-ordination of supervisory approaches and macro-prudential analysis across Europe, as well as a greater co-ordination of deposit insurance arrangements. These suggestions also gained support from the UK Government (HM Treasury, 2009a).

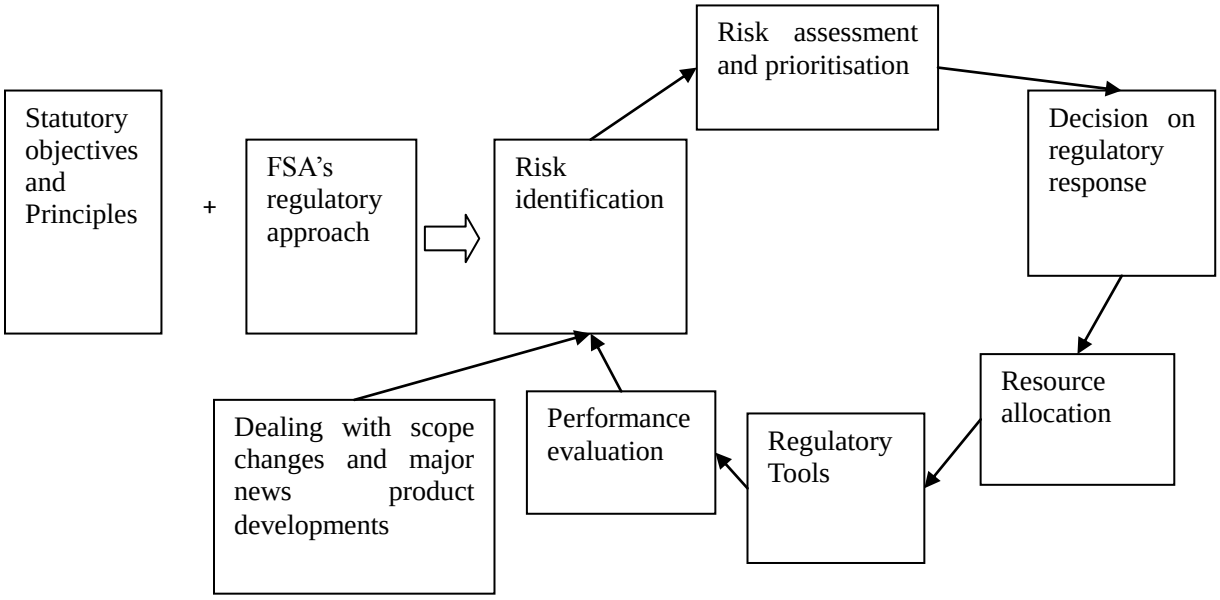
Although many national authorities have proposed reforms on bank regulation and supervision, Hall (2009) still has concerns on many aspects. The recent global financial crisis reveals significant challenges faced by authorities in the UK and Europe; however, the ultimate financial architecture to produce micro- and macro-prudential regulation has yet to be resolved. Moreover, the effectiveness of proposed reforms needs to be validated.

The House of Commons Treasury Committee (2010) claims that the "too-big-to-fail" problem is "*too important to ignore*". The objectives of banking system reforms are to protect the consumer and the taxpayer, ensuring sustainable lending to the economy, rather than increasing moral hazards. Therefore, the "too-big-to-fail" or "too-important-to-fail" culture should be ended; the new banking system should allow systemic institutions to fail smoothly.

5.2.2 FSA's Supervision Approach

In January 2000 the Financial Services Authority (FSA) began to set out their approach to regulation in 'A new Regulator for the New Millennium'. In order to deliver their statutory objectives, the FSA have issued a series of reports to explain the framework in the last decade. The Supervisory Review Process (SRP) has two parts: the Internal Capital Adequacy Assessment Process (ICAAP), which is the firm's own assessment of the internal capital it needs to hold against its risks; and the Supervisory Review and Evaluation Process (SREP), which is the supervisors' assessment of the overall prudential risks to a firm/industry, covering inherent business risk, control factors and oversight/internal governance. The overall risk management system can be described as follows:

Figure 5.3 FSA's Operating Framework



Source: FSA website

In 2003 the FSA introduced their Advanced, Risk-Responsive Operating Framework (ARROW), which covers all aspects of risks, including firm-specific, thematic and internal risks. Moreover, the ARROW mechanism is undertaking the SREP. Under the ARROW regulatory framework both authorised firms and the FSA deliver their objectives in an efficient and economical way. However, there were a number of areas for potential improvement reflected in the use of this risk-based regulatory framework. Therefore, in 2006 the FSA launched the "ARROW II" framework, which is a more principles-based approach, and completely overhauled all their risk management processes under the new operating framework.

Although there have been many changes to ARROW II, the fundamental approach to the task of supervision has not changed. Under the framework there are three main components: ARROW firms, used to assess firm-specific risks, which is also referred to as 'vertical' supervision; ARROW themes, used to assess cross-cutting risks, which is called 'horizontal' supervision; and Internal Risk Management, which

is used to assess the FSA's operational risks. The fundamental feature of the risk model is to consider risk to be the combination of potential impacts and the likelihood of them occurring, as shown below:

Risks to FSMA objective = Impact of the problem if it occurs x Probability of the problem occurring

Within this framework the FSA uses this approach to score each authorised firm, prioritise risks and make decisions. Scoring is on a simple four-point scale on both elements (impact and probability): low, medium low, medium high or high, for both the individual firm and the industry. These ratings will determine the firm regulator's overall approach and the intensity of response.

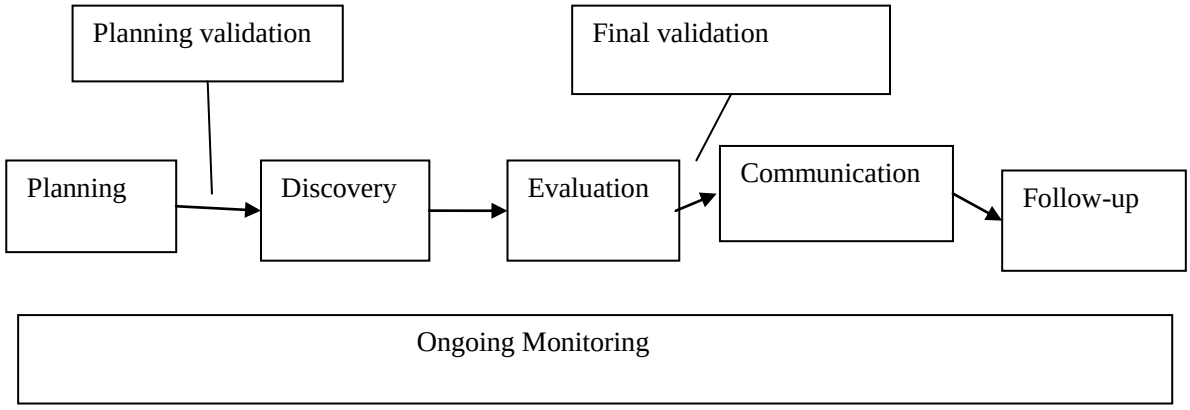
The probability of problems occurring is classified into ten high-level 'risk groups' and these 'risk groups' are further divided into 'risk elements', which cover both business and control risks.

Horizontal dimensions contain three risk categories involving a firm's market risk, such as direct interactions with retail customers and market counterparties; and a firm's internal risks and prudential risks. The FSA focuses more upon and interacts with vertical risk groups, such as gross risks within the firm and control risks. Whether the FSA will take mitigating action towards authorised firms depends on the controls. In the ARROW II risk model where flexibility has been enhanced, senior managers can set parameters to reflect their appetite for risk, for example impact thresholds and sector weightings. For those firms designated as other than low impact, the FSA performs regular risk assessments within the firms. The results of risk assessments may lead to further action, known as a Risk Mitigation Programme (RMP)

in the follow-up phase. The overall supervisory approach is set out depending on the ratings of impact and probability.

The overall supervision can be differentiated into three approaches: full ARROW, a full risk assessment of probability; ARROW light, a reduced-scope risk assessment; and the Small Firms Model, which applies to firms which have a low impact. In all Full ARROW and ARROW Light assessments there are core areas which the FSA assesses explicitly, for instance management, capital and liquidity. In addition, a series of structured stages are designed to gather information and process it, as shown in the figure below:

Figure 5.4 The FSA's Risk-Assessment Framework



Sources: FSA published paper, *the FSA's Risk-Assessment Framework*- August 2006, FSA website.

Besides the ongoing monitoring process, the FSA requires firms to assess regularly the amount of internal capital adequacy as a risk cushion. This process, called the Internal Capital Adequacy Assessment Process (ICAAP), undertaken through ARROW and checked by the Supervisory Review and Evaluation Process (SREP) review, is the firm's responsibility and determines a key input into the supervisory review process. The FSA has applied SREP to 2,616 firms, including banks, building societies and investment firms. The SREP focuses on the regulation of

an individual institution, such as assessing a firm's overall risk profile, measuring capital requirements and controlling capital resources. The intensity and depth of the SREP process is significantly reliant on the nature, scale and systemic importance of a particular firm.

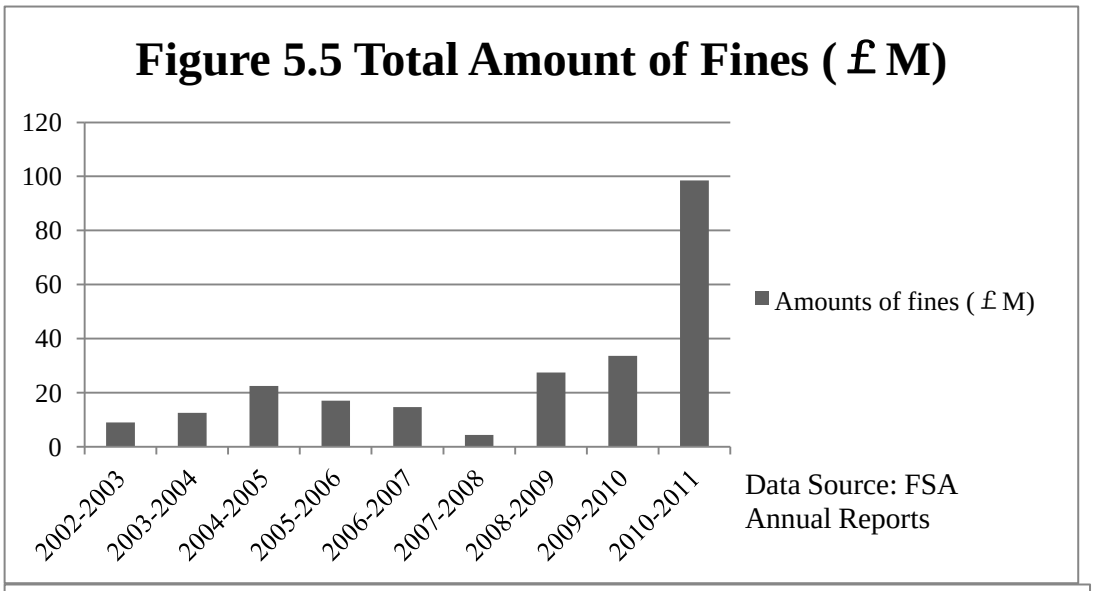
The risk scores, supervisory reports and assessment reports are confidential. However, the FSA publishes its corporate documents regularly, including Annual Reports, Business Plan papers, Financial Risk Outlook documents, Annual Public Meeting transcripts and FSA Board Meeting minutes. In 2005 the FSA began to publish an annual report of enforcement performance accounts (EPA). The EPA measures the effectiveness of bank supervisors' performance, and reports statistical information about cases investigated by the Enforcement and Financial Crime Division. Their use of powers comprises six major aspects: variation/ cancellation/refusal of authorisation/approval/permissions, criminal outcome, financial penalty, civil outcome (injunction/restitution), prohibition and public censure only. Table 5.1 summaries the statistical data for the use of these powers by the FSA from June 2002 to June 2011.

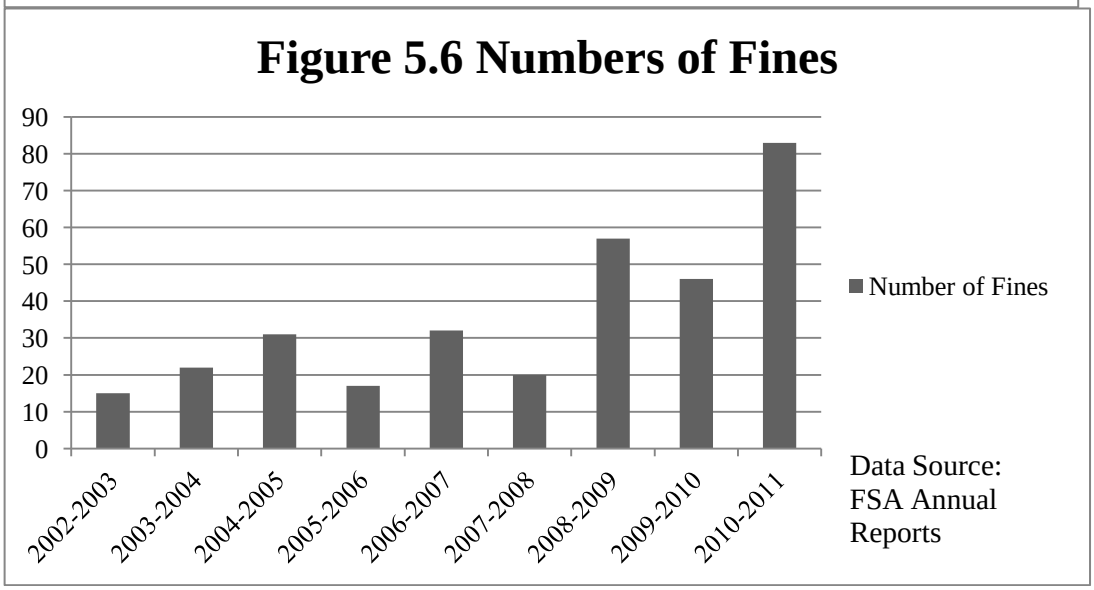
Table 5.1 Use of Powers (No. of Cases)

Year	Variation /Cancellation /Refusal	Criminal outcome	Financial Penalty	Civil Outcome	Prohibition	Public Censure Only	Other
2002-2003	35	1	15	4	4	2	0
2003-2004	34	1	19	7	9	3	0
2004-2005	44	0	26	4	9	0	0
2005-2006	45	3	18	5	7	2	1
2006-2007	65	1	28	3	10	4	1
2007-2008	99	0	20	1	30	2	1
2008-2009	122	1	55	7	48	10	0
2009-2010	142	5	41	11	57	8	2
2010-2011	109	3	74	10	65	14	5

Data Sources: FSA Annual Reports, FSA Enforcement Annual Performance Account Reports

Figure 5.5 and Figure 5.6 show the total value of fines and the number of fines for each financial year, respectively.





From 2002 to 2005 the number of financial penalty cases and the total amount of fines increased smoothly. During the next few years the total amount of fines rose dramatically from 2009 to 2011. Similarly, the number of fines has peaked many times in the last few decades. In the financial year 2008-2009, soon after the global financial crisis erupted and the UK banking panic occurred, the number of cases where financial penalties were imposed increased significantly. During 2010-2011, just after the New Basel III capital requirement for banks had been launched, the bank

regulation and supervision system was criticized strongly, and the number of fines rose greatly, as did the level of the fines.

The failures of the past, such as the nationalisation of Northern Rock and Branford & Bingley, the brokering of takeover rescues of Alliance & Leicester (by Banco Santander) and HBOS (by Lloyds TSB) also call for reforms in the FSA's supervisory approach. Lord Turner's review (2009a) states that the primary focus of the FSA should not only lie in the regulation of individual institutions ('micro-prudential' regulation) but also needs to combine the regulation of the overall system and systemic risk management ('macro-prudential' regulation).

The FSA is completing the Supervisory Enhancement Programme (SEP), which aims to devote increasingly large resources to high-impact firms for the purpose of strengthening market discipline and infrastructure, and this programme is supported by the UK government (HM Treasury, 2009).

Moreover, in the ARROW approach, remuneration policies are the new focus. Turner (2009) designs remuneration policies for top executives and traders, because inappropriate incentives to take extra risks have contributed to the financial crisis (Hall, 2009). The FSA's supervisory approach is no longer '*light touch*' (Turner's review, 2009), but is becoming more intrusive and systematic.

5.3 Literature Review

5.3.1 Theoretical Literature Review

There is an extensive academic literature regarding the ways in which market indicators exert indirect market discipline. Supervisory authorities can use market information in setting up early warning systems and take further actions to constrain developments in financial institutions, such as changing grades in bank examinations, pricing deposit insurance or setting capital requirements (Berger, 1991).

This stream of research primarily focuses on the US bank supervisory system. On-site inspection, where a team of supervisors pay a firm a visit and analyse its operations in detail, is considered the "most comprehensive tool for banking supervision" (Krainer and Lopz, 2008). As an outcome of on-site supervision, the rating CAMEL/BOPEC, which is exercised on a roughly annual basis, reviews the examiners' opinion of the firm's overall financial condition. It has been well documented that changes of supervisory examination outcomes can influence firms' operations in many aspects.

Swindle (1995) and Ediz et al (1998) give examples of regulator driven control. By studying the capital adequacy component of CAMEL on commercial banks in the US, Swindle (1995) finds that publicly available information forces a measure of regulatory pressure to influence inadequately capitalised banks to improve their capital position. Furthermore, Ediz et al (1998) conclude that capital requirements from regulators have more influence on bank behaviour than banks' own internally generated capital targets.

Other research focuses on how rating downgrade drives market control. Crabbe

and Post (1994) examine the response of commercial paper issuances and the Certificates of Deposit funding market to rating downgrades, and find that a bank's stock of outstanding commercial paper is more sensitive to the rating downgrade, and that it consequently contracts its balance sheet. The authors also suggest that deposit insurance may remove market discipline from the Certificates of Deposit market; therefore the CD shows insignificant responses to the downgrades. Similarly, Billett et al (1998) find that rating changes have influences on financial institutions' funding composition. For example, large, uninsured liabilities shift to insured.

Ultimately, based on the force imparted by market indicators, supervisory authorities enforce regulatory actions on observed banks, such as prompt corrective actions to complete the mechanism of market discipline. Evanoff and Wall (2001a, 2002 and 2003) recommend using subordinated debt market indicators, instead of capital ratios which are currently used to initiate prompt corrective action by bank supervisors. The authors compare the effectiveness of subordinated debt yields and risk-based capital respectively to examination ratings in the US, and find that the subordinated debt yield spread is the better measurement for reflecting and predicting the riskiness of the banking organization. In addition, Meyer (1999) argues that subordinated debt spreads provide timely information to help the FDIC to set more accurate deposit insurance premiums.

Finally, Baumann et al (2003), based on the UK supervision authorities, assess the behaviour of six market-based indicators in seven major UK-owned banks, which represent more than 90% of the total assets of UK banks. The six market-based indicators are: bond spreads, credit default swap (CDS) prices, equity prices, equity returns, implied volatilities and implied probabilities of default (PDs). The authors conclude that equity-based indictors are more sensitive to bank-specific risk factors,

while the bond-based market indicators respond more effectively to systematic shocks than microeconomic effects.

Evanoff and Wall (2003) develop a model of optimal bank discipline. The objectives of the bank supervisor are to minimize the cost of errors in the disciplining of banks and to maximize social welfare. Sometimes these two objectives come into conflict. For example, a bank supervisor might sometimes exercise forbearance on regulating weak banks and place social welfare at risk.

Let us assume that banks can be of two quality types $Q \in \{H,L\}$. Type L, low quality banks, should be disciplined by the regulators, and Type H, high quality banks, should not be disciplined. Disciplining type H banks is a type 1 error, which generates total social costs of T1. Failure to discipline a type L bank is a type 2 error, which generates total social costs of T2. Bank examiners observe bank types by receiving a signal of each bank's quality, R, which takes one of three forms: $R \in \{A,B,C\}$. If the examiner receives signal A, it indicates with certainty that the bank is type H; and if the examiner receives signal C, this signifies that the bank may be type L. However, if the examiner receives signal B, it only implies that the bank is type H with probability q and type L with the probability (1-q).

Besides these three forms of signal, an independent signal of a bank's quality (IS), such as a capital adequacy ratio or the yield on a bank's subordinated debt should be observed, and $\infty<IS<\infty$. Through observing this independent signal the bank supervisor can trigger Prompt Corrective Action (PCA). With the observation of this independent signal, the probability that a bank is a high quality type H bank is P(H/IS), the probability that a bank is low quality type L bank is (1-P(H/IS)), and $P'(H/IS) >0$ which implies that the probability that a bank is type H is an increasing function of IS.

On the assumption that there are no agency problems, the bank examiner always uses the signal R optimally. When the signal is A the examiner never disciplines banks, when the signal is C the examiner always disciplines banks, and if the signal is B the examiner only disciplines banks when the expected cost of incorrectly disciplining type H banks that are rated B is greater than the cost of incorrectly failing to discipline type L banks, as:

$$qT1 < (1-q)T2$$

If the alternative signal, IS, is available, the examiner may incorporate the signal to avoid disciplining errors. One way to employ IS into the discipline process is to establish a single trigger score (t) for PCA to discipline all banks. In this case, banks with IS values less that t would be disciplined, and banks with an IS value greater than t but where the examiner receives a signal C would be disciplined as well. Therefore, Evanoff and Wall (2003) solving the value of t minimizes the social costs of disciplining all banks:

$$\min_t SC = \int_{-\infty}^{t} T1p(H/IS, R=A)dIS + \int_{-\infty}^{t} T1p(H/IS, R=B)dIS + \int_{t}^{\infty} T2(1-p(H/IS, R=A))dIS \quad (5.1)$$

The costs of a Type 1 error arise in the case of some banks with the values of IS less than t but with signal A having been disciplined. Moreover, there are potential classification errors of some high and low quality banks that receive rating signal B. With the certainty that type A banks should not be disciplined, the independent signal could be applied only to type B banks. Hence the optimal trigger point for the social

planner suggested by Evanoff and Wall (2003) is:

$$\min_t SC = \int_{-\infty}^{t} T1p(H/IS, R=B)dIS + \int_{t}^{\infty} T2(1-p(H/IS, R=A))dIS \qquad (5.2)$$

The bank supervisor can choose one of the three strategies with the lowest costs: (1) discipline all type B banks; (2) discipline none of the type B banks; and (3) discipline type B banks with IS >t.

Consider reality, in which the agency problems exist. Bank supervisors may exercise forbearance. A regulator's incentives towards forbearance are complex. Regulators may discover that the costs of disciplining a bank are greater than the benefits, or find it is hard to intervene in a timely manner, especially if it affects their own career prospects. In this case, let us assume that a supervisor rates all banks as A or C, and exercises forbearance or leniency on the C-rated banks with the probability of L where 0< L≤1. Moreover, bank supervisors know that they will face a Congress penalty if they fail to regulate a C-rated bank. Therefore they may claim that the examination of the bank should return to signal A.

The social planner needs to pick a PCA trigger rate to minimize the following social costs which is suggested by Evanoff and Wall (2003), with a given probability of forbearance, L:

$$\min_t SC = \int_{-\infty}^{t} T1p(H/IS, R=A)dIS + \int_{t}^{\infty} T2(L)(1-p(H/IS, R=C))dIS \qquad (5.3)$$

Evanoff and Wall (2003) calculates the value of t under the effect of an increase in the proportion of C rated banks that receive forbearance L as:

$$\frac{\partial t}{\partial L}/_{F.O.C=0} = -[T2 - T2p(H/t, R=C)]/[T1p'(H/t, R=A) - T2Lp'(H/t, R=C)] > 0 \qquad (5.4)$$

An increase in the forbearance leads to a decrease in t*, and leads to more banks being disciplined.

Equations (5.1) and (5.2) imply the usefulness of an independent signal. In the absence of agency costs, a single trigger point for all banks is inefficient. Furthermore, the appropriate use of the independent signal may improve social welfare.

Equations (5.3) and (5.4) indicate that agency contributes to cause bank supervisors' regulatory forbearance, and an increase in the rate of forbearance will lead to a lower trigger point for the independent signal. Special attention should be paid to the empirical analysis in cases where the examination signal says the bank is low-risk but the independent signal says otherwise.

5.3.2 Empirical Literature Review

Many researchers have examined the potential usefulness of incorporating market information into the bank supervisory process. Many existing studies focus primarily on two markets: the equity and bond markets.

The application of equity data in supervisory assessments has been well documented, and most of the studies find that the equity market contributes to improving the supervisors' knowledge of intermediaries' firm-specific financial conditions.

Berger et al (2000) compare supervisory and market assessments for large US bank holding companies over the period 1989:Q4 to 1992:Q2 to evaluate which assessment can obtain timely and accurate information about their financial conditions. The authors gather two confidential measures of supervisory examination, BOPEC ratings and the frequency of on-site BHC inspections, and four market indicators: Moody's ratings of outstanding firm debts, BHC's abnormal stock return, the

proportion of outstanding equity owned by corporate insiders, and the proportion of corporate equity owned by institutional investors.

The authors also evaluate timeliness by testing the marginal ability of market information to predict supervisory ratings, and compare the accuracy of both assessments by measuring the marginal value of each assessment group in predicting future changes of the firm's performance. The results suggest that supervisory authorities and bond rating agencies are using similar information to complete each other's predictions. However, equity market indicators do not have a strong relationship with the supervisory assessments. Compared with the accuracy of equity and bond market indicators in predicting further changes in BHC's performance, supervisory assessments are generally less accurate if they are not derived from a recent on-site inspection.

Similarly, Krainer and Lopez (2001) examine the potential contribution of various equity market indicators, such as stock returns and the expected default frequency (EDF) to help bank supervisors conduct accurate assessment ratings (BOPEC) in the US bank holding companies over the period 1990 to 1999. The results indicate that equity-based indicators anticipate BOPEC downgrades, and also that the anticipation can begin up to four quarters in advance. Therefore, the equity market provides useful monitoring information to supervisors. Moreover, the authors propose a BOPEC off-site monitoring (BOM) model.

After estimating quarterly regulatory reports with ordered logit models, Krainer and Lopez (2001) find that adding equity market variables into the BOPEC model improves the supervisory rating's forecast accuracy. Based on the off-site monitoring model, Krainer and Lopez (2003) find that equity prices do strengthen supervisory ratings' forecasting power on financial institutions' conditions. Furthermore, Krainer

and Lopez (2008) conclude that compared with debt and bond market indicators, securities market information can better identify additional ratings downgrades, such as banks affected by systemic risk and contagion.

Gunther et al (2001) claim that stock prices not only help bank supervisors predict a bank's financial condition and then reflect it in ratings appropriately, but that they also supply more information to supervisory assessments. Besides focusing the accuracy of equity information on supervisory assessments, Curry et al (2003) measure to what extent equity market variables provide timely market signals. A sample of banks which were downgraded to the CAMEL 3, 4 or 5 levels during the period 1988 to 1995 is used in comparison with a sample of banks assigned rates 1 or 2, which indicate that these banks are healthy. The results of bivariate regressions show that market variables appeared to provide timely information before supervisors downgraded banks. However, only once combined with quarterly financial data does the market information appear to add any marginal improvements.

Besides comprehensive studies on US markets, Cannata and Quagliariello (2004) use an ordered logistic model to determine the ability of abnormal equity return, distance to default (DTD) and monthly distance to default (MDTD) in forecasting the levels of PATROL ratings. The sample includes Italian listed banks on the Milan stock exchange over the period 1995 to 2002. They find that equity returns fail to provide reliable information until a time window close to the supervisory assignment, whereas DTD is consistent with supervisory ratings.

The most commonly used measure of risk in bond markets is the bond spread, which is defined as the difference in yield on a bond and a risk-free government bond of a similar state of maturity and in the same currency. Recently, since Basel II drew attention to market discipline and subordinated debt, yield spreads of subordinated

debentures and notes have become major concerns.

Evanoff and Wall (2001a and 2002) support the argument that sub-debt yield spreads contain timely and accurate information about issuing banks' risk-taking incentives and overall financial conditions, and therefore that spreads could be used as an effective tool of market discipline.

Evanoff and Wall (2003) further propose the adoption of subordinated debt yield spreads as additional triggers for supervisory discipline under Prompt Corrective Action (PCA). PCA is currently triggered by the capital adequacy ratio, and the ability to limit supervisory forbearance is considered to be weakening through reliance on capital ratio. Theoretically, Evanoff and Wall (2003) find that using an imperfect measure improves PCA outcomes even if the supervisor has perfect information. To capture the probability of failure over the business cycle and long-term effects on liquidity and credit risk, the authors also apply subordinated debt yield spreads over Treasury securities on empirical analysis, showing that sub-debt yield spreads have the substantial predictive powers which current supervisory assessment requires. However, they are also concerned that spreads may mislead investors. For example, other signs from banks which have high spreads fail to support the notion that the banks are high-risk.

Van der Weide and Kini (2000) propose that bank regulators should require large banks to issue a minimum amount of long-term subordinated debt to market investors, and furthermore set a comprehensive subordinated debt programme. Without the bureaucratic and other inefficiencies entailed in federal government, sub-debt holders in both private and secondary markets signal to federal regulators and constrain bank risk-taking effectively.

Hancock and Kwast (2001) observe the secondary market prices of subordinated

debt in the US, finding that yield spreads have been affected by many factors, such as specific characteristics of the instrument and frequency of the trading bonds. Besides its own interest rates, price and maturity, each subordinated debt is affected by other debts with prevailing rates and similar levels of maturity. Yields can also be affected by timing characteristics for cash flow to bond investors, such as call options, step-ups and the frequency of coupon payment.

To critically analyse whether subordinated debt yield spreads are risk-sensitive, Hancock and Kwast develop criteria from alternative data sources, using weekly data over the period January 1997 to October 1999 on 265 bonds issued by 40 bank holding companies. The authors also derive the KMV model, which estimated default frequencies with equity price data and balance sheet information by federal regulators. Even the interpretation of sub-debt spreads is more difficult than other bond market developments; however, the evidence supports the use of subordinated debt spread in supervisory surveillance.

Furthermore, Covitz, Hancock and Kwast (2004a) analyse the usefulness of subordinated debt issuance within banking organization funding strategies over three deposit insurance regimes: 1985-87, the de facto too-big-to-fail regime; 1988-1992, the purchase and assumption regime, and 1993-2002, the post-FDICIA regime. Estimating a sample selection model and an ordinary least squares (OLS) model, the authors find that market discipline was weak in the early period but strengthened later. Consistently with previous studies, Covitz et al (2004a) find that the secondary spreads are influenced by each subordinated debt's specific characteristics and issuing banks' firm-specific risks. Moreover, they suggest that the risk-sensitivity of spreads from the secondary subordinated debt market can be affected by fund managers' decisions. For further analysis of the importance of subordinated debt for bank

supervisors, the authors propose that the Federal Bank should require large US banking organizations to issue a mandatory sub-debt programme.

Sironi (2003) is one of the few academic studies to focus on the European subordinated debt market. With a unique dataset of spreads during the 1991-2000:Q1 period, Moody's Bank Financial Strength (MBFS) and Fitch IBCA Individual (FII) ratings and bank accounting information, Sironi (2003) finds that sub-debt issued by private firms is sensitive to bank risk; however, sub-debt issued by public sector banks, such as government owned or guaranteed institutions, fails to show risk-sensitive idiosyncrasies due to too-big-to-fail effects. Therefore, this result contributes to the loss of control of monetary policy by national central banks and the public budget constraints imposed by the European Monetary Union (EMU).

The recent global financial distress is changing the circumstances of the world, and also the banking systems and sub-debt markets. Evenoff, Jagtiani and Nakata (2011) take into consideration new sub-debt issuance, new market environments and new regulatory frameworks. They find that the degree of market discipline of the US banking industry has been enhanced by previous sub-debt programmes, in the same way as market transparency. From this perspective the authors suggest the promotion of a mandatory subordinated debt programme with specific characteristics in the banking regulatory reform in order to achieve greater liquidity and transparency.

Since market indicators have begun to receive increasing levels of attention from policy makers, academic researchers and market investors, a stream of studies has emerged comparing market indicators from different markets, mainly the sub-debt market and stock market. The results are conflicting.

Flannery (1998) provides a comprehensive literature review on comparing the effects of using different market information in prudential bank supervision within the

US as empirical evidence. Equity prices of banks, he concludes from the sample, have endogamous signs with equity prices of non-bank firms, because Equity investors react rationally to firms' new information. On the other hand, signals from the bond market sensibly reflect bank risks. Therefore, regulators should combine private and public information to supervise banks, particularly large banking firms. For example, stock market indicators can be used to predict a firm's performance, but bond market signals are particularly complementary to supervisory assessments of bank conditions.

Krainer and Lopez (2008) propose a BOPEC off-site monitoring model (BOM) with supervisory information as well as variables from both equity and debt markets. To measure the contribution of equity information to the supervisory bodies monitoring bank holding companies, they construct an abnormal return derived over a period and a fitted return estimated by a two-factor model, while using a BHC's adjusted weighted bond yield to examine the bond market's contribution to lagged BOPEC ratings. The results show that securities market variables improve the model's in-sample fit; however they are weak in out-of-sample forecasting. Additionally, debt-based indicators provide information for supervisory assessment when BHCs are closer to default; nevertheless equity market indicators provide additional information further from default.

Gropp, Vesala and Vulpes (2002 and 2004) use a logit model and a proportional hazard model, and a sample of EU banks to ascertain the quality of two market indicators: distance to default, which is driven by the stock market, and subordinated debt spreads. The results show that distance to default can predict downgrades between six and eighteen months in advance, but that closer to the event the predictive power is quite poor. Sub-debt spreads exert influence over twelve months, and can only be a useful predictor for banks.

In addition, distance to default provides some information relative to accounting variables to regulators, but this is not so for spreads. However, combining these two market indicators reduces the possibility of misclassifying a sound bank as a weak one. Therefore, the appropriate interpretation of market indicators prevents bank supervisors from chasing false leads.

Persson and Blavarg (2003) assess the stability of the Swedish banking system by presenting some new indicators based on equity and bond markets; the data sample includes six banks that existed through the entire crisis period from 1987 to 1994. However, the Swedish subordinated debt market was not liquid enough to be employed as a complementary of supervisory assessment. Birchler and Facchinetti (2007) examine the Swiss bank supervisory framework, and find that market data provides limited useful information to supervisory authorities.

Hamalainen et al (2010b) produce an event study of Northern Rock, which was nationalized in 2007, to analyse whether four financial market instruments identified impending problems at Northern Rock. The market instruments include equity signals (equity prices, trading volumes, returns and distant-to-default), exchange-traded option contracts indicators (implied idiosyncratic volatilities), subordinated debt market indicators (yield spreads) and credit default swaps indicators (prices and spreads). The paper's findings support the argument that equity market indicators can predict default far in advance, while the sub-debt spreads react closer to default. Also, the interpretation of SND spreads requires careful judgement, since the spreads reflect many dimensions of risk.

5.4 Methodology and Data

5.4.1 Empirical Design

It is difficult to measure bank supervisor regulatory forbearance in the UK. Most previous research focuses on US cases. However, it is crucial not to apply the US model to UK banking regulation, since the supervision framework and outcomes are not the same. Moreover, the ratings that the FSA assigned to banks are confidential. These two considerable obstacles make it difficult for this research to be as comprehensive as previous studies.

Birchler and Facchinetti (2007) suggest that the optimal link between market data and policy action can be written as:

$$i = F(M,P,S,d)$$

Where i denotes actions taken by the regulator as a function of a vector of market data M, a vector of other public information such as accounting data P, a vector of private supervisory information S and a discretionary term d. In this intervention function S is not publicly observable, and d cannot be specified in advance.

Curry et al (2003) assess the timing and magnitude of the relationship between equity market valuations of commercial banks in the US and the supervisory effects on these financial institutions by examining changes in CAMEL ratings. CAMEL ratings are assigned on a scale of 1 to 5, with 1 being the highest and 5 the lowest. Ratings of 1 and 2 imply that institutions' financial condition is fundamentally sound. Downgrading the rating to 3 is an important signal of supervisory concern. Downgrading to 4 or 5 indicates the existence of serious problems, with the institution

at risk of a distinct possibility of insolvency.

In the UK banking supervisory system we cannot obtain information of such a rating or a similar scale of measurements. However, formal enforcement actions taken by the FSA, such as cancelling or refusing authorisation/approval/permissions, as well as criminal convictions and financial penalties, are reported in the FSA Annual Report and the FSA Enforcement Report every fiscal year. The regulatory enforcement actions taken by the FSA on examining banks can be taken as our dependent variable.

An abundance of studies find that subordinated debt spreads do contain sufficient information to reflect an issuing bank's financial conditions (e.g. DeYoung et al, 2001; Jagtiani et al, 2002). Krishnan et al (2005) emphasize that both yield spread levels and changes should reflect risk along the entire yield curve. In addition, Evanoff and Wall (2001a, 2002) point out that, compared with current regulatory measures used by US bank supervisors to trigger "prompt corrective action", subordinated debt spread is more informative for identifying problem banks

Previous studies of how market information affects supervisory decisions have produced solid results (e.g. Flannery, 1998). Greenspan (2001) points out that greater disclosure of data from a variety of markets helps policymakers in harnessing market discipline, and that significant changes in a large bank's subordinated debt spreads can prompt more intensive monitoring from the bank supervisor. Calomiris (1999) argues that to introduce credible market discipline into the deposit insurance systems, subordinated debt is an optimal instrument. Hence the author proposes that the subordinated debt spread should be the only element in the intervention function..

Therefore, as suggested by previous related studies, the following models are evaluated:

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \beta_i \text{Balance-sheet variable}_{i,t} + \mu_{i,t} \quad (5.1)$$

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \delta_i \text{Market Variables}_{i,t} + \mu_{i,t} \quad (5.2)$$

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \beta_i \text{Balance-sheet variable}_{i,t} + \Sigma\ \delta_i \text{Market Variables}_{i,t} + \mu_{i,t} \quad (5.3)$$

Model (5.1) includes only balance-sheet variables and Model (5.2) includes only market-based indicators, captured market movements and conditions from the stock market and subordinated debt market. In model (5.3) both balance-sheet and market-based variables are included to verify the ability of market variables to provide extra information to supervisors. As suggested by Cannata and Quagliariello (2005) and given the small number of UK listed large banks, all the observations are pooled to eliminate the irrelevant time perspective and adopt the lag structure of the variables. One advantage of using a panel data set is that although the pooled estimator ignores the actual structure of error term, it provides consistent estimates of coefficients. Therefore, the models above are described as follows:

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \beta_i \text{Balance-sheet variable}_{i,t-1} + \mu_{i,t} \quad (5.4)$$

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \delta_i \text{Market Variables}_{i,t-1} + \mu_{i,t} \quad (5.5)$$

$$\text{Regulation Actions}_{i,t} = \alpha + \Sigma\ \beta_i \text{Balance-sheet variable}_{i,t-1} + \Sigma\ \delta_i \text{Market Variables}_{i,t-1} + \mu_{i,t} \quad (5.6)$$

The regulatory enforcement actions are sticky and various. Therefore, a dummy variable is used to represent whether the FSA has taken action on observed banks. The dummy is equal to 1 if the FSA takes regulatory enforcement action on bank i at time

t, and 0 otherwise. This in fact is a reason why only five large listed banks are considered, instead of all banks listed in the FTSE.

The FSA enforcement entails FSA's disciplinary, criminal and civil powers to take actions against regulated and non-regulated firms and individuals who have failed to have failed to meet the standards that the FSA requests (the FSA, 2010e). Examples of enforcements include withdrawing a firm's authorisation, prohibiting an individual from operating in financial services, suspending a firm to up to 12 months from undertaking specific regulated activities, and censuring firms and individuals through public statements.

The regulatory actions taken by bank supervisors are not frequent and swift; if all listed banks in the UK were studied, the occurrence of too many unchanging values for the dependent variables might affect the robustness of the results, and explanatory variables might turn out to be significant simply because they explain a few regulatory events. Therefore the five largest listed banks in the UK, which are also frequently supervised by the FSA, are observed.

Some of the balance-sheet variables are selected which are widely adopted in related studies (e.g. Cannata and Quagliariello, 2005) and by bank supervisory authorities (e.g. European Banking Authority, EBA) in off-site supervisory analyses. Definitions of selected variables are presented in Table 5.2.

The proportion of bad debt in total loans captures the overall riskiness of the bank portfolio, while the ratio of total loan losses to operating profit indicates the likelihood of debtors' financial conditions on the profit and loss account deteriorating. These two ratios are used as indexes of bank riskiness. To capture observed banks' profitability four indicators are used to measure the overall levels of profitability, diversification and efficiency.

Another risk element to which all bank supervisory bodies pay close attention is capital adequacy. Two ratios are used to assess the bank's capability to satisfy the capital requirements. Since Basel I, increasing attention has been paid to the Tier 1 capital ratio, and it has become a core measure of a bank's financial strength from a regulatory point of view. It is also increasingly being adopted by other market operators such as rating agencies. The logarithm of total assets is calculated as a control variable.

Data are obtained for many equity market indicators because each of the banks in the study is listed in the FTSE 100, and therefore there is a liquid market for its equity liabilities. Daily data are collected from stock markets, and the distance to default [9](DD) is then calculated. DD is the variance between market value and asset value, constituted by asset volatility, stock volatility and other key risk elements. Other market instruments from the equity market, such as equity prices, equity trading volumes and equity returns, are also adopted. Another market indicator explored is yield spreads of subordinated debt, which is the difference between sub-debt yield and treasury bonds with similar maturity.

[9] The detailed literature review and calculation are reported in previous chapter.

Table 5.2 Definitions of Variables

Variable	Description
Balance-sheet variables	
Riskiness	
RISKBD	Bad debts/Total loans
LLOSS	Loan losses / Operating profit
Profitability	
ROE	Net income / Capital and reserves
NETINCOME	Net income / Gross income
FINSERVINC	Income stemming from financial services/ Gross income
Capital Adequacy	
SOLVERATIO	Supervisory capital / Risk-weighted assets
TIER1RATIO	Tier 1 capital / Risk-weighted assets
Control Variable	
Size	Natural logarithm of total assets
Market indicators	
DD	Distance to default
Equity prices	Equity prices for each bank in the study
Equity trading volumes	Equity trading volumes for each bank
Equity returns	Equity returns for each bank
Spreads	Spreads of subordinated debt

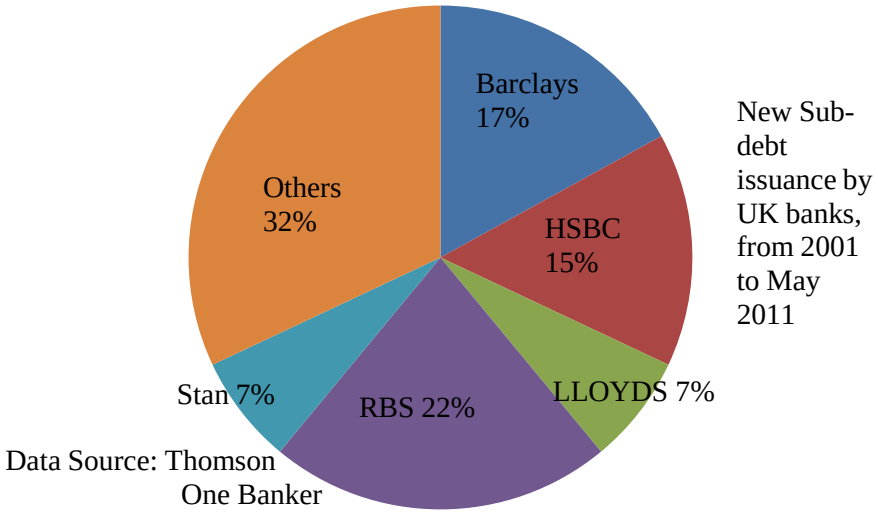
5.4.2 Data

Data are selected from the five biggest banks in the UK: Barclays (BAR), HSBC, Lloyds Banking Group (LLOY), Royal Bank of Scotland (RBS) and Standard Chartered Bank Plc (STAN). The sample period is from June 2001 to June 2011. The summary of variables is shown in Table 5.3.

One potential concern relating on this study is the data sample size. There are reasons why the five biggest banks in the UK are selected. From the standpoint of SND issuing, compared with small financial institutions, big banks issue subordinated debt more frequently and in larger amounts. Hancock and Kwast (2001) and Maclachlan (2002) provide evidence that subordinated debt provides stronger disciplinary forces to the big banks. Furthermore, UK banks issued 308 new subordinated debts from 2001 to May 2011, and 211 of them came from the biggest five banks, as shown in Figure 5.7.

Secondly, although the FSA regulates small firms, the regulatory actions and enforcement cases concerning big banks are more intensive. Moreover, the FSA has run intensive stress tests for major banks during the past few years to assess their capital requirements and major banks' potential need to participate in the Government's Asset Protection Scheme (APS). In particular, during 2009 and 2010 extensive discussions were held with Lloyds Banking Group (LLOY) and the Royal Bank of Scotland (RBS). However, there are very few reports about small financial organizations' regulatory actions. Therefore, the biggest five banks in the UK are selected to examine whether sub-debt provides indirect market discipline.

Figure 5.7 New Sub-debt Issuance



The dependent variable, regulation, is derived from the FSA annual report, the FSA annual enforcement performance account report and the FSA public release website. Banks' accounting data, stock data and subordinated debt market data are collected from Thompson One Banker and Datastream.

Table 5.3 Sample Summary Statistics

Table 5.3 shows the summary statistics for regulation, accounting variables and market variables of the whole sample. REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return.

Variable	No.	Mean	Median	Min	Max	St.dev	Skewness	Kurtosis
REGULATION	50	0.1818	0	0	1	0.3892	1.6499	3.7222
RISKBD	44	0.0184	0.0164	0.0013	0.0617	0.0124	1.5358	5.7388
LLOSS	48	3.4316	2.8676	-6.6938	18.0911	3.1682	1.5285	12.7823
ROE	50	13.8034	15.295	-43.14	37.02	11.1567	-2.6152	15.0483
NETING	50	11.2452	13.315	-40.3	22.91	9.197	-3.7317	21.0269
FSERVIN	41	1.2841	0	-0.1212	7.0359	1.8964	1.5303	4.2631
SOLVER	47	0.2115	0.1956	0.0428	0.3928	0.0913	0.3104	2.1992
TIER1	47	0.3274	0.3227	0.1425	0.4717	0.0828	-0.1427	2.3812
SIZE	50	8.7064	8.6756	7.8274	9.3792	0.4082	-0.4437	2.5444
SPREAD	47	71.6661	40.54	0	389.44	99.6018	1.1867	3.3922
DD	49	1.622	1.6027	-9.2338	11.1455	4.7665	-0.4012	2.6133
EQPRI	50	4610.352	4538.7	29.7	17085.4	4927.054	1.0591	3.0012
EQVOL	50	1.19E+07	9931	1286187	3.55E+07	8200138	0.94	3.6176
EQRET	50	-0.0399	0.0846	-1.9553	0.6348	0.4431	-2.1901	9.3642

Table 5.3 presents the key descriptive statistics for the pooled sample of the five largest banks in the UK from the period 2001 to 2010. The sample mean (median) of DD is 1.6220 (1.6072). Cannata and Quagliariello (2005), using a sample of Italian banks whose shares were listed on the Italian stock exchange from 1995 to 2002, report the mean DD in a range of 1.99 to 3.0, and median DD in a range of 1.99 to 2.79, for banks assigned different PATROL rating levels. The sample mean (median) of Spread value is 96.2373. Evanoff et al (2011) examine the subordinated debt spreads issued by banks and bank holding companies in the US for the period 1990-1999, and report a sample mean of Spread at 90.78.

Regarding the accounting measures of risk, the mean (median) values of loan losses/operating profit and bad debts/total loans are 3.4316 (2.8676) and 0.0184 (0.0164), respectively. Mean (median) values of ROE are 13.3084 (12.295), this indicator capturing the overall probability of banks defaulting. Mean (median)

NETINCOME and FINSERVINC are 11.2452 (13.315) and 1.2841 (0), respectively. In our sample, the mean (median) values of supervisory capital/total capital and Tier 1 capital/total capital are 0.2115 (0.1956) and 0.3274 (0.3227) respectively. These measures capture overall bank performance from the regulators' point of view (Cannata and Quagliariello, 2005, European Banking Authority).

Table 5.4 Correlation Matrix

Table 5.4 represents the correlation matrix for two groups of accounting variables and market variables of the whole sample. REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return.

Panel A: Correlations between balance-sheet variables

	RISKBD	LLOSS	ROE	NETIN	FSERVI	SOLVER	TIER1
LLOSS	.0549						
ROE	-.3282	-.0079					
NETIN	-.3087	-.0104	.9225				
FSERVI	-.1492	-.0339	.0384	.2339			
SOLV	-.3841	.1236	.3561	.2575	-.0178		
TIER1	-.0592	.0773	.1873	.1696	.0221	.7152	
Size	.4499	-.0308	-.3274	-.3977	-.6091	-.6215	-.3301

Panel B: Correlation between market indicators

	DD	SPREAD	EQPRI	EQVOL
SPREAD	-.1961			
EQPRI	.0891	-.1960		
EQVOL	-.0025	.4658	-.3535	
EQREN	.5576	-.4832	.2336	-.3766

Panel A of Table 5.4 presents pair-wise correlations between the balance-sheet variables employed to estimate the FSA's regulatory enforcement actions. The correlations among the variables are generally low, except correlations between NETINC and ROE, Tier 1 capital ratio and supervisory capital ratio, and size and supervisory capital ratio. For example, LOANLOSS has negative correlations with profitability indicators. This implies that the higher the likelihood of worsening of debtors' financial conditions, the lower the profitability, diversification and efficiency of banks becomes.

Panel B reports a correlation matrix between selected market indicators. DD and Spread are negatively correlated (0.1961). Equity prices also have negative

correlations with spreads (0.1960). Equity trading volumes have low and negative correlations with DD (0.0025), which indicates that these two indicators are relatively independent.

5.5. Empirical Results

Based on the characteristics of the binomial dependent variable, Logistic and Probit models are adopted to examine how explanatory factors influence the bank regulators' reactions towards banks' performance.

5.5.1 Whether Market Indicators have Impacts on Regulator's Actions

In this section a bivariate analysis for equations (1) and (2) is performed to examine whether market indicators from both the stock exchange and the subordinated debt market have an impact on bank regulators' responses. The results are estimated in Probit and Logistic models respectively. Coefficients for parameters are reported, as well as coefficients for constant terms. To judge the adequacy of the binary-choice model fitted with Probit or Logistic, indicators of evaluating specification, likelihood-ratio test and goodness of fit, R^2, are reported.

Table 5.5 presents the results calculated by Probit models and Table 5.6 shows the results estimated under the Logit models. The likelihood-ratio test statistics of bivariate regressions for explanatory variables calculated by the Logistic model are greater than test statistics under the Probit model, with the exception of a few variables: ROE, financial services incomes ratio and Tier 1 capital ratio. The LR test statistics produced by the Probit model for the explanatory factors ROE,

FSERINCOME and Tier 1 capital ratio are 0.01, 0.07 and 0.01 respectively. These values are the same as LR test statistics calculated by Logistic models. Similarly, the R^2 statistics, which are used to test goodness of fit for estimations, provide positive evidence that the Logit model is more suitable than the Probit model.

The ratio of bad debts/total loans has a positive coefficient (9.727) and is statistically significant at a 5 per cent level. Sub-debt spreads (Spreads) has a positive and significant impact on the reaction of banking regulators, while the coefficient on distance to default (DD) is insignificant, and equity trading volumes have a positive and 10% level significant coefficient on regulation actions. Constant terms in these regressions are statistically significant, indicating that results are reliable.

Besides reporting the maximum likelihood estimates of coefficients, the marginal effect, which is the effect of infinitesimal changes in explanatory factors, is also displayed. The marginal effects imply that distance to default (DD) has a 1.59% lower probability of bank regulators taking action, whereas a marginal change in subordinated debt spread from the average of 71.6661 basis points is associated with a 0.15% increase in participation. Because of a high proportion of 0s in the dummy variable, the last two columns of each table also present statistical results of testing sensitivity and correctly classified, based on the predictions of the binary-choice model which have been proposed.

Table 5.5 Bivariate in Probit Model (without Year Lag)

Table 5.5 represents results of bivariate regression in Probit model. The total observation number is 50, for the five biggest banks in the UK from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Bivairate analysis		Goodness Of fit		Marginal effects		Classified	
Variable	Coefficients	CONS	LR test	R^2	Predict y	Dx/dy	Sensitivity	Correctly
RISKST	53.706	-2.134	8.68	0.2251	0.1261	11.126	42.8%	90.91%
	[0.009]**	[0.000]***	[0.0032]			[0.020]		
LLOSS	-0.047	-0.901	0.44	0.0111	0.1435	-0.0108	0%	85.42%
	[0.526]	[0.000]***	[0.5056]			[0.524]		
ROE	0.6995	-1.09	0.001	0.0001	0.1399	0.1557	0%	86%
	[0.972]	[0.002]***	[0.9718]			[0.972]		
NETING	0.1062	-1.204	0.15	0.0038	0.1389	0.0023	0%	86%
	[0.711]	[0.003]***	[0.6955]			[0.710]		
FSERIN	-0.035	-1.044***	0.07	0.0018	0.1395	-0.0079	0%	86%
	[0.791]	(.000)	[0.7881]			[0.790]		
SOLVER	-3.293	-0.448	1.60	0.0445	0.1180	-0.6512	0%	87.23%
	[0.223]	[0.388]	[0.2063]			[0.213]		
TIER1	-0.237	-1.06	0.01	0.0002	0.1276	-0.0495	0%	87.23%
	[0.935]	[0.277]	[0.9349]			[0.935]		
SIZE	1.114	-10.891	3.16	0.0781	0.1179	0.2202	0%	86%
	[0.100]	[0.070]*	[0.0753]			[0.074]		
DD	-0.0804	-1.011	2.91	0.0729	0.1266	-0.0167	0%	85.71%
	[0.97]	[0.000]***	[0.0879]			[0.088]		
EQPRI	-0.044	-0.900	0.085	0.0211	0.1346	-0.0096	0%	86%
	[0.373]	[0.002]***	[0.3558]			[0.364]		
EQVOL	4.938	-1.751	3.35	0.0827	0.1218	0.0096	0%	86%
	[0.074]*	[0.000]***	[0.0673]			[0.088]		
EQREN	-0.489	-1.125***	1.16	0.0287	0.1343	-0.1059	0%	86%
	[0.268]	[0.000]	[0.2812]			[0.267]		
Spreads	0.713	-1.715	8.87	0.2532	0.1515	0.0016	28.57%	80%
	[0.006]***	[0.000]***	[0.0029]			[0.010]		

Table 5.6 Bivariate Regressions in Logistic Model (without Year Lag)

Table 5.6 represents results of bivariate regression in Logistic model. The total observation number is 50, for the five biggest banks in the UK from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Bivairate analysis		Goodness Of fit		Marginal effects		Classified	
Variable	Coefficients	CONS	LR test	R^2	Predict y	Dx/dy	Sensitivity	Correctly
RISKST	9.727	-3.829	9.07	0.2352	0.1153	9.925	42.86%	90.71%
	[0.011]**	[0.000]***	[0.0026]			[0.022]		
LLOSS	-0.1033	-1.446	0.52	0.0130	0.1416	-0.0125	0%	85.42%
	[0.488]	[0.014]**	[0.4715]			[0.477]		
ROE	0.1335	-1.833	0.001	0.0001	0.1399	0.0016	0%	86%
	[0.972]	[0.006]***	[0.9714]			[0.972]		
NETING	0.0212	-2.066	0.16	0.0039	0.1385	0.0025	0%	86%
	[0.716]	[0.026]**	[0.6901]			[0.713]		
FSERIN	-0.0629	-1.753	0.07	0.0017	0.1394	-0.0075	0%	86%
	[0.798]	[0.000]**	[0.7939]			[0.798]		
SOLVER	-7.118	-0.561	1.80	0.0501	0.1124	-0.710	0%	87.23%
	[0.210]	[0.603]	[0.1799]			[0.163]		
TIER1	-0.425	-1.782	0.01	0.0002	0.1276	-0.0473	0%	87.23%
	[0.936]	[0.318]	[0.9363]			[0.936]		
SIZE	2.0545	-19.927	3.10	0.0766	0.1151	0.2093	0%	86%
	[0.110]	[0.082]*	[0.0781]			[0.061]		
DD	-0.147	-1.722	2.94	0.0731	0.1233	-0.0159	0%	85.71%
	[0.095]	[0.000]***	[0.0865]			[0.070]		
EQPRI	-0.0915	-1.459	0.091	0.0225	0.1456	-0.0011	0%	86%
	[0.380]	[0.006]***	[0.3399]			[0.1322]		
EQVOL	8.288	-2.961	3.16	0.0780	0.1322	0.0088	0%	86%
	[0.077]*	[0.000]***	[0.0755]			[0.063]		
EQREN	-0.844	-1.899	1.12	0.0276	0.1215	-0.0979	0%	86%
	[0.271]	[0.000]***	[0.2908]			[0.264]		
Spreads	0.0121	-2.937	8.73	0.2493	0.1339	0.0015	28.57%	80%
	[0.010]**	[0.001]***	[0.0031]			[0.015]		

Probit and Logistic models are also employed to estimate the relationships between explanatory factors and regulators' enhancement actions with a one-year lag. Table 5.7 shows the results calculated by the Probit models for regressions (4) and (5), and Table 5.8 represents the estimations under the Logistic models for the same regressions. Under the Probit regression, equity trading volumes have a positive coefficient (9.838) with a 1 per cent level of statistical significance. The value for the LR test is greater than the test result of the Logistic model.

In Table 5.8 which displays bivariate regressions estimated by Logistic models with a one-year lag structure, the risky bad debt ratio shows positive and statistically significant signs (14.562), similar with the size variable, which is at a 5 per cent significant level. The supervisory capital ratio also has a 5 per cent level statistically significant coefficient, but with a negative sign (-10.055). All the market indicators except DD and equity prices show significant signs. Spreads have a positive and 5 per cent level significant coefficient (0.1164), and equity returns have a negative coefficient (1.246) with 10 per cent level of significance. Compared with the estimated parameters shown in Table 5.5 and 5.6, the results with a one-year lag are more intensive and significant, which indicates that balance-sheet variables and market indicators have a stronger impact on a regulator's enforcement actions with a one-year delay.

Table 5.7 Bivariate Regression in Probit Model with One Year Lag

Table 5.7 represents results of bivariate regression in Probit model. The total observation number is 50, for the five biggest banks in the UK from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Bivariate Analysis		Goodness of Fit		Marginal Effects		Classified Measures	
Variable	Coefficient	CONS	Likelihood-ratio tests(LR)	R^2	Predict Y	dy/dx	Sensitivity	Correctly classified
RISKBD	8.0463	-2.4885	14.81	0.3321	0.1571	1.9345	44.44%	88.64%
	[0.004]***	[0.000]***	[0.0001]			[0.011]		
LLOSS	0.0682	-1.134	1.44	0.0310	0.1841	0.0181	11.11%	83.33%
	[0.239]	[0.000]***	[0.2308]			[0.246]		
ROE	-0.0265	-0.513	2.46	0.0492	0.1893	-0.0071	0.00%	78.00%
	[0.107]	[0.070]*	[0.1167]			[0.106]		
NETING	-0.0237	-0.5954	1.42	0.0283	0.1941	-0.0065	0.00%	78.00%
	[0.217]	[0.034]	[0.2341]			[0.216]		
FSERVIN	-0.126	-0.721	0.88	0.0217	0.1943	-0.0340	0.00%	80.49%
	[0.372]	[0.007]***	[0.3489]			[0.363]		
SOLVER	-7.263	1.7959	8.24	0.1646	0.1930	-1.8545	0.00%	78.72%
	[0.007]***	[0.072]**	[0.0041]			[0.010]		
TIER1	7.2634	-5.4675	8.24	0.1646	0.2102	1.8545	40.00%	86.00%
	[0.007]***	[0.000]***	[0.0041]			[0.010]		
Size	1.725	-16.059	7.98	0.1595	0.1508	0.4038	10.00%	80.00%
	[0.013]**	[0.009]**	[0.0047]			[0.005]		
DD	-0.568	-0.841	1.72	0.0369	0.1753	-0.0146	0.00%	81.63%
	[0.192]	[0.000]***	[0.1894]			[0.188]		
EQPRI	-0.642	-0.586	1.94	0.0388	0.1886	-0.0174	0.00%	80.00%
	[0.187]	[0.030]**	[0.1634]			[0.175]		
EQVOL	9.838	-2.217	12.68	0.2535	0.1469	2.268	30.00%	80.00%
	[0.002]***	[0.000]***	[0.0004]			[0.003]		
EQRET	-0.6941	-0.8952	2.71	0.0543	0.1928	-0.1901	10.00%	82.00%
	[0.110]	[0.000]***	[0.0994]			[0.117]		
SPREAD	0.6994	-1.339	7.61	0.2150	0.2281	0.0021	50.00%	83.87%
	[0.011]**	[0.001]***	[0.0058]			[0.017]		

Table 5.8 Bivariate Regressions in Logistic Model with One Year Lag

Table 5.8 represents results of bivariate regression in Logistic model. The total observation number is 50, for the five biggest banks in the UK from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Bivariate Analysis		Goodness of Fit		Marginal Effects		Classified Measures	
Variable	Coefficient	CONS	Likelihood-ratio tests(LR)	R^2	dy/dx	Predict Y	Sensitivity	Correctly classified
RISKBD	14.562	-4.4719	15.05	0.3375	1.7861	0.1431	44.44%	88.64%
	[0.008]**	[0.001]***	[0.0001]		[0.017]			
LLOSS	0.1506	-2.0412	1.84	0.0397	0.0221	0.1788	11.11%	83.33%
	[0.192]	[0.001]***	[0.1753]		[0.189]			
ROE	-0.0448	-0.821	2.30	0.0459	-0.0069	0.1913	0.00%	78.00%
	[0.158]	[0.120]	[0.1296]		[0.159]			
NETING	-0.0388	-0.9792	1.31	0.0262	-0.0061	0.1952	0.00%	78.00%
	[0.258]	[0.050]**	[0.2519]		[0.259]			
FSERVIN	-0.2202	-1.183	0.85	0.0209	-0.0335	0.1934	0.00%	80.49%
	[0.395]	[0.009]**	[0.3573]		[0.377]			
SOLVER	-10.055	5.991	4.88	0.1004	-1.4734	0.1783	20.00%	82.98%
	[0.049]**	[0.529]	[0.0271]		[0.025]			
TIER1	-3.049	-0.3275	0.49	0.0101	-0.5055	0.2097	0.00%	78.72%
	[0.486]	[0.819]	[0.4837]		[0.481]			
Size	3.1492	-29.2225	8.08	0.1616	0.3824	0.1414	10.00%	80%
	[0.016]**	[0.013]**	[0.0045]		[0.003]			
DD	-0.1027	-1.3979	1.76	0.0377	-0.0147	0.1729	0.00%	81.63%
	[0.189]	[0.000]***	[0.1843]		[0.172]			
EQPRI	-0.1213	-0.925	2.00	0.0399	-0.0183	0.1847	0.00%	80.00%
	[0.206]	[0.047]*	[0.1578]		[0.173]			
EQVOL	1.647	-3.734	12.33	0.2464	2.028	0.1436	30.00%	82.00*
	[0.003]***	[0.000]***	[0.0004]		[0.004]			
EQRET	-1.246*	-1.5095	2.92	0.0583	-0.1906	0.1885	10.00%	80.00%
	[0.097]	[0.000]***	[0.0875]		[0.098]			
SPREAD	0.1164**	-2.2437	7.54	0.2129	0.0020	0.2221	50.00%	83.87%
	[0.017]	[0.002]***	[0.0060]		[0.024]			

To further examine the regulatory potential of subordinated debt spreads, the dataset is divided into two sub-samples. One sub-sample contains spreads greater than the sample mean (71.6661) and the other is for smaller spreads. Consistent with empirical designs, regressions are run for each sub-sample in both Probit and Logistic models, both with and without the year lag, as well the marginal effects.

The results are shown in Table 5.9. None of the coefficients on spreads which estimated by Probit and Logistic models shows significant signs of regulatory action. Column (1) presents the results for regressions of spreads greater than the sample mean without the year lagged value under the Probit model, and the LR test statistic (2.27) is significantly greater than that of other regressions, the same as the R^2 (0.1123). These statistics indicate that the model for bigger spreads samples estimated by the Probit model has better specifications and is better fitted. For the greater spreads reflected by these results, an increasing of sub-debt spreads in the current year has a 39.24% probability of predicting bank supervisors' regulatory actions. Compared with the results displayed in columns (3) and (4), it is fair to conclude that spreads have predicted ability for regulators' actions in a timely fashion.

Table 5.9 Bivariate Regressions for Different Levels of Sub-debt Spreads under Probit /Logistic Models

Table 5.9 represents results of bivariate regression for different levels of sub-debt spreads with both Probit and Logistic model. The total observation number is 50, for the five biggest banks in the UK from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Spreads > Sample Mean				Spreads< Sample Mean			
	Without Year Lag		With One Year Lag		Without Year Lag		With One Year Lag	
	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic
Coefficient	0.599	0.952	0.419	0.677	-0.256	-0.525	-0.131	-0.276
	[0.153]	[0.167]	[0.233]	[0.246]	[0.409]	[0.418]	[0.724]	[0.714]
CONS	-1.437	-2.296	-0.743	-1.211	-1.053	-1.751	-1.133	-1.896
	[0.109]	[0.124]	[0.243]	[0.256]	[0.010]***	[0.021]**	[0.009]***	[0.022]**
LR test	2.27	2.23	1.52	1.52	0.97	0.97	0.13	0.14
	[0.1323]	[0.1356]	[0.2169]	[0.2170]	[0.3238]	[0.3243]	[0.7231]	[0.7113]
R^2	0.1123	0.1103	0.0736	0.0735	0.0489	0.0488	0.0066	0.0072
Marginal Effects:								
Predict y	0.3924	0.3902	0.4698	0.4671	0.0782	0.0782	0.1058	0.1052
Dy/dx	0.0023	0.0022	0.0016	0.0016	-0.0037	-0.0037	-0.0023	-0.0026
(P value)	[0.155]	[0.168]	[0.234]	[0.247]	[0.341]	[0.308]	[0.723]	[0.710]

5.5.2 Whether Market Information Provides Additional Information to Bank Regulators

To verify the ability of market indicators to provide additional information to bank supervisors, a Probit model and a Logistic model are estimated in which the dummy variable indicates that the FSA's enforcement action is the dependent variable and that the balance-sheet and market-based indicators are the explanatory factors.

Since the enforcement statements are reported on an annual basis, and actions are taken when events occur, the aim is to investigate the possibility of exploiting secondary market-based data, such as spreads of the subordinated debt market and distance to default, calculated mainly for stock market supervisory purposes, and other equity market indicators which bank regulators may pay attention to, such as equity prices, trading volumes and equity returns. Compared with supervisory statistics, these kinds of market information are timelier and are more easily accessed by market investors.

Both Probit and Logistic estimations are used to calculate parameters for both regressions (3) and (6), and the results are reported in Table 5.10. Hypothesis tests and tests for evaluating specification and goodness of fit are also reported in both tables. Wald tests for adding variables are conducted; results are included in both tables. Besides correlation coefficients, the marginal effects of the explanatory factors are also shown in Table 5.11.

Table 5.10 Multivariate Regressions with Probit and Logistic Models (without Year Lag)

Table 5.10 represents results of regression of regulation dummy on accounting and market variables with both the Probit and Logistic model. The total observation number is 50. The panel sample period is from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Model1		Model2		Model3		Model 4		Model5		Model6	
Variable	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic
RISKBD	1.979	3.418	2.319	3.881	2.036	3.574	2.042	3.469	2.025	3.469	2.642	4.259
	[0.017]**	[0.021]**	[0.027]**	[0.029]**	[0.021]**	[0.027]**	[0.066]*	[0.021]**	[0.019]**	[0.021]**	[0.131]	[0.149]
LLOSS	-0.316	-0.5286	-0.236	-0.398	-0.307	-.0507	-0.227	-0.571	-0.345	-0.571	1.148	1.846
	[0.180]	[0.199]	[0.376]	[0.393]	[0.189]	[0.215]	[0.367]	[0.226]	[0.220]	[0.226]	[0.366]	[0.391]
ROE	-0.032	-0.050	-0.029	-0.039	-0.01	0.042	-0.191	-0.033	-0.023	-0.033	-0.506	-0.810
	[0.695]	[0.730]	[0.710]	[0.786]	[0.929]	[0.983]	[0.341]	[0.836]	[0.795]	[0.836]	[0.318]	[0.343]
NETING	0.593	0.993	0.581	0.968	0.591	0.989	1.005	0.988	0.597	0.988	1.885	3.048
	[0.096]	[0.124]	[0.084]	[0.107]	[0.093]	[0.125]	[0.166]	[0.114]	[0.089]	[0.114]	[0.240]	[0.263]
FSERIN	-0.381	-0.735	-0.581	-0.986	-0.429	-0.839	-0.279	-0.815	-0.430	-0.815	-9.411	-15.213
	[0.537]	[0.547]	[0.499]	[0.507]	[0.457]	[0.545]	[0.615]	[0.536]	[0.529]	[0.536]	[0.295]	[0.319]
TIER1	-4.496	-9.48	-3.899	-6.824	-0.633	-0.727	-1.623	-8.744	-4.175	-8.744	15.881	25.578
	[0.600]	[0.567]	[0.660]	[0.688]	[0.970]	[0.998]	[0.876]	[0.602]	[0.628]	[0.602]	[0.483]	[0.509]
SOLVE	6.194	11.547	9.337	14.865	1.470	-0.235	10.917	11.249	6.147	11.249	29.493	46.988
	[0.545]	[0.520]	[0.412]	[0.435]	[0.943]	[0.999]	[0.402]	[0.531]	[0.547]	[0.531]	[0.252]	[0.278]
SIZE	1.129	1.457	0.966	1.483	0.805	0.616	1.542	1.485	1.165	1.485	-2.814	-4.446
	[0.675]	[0.772]	[0.751]	[0.784]	[0.780]	[0.910]	[0.621]	[0.773]	[0.673]	[0.773]	[0.524]	[0.551]
DD	----	----	0.115	0.185	----	----	----	----	----	----	----	----
			[0.533]	[0.576]	----	----	----	----	----	----	----	----
EQPRI	----	----	----	-----	0.462	0.116	----	----	----	----	----	----
					[0.794]	[0.729]	----	----	----	----	----	----

Table 5.10 *Continued*

EQVOL	----	----	----	-----	----	----	2.437 [0.252]	4.137 [0.233]	----	----	----	----
EQRET	----	----	----	-----	----	----	----	----	0.445 [0.836]	0.722 [0.842]	----	----
SPREAD	----	----	----	-----	----	----	----	----	----	----	0.121	0.196
	----	----	----	-----	----	----	----	----	----	----	[0.288]	[0.312]
CONS	-2.139	-3.193	-2.176	-3.513	-1.953	-2.701	-33.821	-55.086	-22.016	-32.531	-18.309	-30.433
	[0.439]	[0.018]	[0.470]	[0.516]	[0.516]	[0.600]	[0.369]	[0.399]	[0.438]	[0.533]	[0.588]	[0.606]
LR test	19.05	18.77	19.14	18.77	19.11	18.89	21.14	20.92	19.09	18.81	19.75	19.56
	[0.0149]	[0.0162]	[0.0240]	[0.0273]	[0.0242]	[0.0262]	[0.0120]	[0.0130]	[0.0244]	[0.0269]	[0.0195]	[0.0209]
R^2	0.5688	0.5604	0.5774	0.5661	0.5708	0.5640	0.6313	0.6247	0.5701	0.5616	0.6395	0.6332
Test for Non-linear	2.006	3.4509	2.382	3.973	2.051	3.575	2.153	3.612	2.059	3.512	3.000	4.831
	[0.018]	[0.022]	[0.030]	[0.032]	[0.020]	[0.026]	[0.074]	[0.072]	[0.021]	[0.022]	[0.147]	[0.166]
Wald tests	----	----	-2.176	-3.513	0.07	0.12	1.31	1.42	0.04	0.04	1.13	1.02
			[0.470]	[0.516]	[0.7942]	[0.7292]	[0.2516]	[0.2330]	[0.8359]	[0.8423]	[0.2878]	[0.3117]

The first two columns report the estimated coefficients for model 1, which investigates the relationship between the FSA's actions and accounting variables that bank supervisors always use. The Likelihood-ratio test statistics are 19.05 and 18.77 respectively, which suggests that the model fits well. Moreover, the R^2 (0.5688 and 0.5604 respectively) provides evidence for the goodness of fit of the model. These results imply that the binary-choice model is well fitted. However, there is no strong evidence that balance-sheet variables have significant coefficients with the UK banking regulator's enforcement actions besides the bad debt ratio, which captures the overall riskiness of a bank's portfolio.

Columns (3) and (4) present the estimated parameters for model 2 which added distance to default (DD) as an extra explanatory factor. Statistics for evaluating specification and goodness of fit imply that model 2 is better than the benchmark (model 1). As a stock market-based indicator, distance to default (DD) has a positive coefficient with a bank supervisor's actions, but the estimated coefficient does not appear strongly statistically significant.

The test statistics in column (3) are greater than in column (1), implying that the model which adds DD as an explanatory factor is more reliable than the one without DD. A Wald test is also produced to identify the importance of adding DD. However, the F-statistic shows a statistically insignificant result. Column (3) in Table 5.11 shows that as the DD statistic for each financial institution increases, there is a 0.3% higher probability of participating supervision.

Model 3 is the regression, and adds equity prices as one of the additional explanatory factors to the balance-sheet variables that regulators currently use. The statistic for the LR test under the Probit model is greater than the value estimated by the Logistic model, as well as the R^2. The equity prices fail to show any significant

sign of regulatory actions. Balance-sheet variables, besides the bad debt ratio, also present insignificant relationships with the dummy explained variable. The marginal effects indicate that an increase of equity prices raises a 16.71% probability of the regulators utilising equity price in their off-site assessments.

There are similar results for model 4, which adds equity trading volumes in the regression, and model 5, which examines the additional information equity returns provide to regulators. Neither of the market indicators have statistically significant coefficients, and the risky bad-debt ratio has positive and statistically significant coefficients in all regression models. These results imply that even with the timely information from equity markets, a bank regulator still mainly focuses on a bank's bad debts. The higher the proportion of bad debts to total loans, the greater is the possibility that the bank supervisor will take regulatory action.

To investigate the evidence of the contribution of subordinated debt spreads, spread is added as an explanatory factor in model 6 and the results are shown in columns (11) and (12) in Table 5.10, with parameters calculated by Probit estimation and Logistic estimation respectively. There is not a significant coefficient on spreads. Column (11) in Table 5.11 shows that marginal effects of spreads indicate that spread has limited explanatory power to predict supervisory actions.

Interestingly, the risky bad-debt ratio shows statistically insignificant coefficients in model 6. This result implies that including spread in off-site risk assessments, risky bad debt ratio is no longer the priority of bank regulators, because spread can provide additional information on the overall riskiness of debt structure. Moreover, what matters for this research is that the model can be verified with subordinated debt spreads to achieve a better fit than the other two models. The R^2 values of model 6 (0.6395 and 0.6332) are greater than the benchmark model (0.5688 and 0.5604), and

the likelihood-ratio test statistic (19.75) is greater than both model 1 and model 2 (19.05 and 19.14 respectively). Although the Wald test for adding Spreads fails to present strongly statistically significant signs, we find that spreads of subordinated debt provide additional information to bank regulators, relative to the balance-sheet information they currently employ.

Table 5.11Marginal Effects for Probit and Logistic Models (without Year Lag)

Table 5.11 represents the marginal effects of the regression of the regulation dummy on accounting and market variables with both the Probit and Logistic model. The total observation number is 50. The panel sample period is from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Model1		Model2		Model3		Model 4		Model5		Model6	
Variable	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic
RISKBD	0.9078	1.9295	0.6485	1.8547	0.7364	1.6847	0.0106	0.2713	0.6364	1.6659	0.5011	0.6510
	[0.768]	[0.595]	[0.796]	[0.612]	[0.790]	[0.629]	[0.924]	[0.793]	[0.807]	[0.631]	[0.131]	[0.941]
LLOSS	-0.0014	-0.0029	-0.0006	-0.0019	-0.0011	-0.0023	-0.0000	-0.0003	-0.0011	-0.0027	0.0021	0.0002
	[0.761]	[0.587]	[0.815]	[0.685]	[0.786]	[0.626]	[0.924]	[0.804]	[0.796]	[0.607]	[0.366]	[0.938]
ROE	-0.0001	-0.0002	-0.0001	-0.0002	-0.0000	0.0000	-0.0001	-0.0002	-0.0001	-0.0001	-0.0009	-.00001
	[0.795]	[0.747]	[0.828]	[0.807]	[0.934]	[0.983]	[0.920]	[0.771]	[0.865]	[0.852]	[0.318]	[0.939]
NETING	0.0027	0.0056	0.0016	0.0046	0.0021	0.0046	0.0001	0.0013	0.0018	0.0047	0.0035	0.0004
	[0.757]	[0.570]	[0.799]	[0.623]	[0.782]	[0.607]	[0.922]	[0.780]	[0.802]	[0.619]	[0.240]	[0.939]
FSERVIN	-0.0017	-0.0042	-0.0016	-0.0047	-0.0015	-0.0039	-0.0001	-0.0004	-0.0013	-0.0039	-0.0178	-0.0023
	[0.778]	[0.662]	[0.778]	[0.607]	[0.790]	[0.657]	[0.926]	[0.823]	[0.800]	[0.652]	[0.295]	[0.939]
TIER1	-0.0206	-0.0535	-0.0109	-0.0326	-0.0023	-0.0003	-0.0001	-0.0021	-0.0131	-0.0419	0.0301	0.0039
	[0.784]	[0.673]	[0.827]	[0.761]	[0.971]	[0.998]	[0.938]	[0.906]	[0.828]	[0.723]	[0.483]	[0.938]
SOLVE	0.0284	0.0651	0.0261	0.0710	0.0053	-0.0001	0.0006	0.0146	-0.0193	0.0540	0.0559	0.0072
	[0.792]	[0.683]	[0.801]	[0.664]	[0.949]	[0.999]	[0.922]	[0.790]	[0.825]	[0.713]	[0.252]	[0.940]
SIZE	0.0051	0.0082	0.0027	0.0071	0.0029	0.0029	0.0001	0.0018	0.0036	0.0071	-0.0053	-0.0006
	[0.788]	[0.782]	[0.848]	[0.811]	[0.838]	[0.910]	[0.919]	[0.782]	[0.816]	[0.788]	[0.524]	[0.939]
DD	----	----	0.0003	0.0008	----	----	----	----	----	----	----	----
	----	----	[0.786]	[0.648]	----	----	----	----	----	----	----	----
EQPrice	----	----	----	----	0.1671	0.5511	----	----	----	----	----	----
	----	----	----	----	[0.827]	[0.739]	----	----	----	----	----	----
EQVOL	----	----	----	----	----	----	0.1261	0.3271	----	----	----	----
							[0.921]	[0.778]				
EQRET	----	----	----	----	----	----	----	----	0.0014	0.0034	----	----
									[0.833]	[0.829]		
SPREAD	----	----	----	----	----	----	----	----	----	----	0.0002	0.0003
	----	----	----	----	----	----	----	----	----	----	[0.288]	[0.939]
Predict Y	0.0014	0.0056	0.0008	0.0048	0.0011	0.0047	0.0001	0.0008	0.0009	0.0048	0.0016	0.0015

Also considered is the time-lagged structure, which is examined in regression 6. The parameters estimated by both Probit and Logistic models are shown in Table 5.12. The results of the benchmark model (model 1) which includes only accounting information that the regulator assesses are shown in columns (1) and (2). The risky bad-debt ratio displays positive and statistically significant coefficients under both of the models.

Model 2 examines the additional informative potential that distance to default (DD) provides (in column 3 and 4). The statistics of the LR test and R^2 calculated by the Logistic model are greater than the statistics of the Probit model, indicating that the results under the Logistic model have better explanatory power. The one-year-lagged value of balance sheet variables and DD show statistical insignificance with the dependent variable. The additional predictive power of equity prices is examined in model 3. The equity prices show no sign of significantly correlating with regulatory actions, but the statistics of the LR test and R^2 are greater than the benchmark regression.

Column (7) tests whether equity trading volumes related to regulatory actions in the Probit estimation. The LR test statistic (25.16) and R^2 (0.6356) indicate that the results of the Probit model are better fitted. Equity trading volumes have a positive coefficient with a 10 per cent level of statistical significance. Furthermore, compared with the benchmark (reported in column 1) the indicators of specification fitness are greater. Model 5 examines whether equity return as a market indicator provides additional information relative to balance-sheet information to bank regulators. The coefficients on equity returns show no sign of statistical significance, but the bad-debt ratio has positive and significant coefficients.

The results for model 6 report that neither spreads nor balance sheet variables

have significant relationships with regulators' actions. However, LR test statistics for both Probit and Logistic estimations for model 6 are greater than model 1, which excludes market indicators. Therefore, including the spreads in the regression improves the model's specification fitness.

Table 5.13 shows the marginal effects. With an increase of spreads there is a 0.38% probability of providing additional regulatory information to bank supervisors. It is relatively smaller regarding the marginal effects of equity trading volumes (87.39% in the Probit estimation and 72.99% in the Logistic estimation). However, the marginal effects of spreads are greater than equity prices' marginal effects (0.1% in both Probit and Logistic models).

The dataset is also divided into two sub-samples to evaluate progressive information reflected by different values of spreads. However, owing to the limited number of observations Probit and Logistic estimations are not conducted.

Table 5.12 Regressions in Probit / Logistic Models (with One-year-lag)

Table 5.12 represents the results of the regression of the regulation dummy on accounting and market variables with both the Probit and Logistic model. The total observation number is 50. The panel sample period is from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Model1		Model2		Model3		Model 4		Model5		Model6	
Variable	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic
RISKBD	1.293	2.366	1.007	1.873	3.480	6.075	1.1485	2.069	1.197	2.211	1.219	2.083
	[0.030]**	[0.050]*	[0.089]*	[0.106]	[0.321]	[0.321]	[0.238]	[0.236]	[0.039]**	[0.060]*	[0.339]	[0.349]
LLOSS	0.121	0.229	0.0194	0.017	-0.726	-1.286	0.171	0.296	0.103	0.191	0.663	1.119
	[0.443]	[0.421]	[0.912]	[0.957]	[0.594]	[0.583]	[0.619]	[0.619]	[0.512]	[0.515]	[0.171]	[0.194]
ROE	-0.045	-0.075	-0.034	-0.040	0.227	0.3888	-0.084	-0.138	-0.047	-0.069	-0.097	-0.157
	[0.578]	[0.607]	[0.672]	[0.781]	[0.265]	[0.263]	[0.405]	[0.446]	[0.555]	[0.618]	[0.378]	[0.421]
NETING	0.072	0.117	0.078	0.111	-0.195	-0.342	0.122	0.201	0.078	0.118	0.139	0.219
	[0.456]	[0.502]	[0.426]	[0.517]	[0.446]	[0.440]	[0.322]	[0.363]	[0.419]	[0.488]	[0.286]	[0.349]
FSERVIN	-0.489	-0.844	-0.401	-0.668	0.322	0.592	-0.478	-0.873	-0.489	-0.854	-2.592	-4.104
	[0.341]	[0.371]	[0.484]	[0.543]	[0.985]	[0.947]	[0.522]	[0.516]	[0.352]	[0.396]	[0.454]	[0.484]
TIER1	-1.308	-2.602	-2.648	-6.215	-66.764	-11.419	-3.084	-5.427	-1.830	-3.846	-1.749	-2.613
	[0.856]	[0.842]	[0.713]	[0.650]	[0.259]	[0.262]	[0.714]	[0.721]	[0.796]	[0.768]	[0.863]	[0.883]
SOLVE	11.123	21.994	9.243	21.071	52.483	90.157	13.294	22.868	11.328	23.687	18.399	32.649
	[0.235]	[0.253]	[0.342]	[0.290]	[0.141]	[0.148]	[0.217]	[0.270]	[0.215]	[0.223]	[0.118]	[0.144]
SIZE	1.861	3.632	1.571	3.297	8.114	13.941	1.042	1.878	1.828	3.665	-0.423	-0.5927
	[0.282]	[0.253]	[0.421]	[0.368]	[0.195]	[0.202]	[0.662]	[0.648]	[0.292]	[0.261]	[0.903]	[0.923]
DD	----	----	-0.093	-0.189	----	----	----	----	----	----	----	----
			[0.516]	[0.502]								
EQPRI	----	----	----	----	-0.0018	-0.0031	----	----	----	----	----	----
					[0.342]	[0.340]						
EQVOL	----	----	----	----	----	----	1.667	2.757	----	----	----	----
							[0.088]*	[0.100]				
EQRET	----	----	----	----	----	----	----	----	-0.455	-0.957	----	----
									[0.640]	[0.611]		
SPREAD	----	----	----	----	----	----	----	----	----	----	0.041	0.066
											[0.366]	[0.381]
CONS	-22.137	-42.823	-18.019	-37.185	-58.804	-101.252	-16.678	-29.495	-21.516	-42.742	-5.718	-11.226
	[0.168]	[0.155]	[0.336]	[0.294]	[0.151]	[0.161]	[0.445]	[0.437]	[0.182]	[0.164]	[0.845]	[0.830]
LR tests	20.66	21.03	18.42	18.84	31.02	30.96	25.16	24.98	20.89	21.32	22.85	22.80
	[0.0081]	[0.0071]	[0.0306]	[0.0266]	[0.0001]	[0.0001]	[0.0028]	[0.0030]	[0.0132]	[0.0113]	[0.0065]	[0.0067]
R^2	0.5220	0.5314	0.5073	0.5190	0.7839	0.7823	0.6356	0.6312	0.5277	0.5386	0.6350	0.6335
Tests for non-lines	1.407	2.590	1.084	2.047	3.412	5.963	1.259	2.259	1.302	2.430	1.364	2.351
	[0.024]	[0.045]	[0.084]	[0.099]	[0.302]	[0.303]	[0.187]	[0.195]	[0.032]	[0.032]	[0.264]	[0.270]
Wald tests	----	----	0.42	0.45	0.90	0.91	2.92	2.70	0.22	0.26	0.82	0.77
			[0.5159]	[0.5017]	[0.3417]	[0.3399]	[0.0876]	[0.1003]	[0.6379]	[0.6105]	[0.3664]	[0.3808]

Table 5.13 Marginal Effects for Probit /Logistic Models with One-year-lag

Table 5.13 represents the marginal effects of the regression of the regulation dummy on accounting and market variables with both the Probit and Logistic model. The total observation number is 50. The panel sample period is from the period 2001 to May 2011. The dependent variable REGULATION is a dummy variable, and takes 1 if the FSA takes enforcement actions on the bank, 0 otherwise. RISKBD is the ratio of bad debts to total loans, LLOSS is the ratio of loan loss to operating profit, ROE is the ratio of net income to capital and reserves, NETING is the ratio of net income to gross income, FSERVIN is the ratio of income stemming from financial services to gross income, SOLVER is the ratio of supervisory capital to risk-weighted assets, TIER1 is the ratio of Tier 1 capital to risk-weighted assets, SIZE is the natural logarithm of total assets, SPREAD refers to the spreads of subordinated debt, DD is the distance to default, EQPRI denotes the equity prices for each bank, EQVOL is the equity trading volumes, and EQRET is the equity return. P-values are shown in brackets as ***, **, * indicating significance at 1%, 5% and 10% levels, respectively.

	Model1		Model2		Model3		Model 4		Model5		Model6	
Variable	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic	Probit	Logistic
RISKBD	9.283	6.985	8.6853	6.3697	0.6296	0.0203	6.0403	5.4963	9.1055	6.6359	11.4104	9.9509
	[0.319]	[0.326]	[0.292]	[0.332]	[0.994]	[0.945]	[0.554]	[0.489]	[0.305	[0.334]	[0.453]	[0.463]
LLOSS	0.0087	0.0067	0.0016	0.0006	-0.0006	-0.0004	.0090	0.0078	0.0078	0.0057	0.0621	0.0534
	[0.450]	[0.450]	[0.908]	[0.956]	[0.994]	[0.944]	[0.619]	[0.611]	[0.501]	[0.518]	[0.423]	[0.404]
ROE	-0.0033	-0.0022	-0.0030	-0.0013	-0.0002	0.0015	-0.0045	-0.0036	-0.0035	-0.0021	-0.0091	-0.0075
	[0.627]	[0.662]	[0.702]	[0.796]	[0.994]	[0.708]	[0.635]	[0.624]	[0.616]	[0.677]	[0.524]	[0.515]
NETING	0.0052	0.0034	0.0067	0.0037	0.0003	-0.0001	0.0064	0.0053	0.0059	0.0035	0.0130	0.0105
	[0.544]	[0.592]	[0.551]	[0.622]	[0.996]	[0.944]	[0.612]	[0.590]	[0.532]	[0.598]	[0.449]	[0.448]
FSERIN	-0.0351	-0.0249	-0.0345	-0.0227	0.0496	0.0001	-0.0251	-0.0232	-0.0372	-0.0256	-0.2425	-0.1960
	[0.224]	[0.269]	[0.278]	[0.373]	[0.994]	[0.972]	[0.403]	[0.354]	[0.218]	[0.281]	[0.382]	[0.425]
TIER1	-0.0938	-0.0768	-0.2284	-0.2113	-0.0631	-0.0038	-0.1622	-0.1441	-0.1392	-0.1154	-0.1636	-0.1248
	[0.853]	[0.838]	[0.714]	[0.658]	[0.994]	[0.946]	[0.728]	[0.727]	[0.794]	[0.767]	[0.869]	[0.887]
SOLVE	0.7982	0.6494	0.7972	0.7164	0.0496	0.0030	0.6991	0.6072	0.8616	0.7110	1.7209	1.5591
	[0.381]	[0.368]	[0.446]	[0.429]	[0.994]	[0.946]	[0.545]	[0.489]	[0.383]	[0.384]	[0.440]	[0.423]
SIZE	0.1336	0.1072	0.1354	0.1121	0.0076	0.0004	0.0548	0.0498	0.1391	0.1100	-0.0395	-0.0283
	[0.510]	[0.497]	[0.571]	[0.560]	[0.994]	[0.946]	[0.734]	[0.710]	[0.514]	[0.513]	[0.898]	[0.920]
DD	----	----	-0.0080	-0.0064	----	----	----	----	----	----	----	----
			[0.616]	[0.609]								
EQPRI	----	----	----	----	-0.0001	-0.0001	----	----	----	----	----	----
					[0.994]	[0.945]						
EQVOL	----	----	----	----	----	----	0.8739	0.7299	----	----	----	----
							[0.601]	[0.558]				
EQRET	----	----	----	----	----	----	----	----	-0.0346	-0.0287	----	----
									[0.688]	[0.663]		
SPREAD	----	----	----	----	----	----	----	----	----	----	0.0038	0.0032
											[0.356]	[0.378]
Predict Y	0.0319	0.0304	0.0400	0.0352	0.0001	0.0003	0.0221	0.0273	0.0343	0.0309	0.0443	0.0502

5.5.3 Case Study: Did the Market Signals Help the FSA to anticipate Impending Problems at RBS?

This section investigates a case study of one of the five biggest banks in the UK and assesses whether market signals of this bank's impending problems existed and whether these market signals helped the bank supervisor, the FSA, to anticipate impending problems. An analytical background is sketched to the events that culminated in the announcement on 24 November 2009, in which the Bank of England for the first time revealed that it had been lending RBS emergency funding since October 2008. For reference purposes, Appendix 2 tables the events both before and after October 2008 in detail. This section utilises data from the Nexis UK, London Stock Exchange Regulatory News Services and other financial media to identify key dates and access source material.

5.5.3.1 Background

As one of the biggest multinational banking groups in the UK, RBS has been enthusiastic in international expansion in US, European and Asia-Pacific markets in the last few decades. In 2005 the bank expanded into China, acquiring a 10% stake in the Bank of China for £1.7 billion. RBS opened 2007 reporting profitability in the previous financial year and a high dividend (25%) (RBS, 2007). In 2007, the Group led a consortium to acquire the Dutch bank ABN AMRO, and declared their victory in the takeover battle on 9 October 2007 with a higher offer than Barclays.

Market investigators and researchers speculated that RBS had overpaid for the Dutch bank, and the market reacted to the news with the company's share price declining 875.6p within a week. Furthermore, with the impact of the US sub-prime crisis and the bail-out of Northern Rock, the share price kept falling during the rest of

the year. However, the chairman concluded the takeover positively: "*the acquisition of ABN AMRO will deliver good, long-term value enhancement to shareholders*" (Royal Bank of Scotland Group, 2008).

On 22 April 2008 RBS announced the largest rights issue in British corporate history which aimed to raise £12 bn in new capital, and then issued new long-term bonds or debts. Immediately, rating agencies downgraded RBS's financial strength ratings and debt ratings. Later on, in order to gain more capital, RBS launched a range of new savings accounts. From October 2008 onwards the Bank of England began to secretly inject emergency funds into RBS. This action has been recognized by the market as "*classic lender of last resort operation*" (Giles et al, 2009).

On 13 October 2008, the British Prime Minister Gordon Brown made a speech announcing that the UK government had decided to bail out the financial system. The Treasury infused new capital into RBS by preference shares. This resulted in a total government ownership stake in RBS of 58%. Meanwhile, RBS announced a profit warning, published details of capital rises and announced that dividends were to be stopped until it paid off the preference shares dividend of the UK government.

At the beginning of 2009, RBS announced losses. At the same time, the UK government converted their preference shares into ordinary shares, which resulted in 70% ownership of RBS. Later on, the UK government forced RBS to forgo the right to claim tax benefits, in order to participate in the government insurance scheme. The market's reaction to this news was significant: the common stock price declined sharply on 27 February 2009.

In May 2009, the Financial Services Authority (FSA) officially launched a supervisory investigation into RBS as it required partial taxpayer bailout support. The investigation lasted more than a year. On 2 December 2010, the FSA announced that

the investigation was closed, and confirmed that "*RBS made a series of bad decisions in the years immediately before the financial crisis*" (FSA, 2010c), most significantly the acquisition of ABN AMRO in 2007 and the 2008 capital raisings. However, the FSA cannot publish the content of the RBS review. Towards the end of 2009, RBS began to sell part of its operations in other countries. At the end of the year, the Bank of England revealed for the first time that it had lent RBS and HBOS emergency funding in October and November 2008.

In 2010, the Committee of European Banking Supervisors (CEBS) together with the Financial Services Authority (FSA) and the European Banking Authority (EBA) published a statement of its intention to conduct an EU-wide stress-test exercise. The results were published on 15 July 2011. Four UK banks (Barclays, HSBC, RBS and Lloyds) passed, and RBS "*remains well capitalised with a Core Tier 1 capital ratio passing both the baseline and adverse scenarios*" (FSA, 2011c).

5.5.3.2 Did Market Signals Anticipate Impending Problems?

This section analyses the signalling qualities of different market instruments. Two types of markets were included: equity and subordinated debt.

5.5.3.2.1 Equities

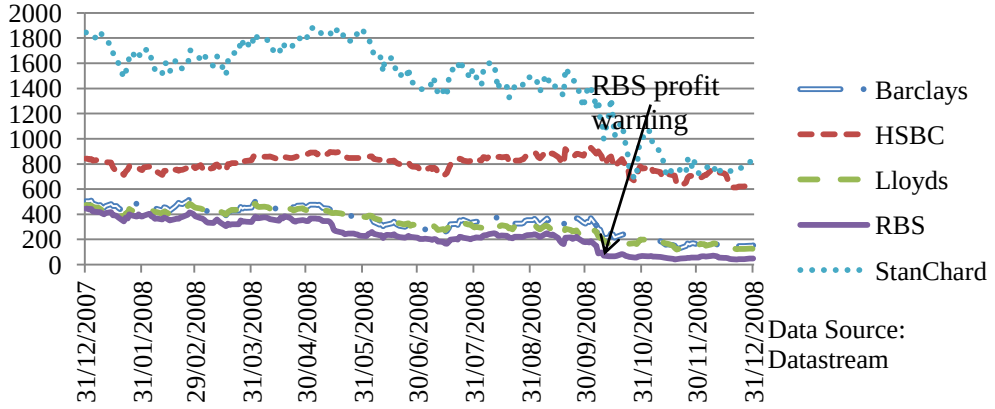
The five major multinational banks in the study are listed in the FTSE 100, therefore their equity liabilities are liquid. Based on existing literature (e.g. Hamalainen et al, 2010b) the qualities of the following equity market indicators are examined: stock prices, trading volume and returns.

Equity prices. Market participants, central bankers and supervisors use equity prices to picture the average view and compare the development between different

banks, although equity prices can be affected by many factors, such as market overreactions or herding, and there is no unambiguous link between stock prices and default risk (Persson and Blavary, 2003).

In the RBS context, however, their share price had been consistently failing since the beginning of 2008, and even at the end of 2007 RBS had just declared their victory in the ABN AMRO takeover battle. Even if RBS raised new capital and UK government-infused funds, the deterioration in the RBS share price becomes truly apparent after the profit warning issued in October 2008. Figure 5.8 presents the share price data for the five UK multinational banks; the arrow indicates when RBS issued a profit warning.

Figure 5.8 UK Major Banks' Equity Prices

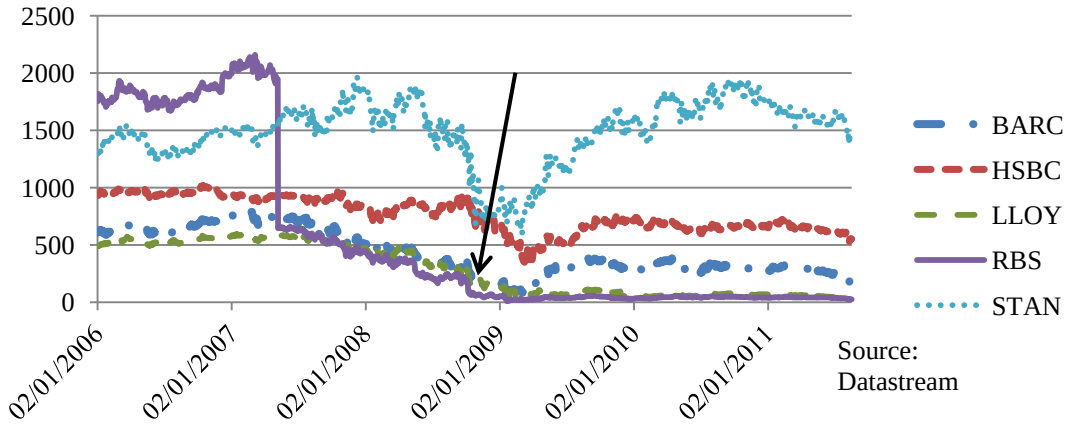


The worst deterioration in RBS's share price occurred in April and May 2007, when RBS announced the proposed acquisition of ABN AMRO with other international banks. Figure 5.9 emphasises that RBS was the best-performing UK bank in terms of shares during 2006.

The figure again suggests that the market's intensive reactions to the suspicion that the RBS-led consortium overpaid the ABN AMRO and that the equity market

became particularly concerned with RBS after the profit warning in October. This may well be because the British Prime Minister announced the bailout plan for the financial system, which accelerated deterioration in market investors' confidence in the UK banking system, particularly shortly after the Northern Rock credit crisis and sharp drops in the FTSE as concerns over the US sub-prime crisis increased.

Figure 5.9 Major UK Banks' Equity Prices (From Jan 2006)

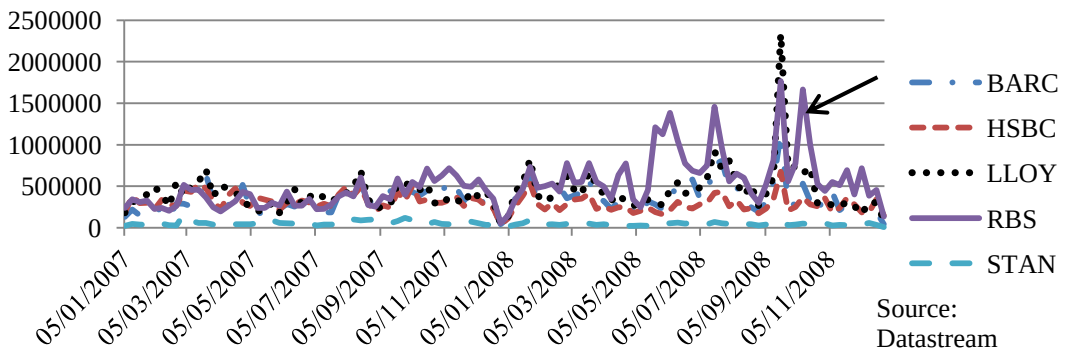


Source: Datastream

Equity trading volumes. Although there is also no clear link between equity trading volumes and default risk, supervisory authorities can employ trading volumes to indicate potential issues that may have been identified by equity market investors and to discover what requires further investigation (Hamalainen et al, 2010b).

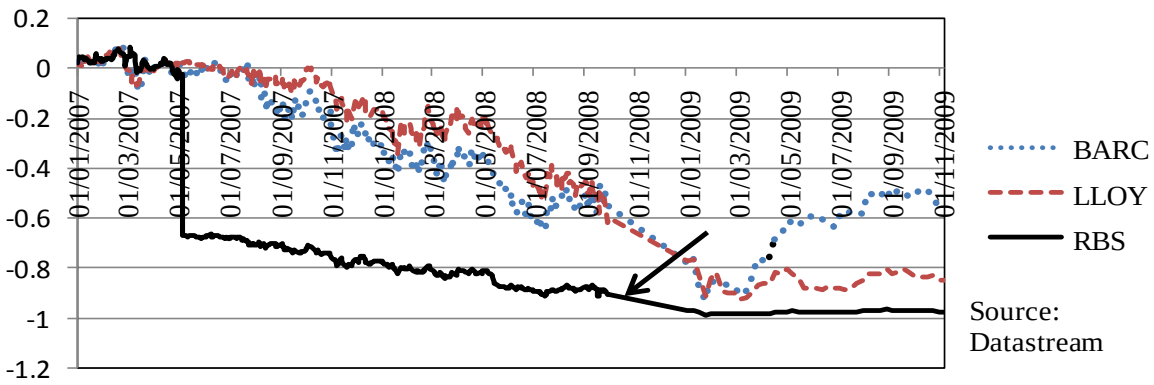
Figure 5.10 illustrates a simple peer analysis with other multinational banks, and suggests consistently higher trading volumes in RBS shares, particularly after the profits warning in October 2008. The two peaks in trading volumes may imply that for investors searching for potential value stocks, however, the jump in October warranted further investigation. Similarly, the Lloyds TSB Banking Group had a higher peak of share trading volume, which may have alerted the supervisory authorities to conduct further investigations.

Figure 5.10 Major UK Banks' Equity Trading Volume



Equity returns. In order to further test whether equity market indicators anticipated RBS's problems, the cumulative weekly returns for the bank were calculated, along with those of other two similar banks between January 2007 and 30 September 2008. Figure 5.11 presents the results. As for the equity price signal graphs, the equity return dropped significantly during the Dutch bank takeover battle. Before the profit warning in October 2008, RBS's equity returns had already become significant and thus signalled a potential concern.

Figure 5.11 Cumulative Weekly Returns for Portfolio of Major UK Banks



5.5.3.2.2 Subordinated Debt

This study focuses on sterling-issued subordinated debt. Hamalainen et al (2007) suggest that the currency of denomination does influence sub-debt spreads. Moreover, only non-perpetual in maturity, non-callable subordinated debts which are regularly traded were selected. Figure 5.12 and 5.13 present the findings for the five biggest banks in the UK. Figure 5.12 shows those bonds with ten years and less to maturity, and suggests that RBS spreads had been rising until the rights issuance in April. Before the profit warning in October, sub-debt spreads declined sharply. This may be because RBS had been downgraded by rating agencies in April and June. Immediately after the announcement of RBS's rights issuance, Fitch downgraded RBS to 'AA'. Shortly after, Moody's Investor Services cut RBS's senior debt rating down to 'Aa2', then soon afterwards to 'Aa1'. However, RBS raised subordinated debt spreads to absorb new capital, despite the existence of high volatility and great risks as indicated by rating agencies.

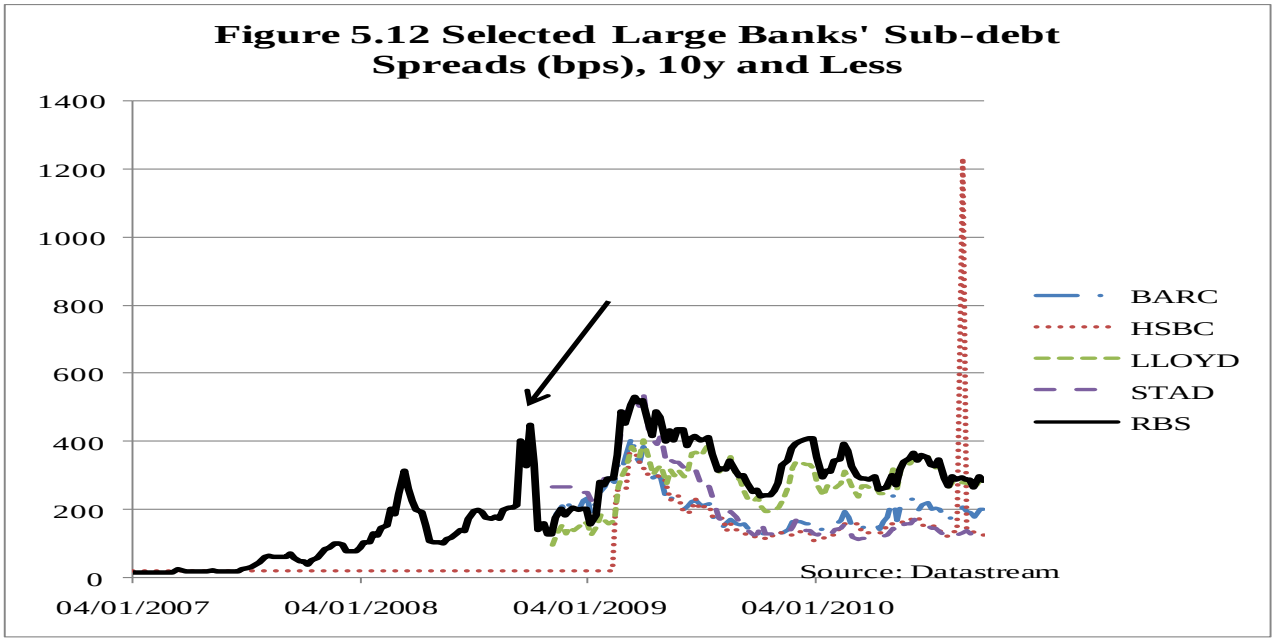
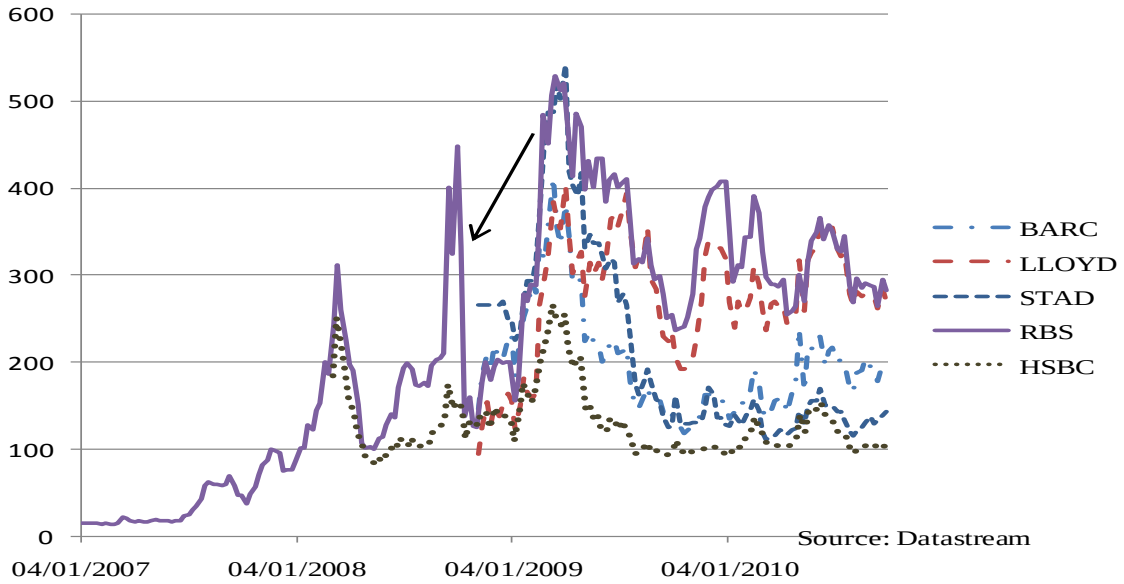


Figure 5.13 reports the sub-debt spreads for a selection of sterling-dominated

subordinated debt issued by the five observed international-expanded banks with greater than ten years to maturity. The turbulences in two maturity groups are similar. RBS's sub-debt spreads are generally higher than other selected subordinated debt. This may be because RBS was eager to expand and raise new capital between 2007 and 2008. However, it should not be forgotten that higher spreads may indicate potential greater risks.

Figure 5.13 Selected Large Banks' Sub-debt Spreads (bps), 10y and More



For the high spreads of all banks during 2007, Hamalainen et al (2010b) explain that this was because investors were recognising increased risks in the whole financial system, and therefore that high sub-debt spreads were caused by market rather than bank-specific fluencies. However, from 2008 onwards, RBS's SND spreads are the highest of the five observed banks. As a risk indicator from the subordinated debt market, widening spreads may imply potential issues that bank supervisors should further investigate, although Group et al (2002) claim that SND spreads signal problems up to six months before a bank falls into financial distress.

5.5.4 Comparative Signalling Analysis of Financial Instruments and Their Applications by the Supervisory Authorities

Of the financial instruments from two capital markets analysed in this study, equities appear to present the clearest signals with regard to RBS and the swiftest response by market participants during the acquisition of ABN AMRO in 2007 and the raising of new capital in 2008. There were significant bank-specific falls in equity prices, trading volumes and returns.

The bank-specific signs are apparent at two turning points: one was the dramatic fall in April 2007, which was the stage during which RBS offered an ABN AMRO takeover bid; the other was when RBS announced a profit warning in October 2008. Meanwhile, the government revealed the bailout plans for the bank and the financial system. These disclosures appear to have highlighted to the market the weakness in RBS's business model and accelerated declines in RBS's share price.

Sub-debt spreads report significant jumps in RBS's spreads following the announcement of the rights issue and sales of retail and commercial banking operations. By analysing Northern Rock, Hamalainen et al (2010b) conclude that SND spreads were considerably slower in indicating concerns with Northern Rock. In this study there is no significant evidence that sub-debt spreads take a long time to highlight specific concerns with RBS.

However, it is difficult to extract clear bank-specific signals from the general bond market trend for rising subordinated debt spreads. Spreads of subordinated debt with similar levels of maturity issued by Barclays, HSBC, Lloyds and Standard Chartered display similar waves. Hence finding comparable SND instruments for risk signalling purposes is difficult, even though the subordinated debt market in the UK has become considerably larger and more liquid in the past decade. Therefore,

proponents of sub-debt market discipline propose to standardise the subordinated debt structure, for instance through mandatory sub-debt policies.

In the recent global banking crisis, RBS was neither the first nor the only victim. In September 2007 the Tripartite Authorities announced provision of Lender of Last Resort emergency funding facilities to Northern Rock, and the UK government guaranteed all existing retail savings and certain existing wholesale liabilities. Although the House of Commons Treasury Committee (2009b) views the reasons for Northern Rock's crisis as lying in the tightening of wholesale funding markets; while the Northern Rock business model was highly dependent on wholesale funding, it also points out that "*The Financial Services Authority systematically failed in its regulatory duty to ensure that Northern Rock would not pose a systemic risk*" (House of Commons Treasury Committee, 2009b). Hamalainen et al (2010b) suggest that the regulatory authorities could concentrate on equity market signals to enhance their monitoring of bank risk.

The biggest difference between RBS and Northern Rock is that RBS had a leverage business model. Before October 2008, when RBS announced a £20bn capital raising programme which was underwritten by HM Treasury, equity market indicators could prompt the regulatory authorities concerned with RBS. However, with 84% state-owned shares, RBS's equity indicators are difficult to use to illustrate potential problems. Therefore, the regulatory authorities should look for other market indicators which are able to reveal leverage risks. Sub-debt spreads are relatively straightforward indicators that had alerted the supervisory authorities to undertake further investigation into RBS. Furthermore, the regulatory authorities should consider mandatory subordinated debt programmes, to standardise subordinated debt structure and obtain timely, effective and bank-specific information.

5.6 Conclusion

This study builds upon previous studies in using subordinated debt for indirect market discipline for the UK banks. Market data has been widely used in off-site monitoring models assigned by regulators; for example, in studies on how the US market data affects the CAMEL ratings, and how market data also has been used for the purposes of anticipating downgrades of regulators' ratings. Moreover, previous studies pointed out that subordinated debt's disciplinary role only works well for well-capitalized financial organizations.

A sample of five of the biggest banks in the UK was used in the analysis, along with the disciplinary actions taken by FSA on these five banks between the years 2002 and 2010. In the first part of the analysis, extensive bivariate analysis confirms the existence of timely information in sub-debt spreads which affects the FSA's regulatory actions. In addition, the structure and quality of loans are under the scrutiny of policy makers and bank regulators.

The second part of the analysis tests whether subordinated debt market information provides additional information for models. We find signs that subordinated debt spreads act as a replacement of the risky bad-debt ratio, but we cannot find strong evidence that sub-debt spreads have significant correlation coefficients with the regulatory actions taken by the FSA. In other words, evidence cannot be found that besides accounting data, the FSA have used subordinated debt market data as an instrument of indirect market discipline wisely and appropriately.

An event study was also conducted for the Royal Bank of Scotland Group (RBS), one of the largest multinational banking groups, announced as having to be bailed out by the UK government on 13 October 2008. Four market indicators (equity prices,

equity trading volumes, abnormal returns and sub-debt spreads) were analysed. The results support the argument that market indicators anticipated the problems of RBS, but also support the argument of existing market discipline literature that it is difficult to extract clear risk signals from sub-debt spreads (Hancock and Kwast, 2001), because sub-debt spreads trend to reflect systematic risk, and equity indicators reveal bank-specific risks.

Therefore, this chapter provides evidence to support the proposal of mandatory subordinated debt programmes, in order to provide market participants, including government regulatory authorities, with regular subordinated debt information, for then subordinated debt could be used as an efficient instrument of indirect market discipline in the UK.

Chapter 6 Conclusion

6.1 Main Findings of the Research

This thesis has examined the efficacy of subordinated debt as an instrument of market discipline, both direct and indirect, in the UK banking industry. The UK case represents a fine opportunity to study whether market discipline can be effectively channelled into banks via subordinated debt. The active involvement of British banks in subordinated debt issuance and transactions has created a data-rich environment in which it is possible to explore the nexus of relationships between market discipline and the subordinated debt market. Such research is potentially especially fruitful given that most UK debt securities are publicly placed, and hence the scope for and depth of the working of market discipline via subordinated debt could be considerable in the UK banking industry. This contrasts with the situation for privately issued debt in other countries, such as Japan, where research productivity is limited to some extent by data availability. Furthermore, a series of recent bank failures and responses to them by UK supervisory authorities provides a useful setting for an empirical examination. Study of these events can reveal the flaws in UK financial regulation and highlight the usefulness of the sub-debt market as a mechanism for generating indirect market discipline.

Using the UK data, the research empirically investigates how and to what extent bank sub-debt plays a role in providing market discipline whereby the private sector is deployed to monitor and influence bank risk taking, and complements official supervision and regulation of UK banks. The investigation centres on three

fundamental questions at the core of the subordinated debt literature: 1) Do sub-debt price movements have a signalling effect that can indicate the risk-taking level of issuing banks accurately and in a timely manner? 2) Is the price signal recognized by banks, and does it influence their behaviour; that is, do disciplinary forces generated from the sub-debt market constrain issuing banks' risk-taking incentives and performance? 3) To what extent does the regulatory authority in the UK react to the sub-debt price signal, or how useful is sub-debt as a tool contributing to regulatory action and efficacy?

The examination of whether there exists a signalling effect of sub-debt price movements focuses on whether yield spreads of sub-debt issued by UK banks are sensitive to bank risks during the sample period 1997 to 2009. The results show that traditional ratings such as those provided by Moody's and S&P have significant and negative impacts on spreads, and investors have exercised rational discrimination between different risk profiles of UK banks. However, accounting measures show an absence of the explanatory power of spreads. Likewise, market conditions have little influence on the sub-debt market in the UK, except those related to European markets. It can then be concluded that yield spreads of sub-debt contain timely and accurate information on issuing banks' risk taking, and this underpins the proposals that advocate forcing large financial institutions to issue subordinated debt to the public on a regular basis.

It is essential for the working of the proposed sub-debt scheme that the issuing banks are receptive to sub-debt market indicators and adjust their risk-taking

behaviour accordingly. Using panel data from 1997 to 2009 to examine to what extent British banks respond to sub-debt signals such as amount of debt and interest payable, we find that, with a time lag of one year, the amount of sub-debt can impose strong discipline on banks' capital adequacy, suggesting that amount of sub-debt issued is a conditioning factor on banks' capital adequacy and management quality. However, the strength of discipline provided by sub-debt's interest is not as great.

Both debt amount and debt interest have the power to explain changes in the quality of loans and securities investments. For bank liquidity, the level of interest compels strong market discipline on all proxies of bank liquidity, while amount of sub-debt issued appears to impose discipline on the liquidity ratio only. This multitude of evidence confirms the influence of sub-debt as a means of market discipline. With some time hysteresis, signals emanating from the sub-debt market are shown to be able to induce interactions of market discipline with banks' fundamentals, including bank managers' risk-taking decisions on management, liquidity and solvency. But when it comes to large British banks, evidence shows that the disciplinary strength provided by sub-debt has been dented. In addition, comparing the two sample periods, the pre-crisis sample shows stronger market discipline strength than that in the post-crisis period.

The influencing effect of the sub-debt market is also reflected in sub-debt's impact on banks' default risk and financial distress. Using forward-looking market-based risk measures to supplement analysis of traditional financial statements, we find that issuing sub-debt requires banks to disclose more accounting information

to market participants, especially in the case of banks with high charter value and low capitalization. In addition, empirical evidence shows that in the wake of the recent financial crisis, the market-based distress indicator (distance to default) carries more information about the banks to regulators, particularly about the banks that have issued sub-debts.

The fundamental rationale for regulators' resorting to the sub-debt market is that the market discipline it generates may improve and complement government bank regulation. To examine this particular influence, or the indirect market discipline, the five biggest UK banks are selected for a case study. While in the UK banking industry there is supportive evidence for the direct disciplining effect generated by the sub-debt market, no significant evidence can be found that the UK financial regulator has adopted sub-debt market signals as a risk proxy in on- and off-site bank monitoring. The FSA is shown to have little enthusiasm for subjecting itself to indirect market discipline, reflecting its distrust of the usefulness of the market in providing disciplining effects. In an additional event study of the Royal Bank of Scotland, which during 2008 and 2009 received a series of bailouts from the government (i.e. taxpayers), we analyse and compare indicators based on the share market and the sub-debt market, respectively. The outcome suggests that indicators from both markets had anticipated the problems of RBS, but sub-debt indicators tend to reflect systematic rather than firm-specific risks.

6.2 Implications for Reform of Bank Regulation

The notion of using sub-debt as a means of market discipline stems from the recognition that it can produce desirable disciplining effects that can complement government regulation over banks. This thesis confirms the existence in the UK banking industry of the signalling, monitoring and enforcing effects of such market discipline. These effects can be very useful to investors and bank managers in helping them balance risk control and investment efficiency. But more important is their potential input in the reform of bank regulation, by advancing a paradigm change that may usher in a fundamental role for market discipline in government supervision and regulation of banks.

The research exposes flaws and weaknesses in the current regulatory framework. For example, the findings raise a logical doubt on rating agencies' estimations of creditworthiness. Rating agencies have been too generous in giving out top ratings to please the issuers of securities. Because of this malpractice, market participants are misguided with backward-looking and anamorphic information. Furthermore, many economists and policy makers have pointed out that the materialization of the financial crisis in 2007 is to an important extent related to the inadequacy of the Basel II Capital Accord (Moosa, 2010). Empirical results in this thesis have also shown that under the present regulatory framework, liquidity and leverage have been ignored, which also contributes to the controversial issue of micro-prudential regulatory reform.

The default response of the regulators has been to add new regulations to the old.

But at best this serves only to patch up the troubled regulatory system, and in reality the approach often creates more problems than it solves. In time, viable alternatives must be found, and enlisting market discipline is a prominent option for consideration. In this regard, as shown in this research, the subordinated debt market can be a valuable instrument.

The sub-debt market can provide solid information infrastructure for effective bank supervision and regulation via the market indicators it produces. With the rapid development of the banking industry in terms of operational complexity, product diversity and asset size, relying solely on conventional accounting information to discipline banks has become increasingly problematic. This situation requires that investors and bank supervisors focus more closely on information dispersing from market indicators. At this juncture, the emergence of the sub-debt market provides an apt mechanism for generating information that can usefully assist government regulation. To improve bank regulation, sub-debt information such as sub-debt spreads and distance to default has many advantages over the accounting data traditionally used by the regulatory authority for overseeing banks. For example, sub-debt market information is forward-looking, while accounting data are of a retrospective nature. In addition, sub-debt information is available with high frequency and in a very timely manner.

The sub-debt market can be a cost effective complement to official regulation. In response to the challenges posed by the growing complexity of banking, and by the motivation of bank managers and shareholders to take excessive risks in order to

maximize their own benefits (Ahmed, 2009), the regulatory authority tends to pin hopes of regulatory improvement on more extensive information disclosure. However, this is time-consuming, and it is increasingly expensive to force banks to disclose information. In addition to the fact that the sub-debt market can generate forward-looking and high frequency information, we have shown that compulsory issuance of sub-debt can make banks become more transparent regarding their risk profiles. This, in turn, can help the conduct of bank regulation at low cost.

The complementarity of the sub-debt market to government regulation for market discipline is also reflected in the ability of the sub-debt market to force banks to behave in a manner desired by the regulator. As shown in this thesis, discipline from the sub-debt market has the power to constrain bank managers' risk-taking incentives. The study has also found that sub-debt signals can act as predictive indicators of banks' default probability, another property that the regulators can make use of to improve their regulatory action.

These properties of the sub-debt market render it an apposite mechanism that can generate direct and indirect market discipline. Such disciplining effects are shown to be capable of directing banks to behave in a way desired by the regulatory authority. As such, sub-debt constitutes a viable complement to government regulation of banks. The evidence documented in this research therefore argues a case for a paradigm change in bank regulation. In reforming bank supervision and regulation, rather than relentlessly adding new regulations to the old, more attention should be given to allowing a more prominent role for the sub-debt market in the regulatory framework.

6.3 Limitations and Areas for Further Research

The market discipline effects on subordinated debt issued by the UK banks are examined in this thesis through both direct and indirect approaches. The UK subordinated debt market has been very active, and it is in particular attractive for studying the desirability and feasibility of subordinated debt as an instrument of market discipline. However, issuing subordinated debt is not mandatory for UK banks, even thought Basel II had made such recommendation. Moreover, subordinated debt is in the light of its expensive issuing costs merely optional when gaining capital for large banks. Therefore, data availability is not as sufficient as other risky investment such as shares; hence it is one limitation in my research.

The efficiency of subordinated debt as an instrument of market discipline is empirically examined in chapter 2, with a unique dataset that includes yield spreads, ratings, accounting measures of bank risk and market conditions indexes. For the accounting measures of bank risks, not all the firms in our selected sample report continuous financial data across the sample period. The potential reasons are that several financial institutions fail to keep operating through the sample period due to business suspending, bankruptcy or other unknown circumstances. Furthermore, we adopt both banks and financial institutions in our observation, which do not follow the same accounting code. Take the loan loss reserve for example: it is optional to include this element in the annual report disclosure of financial institutions. Therefore, observations of the ratio of loan loss reserve of total loan are significantly less than other variables (401 out of 631).

In order to examine the direct disciplinary strength provided by SND yield spreads at the launch of issuance we adopt fixed-rate debt in the primary market. Therefore, there are openings for further research in the direct market discipline provided by floating-rate SND or in the secondary market. Also, the efficiency of changes in yield spreads of floating rate as market signals of direct discipline remains uncovered.

The reaction of financial institutions to the disciplinary effects provided by subordinated debt is examined in Chapter 3. The investigations are not only conducted into the proxies of market discipline and bank efficiency, but also into changes in these proxies, to provide a unique angle on to what extent the issuing banks would respond to the signals of subordinated debt. However, the optimal quantity structure and pricing of SND to maximize issuers' management and profit remains uncovered. Moreover, whether other risky investments, such as uninsured deposits, certificates of deposit and common equity provide market discipline remains unclear. Equally diffuse is the question to what extent in which approach, and comparisons of disciplinary effects from subordinated debt and other investments popularly adopted by market participants.

Subordinated debt's impact on banks' default risk and financial distress indicator (distance-to-default) is examined in Chapter 4. It is an increasing trend that central banks and multilateral financial institutions use forward-looking market-based risk measures to supplement traditional financial statements analysis. Although subordinated debt is actively issued in the UK market, as acknowledged before,

because of its high cost and non-mandatory nature, our data pool on subordinated debt is not as sufficient as on other market-based risk portfolios (such as stock). The relationships between bank fundamentals and default risk indicators in the context of other markets have not yet been discussed, and this uncovered area proposes a direction for further research.

The effectiveness of subordinated debt in eliminating regulatory forbearance by proving indirect market discipline is investigated in Chapter 5. The potential usefulness in incorporating market information into the bank supervisory process has been discussed. However, it is difficult to measure the bank supervisor regulatory forbearance in the UK. Previous research focuses predominantly on US cases, and it is critical to apply the US model to the UK banking regulation, since the supervision framework and outcomes are not the same. Furthermore, ratings that the FSA assigned to individual banks are confidential. Hence these two considerable obstacles make it difficult for this research to be as comprehensive as previous studies.

With free access to regulatory data, future studies can focus on grading the FSA assigned to individually observed financial institutions which issued SND, and changes in grading with changes in SND's market signals. Also, the optimal portfolio and pricing of SND to eliminate FSA's regulatory forbearance, and indirect market discipline combined with other market information remain open questions.

Appendix 1. A Comparison of the Reform Proposals

	Current System[a]	FSA	Treasury	Bank of England
Regulatory achitecture				
1. Micro-prudent regulation	FSA	DSA	FSA	FSA
2. Macro-prudent regulation	----	FSA/ Bank of England re-constitution of the Financial Stability Committee as a joint FSA/Bank of England Committee	?[b]	Bank of England
3. Trigger of SRR	FSA	FSA	FSA	Bank of England
4. Operational control of SRR	Bank of England	?	Bank of England	Bank of England
5. Tripartite system	Standing Committee	?	New 'Council for Financial Stability' (comprising existing Standing Committee membership)	?
6. Consumer protection	FSA	FSA	FSA	FSA
7. Consumer credit regulation	OFT	OFT	OFT	OFT?
8. Deposit protection	FSA (runs the FSCS)	FSA	FSA	FSA?
9. Statutory responsibility for financial stability	Bank of England	?	Bank of England and FSA	Bank of England

[a] Under the Financial System and Markets Act 2000 and the Banking Act 2009

[b] A '?' denotes the absence of a clear statement on the policy/principle concerned.

Sources; Hall, M(2009)

Appendix 2: RBS –Pre-crisis and Post Crisis Timeline

18 April 2007	RBS-led consortium banks (including RBS, Fortis, Banco Santander) jointly bid for ABN AMRO. RBS proposed to take over ABN's Chicago operations, LaSalle and ABN's wholesale operations.
23 April 2007	ABN AMRO and Barclays announced the proposed acquisition of ABN AMRO by Barclays.
31 May 2007	Standard & Poor's rating services affirm that its 'AA-' long- and 'A-1+' short-term counterparty credit ratings on Royal Bank of Scotland Group Plc.
26 July 2007	The FTSE 100 drops 3.14% as concerns over the US sub-prime crisis intensify
30 July 2007	ABN AMRO withdrew its support for Barclays' offer which was lower than the offer from the RBS-led consortium.
3 August 2007	Fitch ratings affirm RBS's long-term issuer default rating of 'AA+' to reflect its consistently strong performance, powerful and diversified franchise and good asset quality.
9 August 2007	The European Central Bank, the US Federal Reserve and Bank of Japan pump unprecedented amounts of liquidity into the financial system to allay fears about a credit crunch. This represents the start of numerous actions by central banks into the money markets to shore up confidence in the financial system.
10 August 2007	The FTSE 100 suffers its worst one-day fall (3.7%) for more than four years.
14 August 2007	RBS announced that it bought a 3.25% stake in ABN AMRO Holding NV. The Dutch bank was attempting to buy for $96.5 billion in what would be the banking industry's largest takeover.
16 August 2007	The FEST 100 drops a further 4.1%.
14 September 2007	The Tripartite Authorities announce that the Bank of England is providing Lender of Last Resort emergence funding facilities to Northern Rock to allow it to continue operating. Under the open-ended facility, the bank is charged a penal rate and can use mortgages and mortgage-backed securities as collateral.
9 Oct 2007	RBS-led consortium announced the victory of bidding for control of ABN AMRO with €70bn offer.
11 December 2007	Moody's Investors Services affirmed the Aa1/P-1/B+ ratings of the RBS. The outlook on the Bank Financial Strength Ratings and long-term debt and deposit ratings remain negative.
22 April 2008	RBS announced the largest rights issue in British corporate history, which aimed to raise £12 bn in new capital to offset a writedown of £5.9 bn resulting from credit market positions and to shore up its reserves following the purchase of ABN AMRO.
22 April 2008	Fitch downgraded RBS to 'AA'.
20 June 2008	RBS announced that Greenock Funding No.1 Plc issued approximately £3.71 billion of asset-backed floating-rate notes, due October 2048.
27 June 2008	Moody's Investor Services cut RBS's senior debt rating to 'Aa2'. Moody's said the downgrade reflects the higher volatility the ratings agency expects to continue in RBS' earning from its investment banking activities and the greater risk of impairments in the UK, and both these developments align the

	bank's financial strength rating more closely with 'B' BFSR peers.
30 June 2008	Moody's downgraded senior debt rating of RBS to 'Aa2' from 'Aa1'.
12 September 2008	RBS sold $2 billion of six-year extendible medium-term floating-rate notes.
23 September 2008	RBS launched a range of new savings accounts, including Cash ISA with a top rate of 7.25%.
1 Oct 2008	The Bank of England began to extent £61.6bn in emergency funds to the banks at the height of the financial crisis in 2007, this movement is called "classic lender of last resort operation". The banks, RBS and HBOS, and the authorities decided to keep the Bank's operation secret, because disclosing details of the lending to the two banks "would seriously jeopardise the financial stability of the system as a whole". The Government provided a £20bn bail-out and a further injection of capital followed.
7 October 2008	Standard & Poor lowered RBS's long- and short-term counterparty credit ratings to A+/A-1 from AA-/A-1+.
13 October 2008	British Prime Minister Gordon Brown announced a UK government bailout of the financial system. The Treasury would infuse £37 billion ($64b, €47b) of new capital into RBS, Lloyds TSB and HBOS Plc, to avert financial sector collapse. This results in a total government ownership in RBS of 58%. At the same day, RBS announced a profit warning along with details of a £20bn capital raising and decision not to pay a dividend until it had repaid £5bn of preference shares being bought by the UK government.
27 October 2008	Fitch downgraded the long-term issuer default rating to AA- from AA with a stable outlook, senior unsecured rating to AA- from AA, subordinated debt rating and preferred stock rating to A+ from AA- and individual rating to B/C/ from A/B for RBS.
27 Nov 2008	RBS issued 5.0 million noncumulative sterling preferred shares series.
19 January 2009	RBS announced that had made a loss of £28bn of which £20bn was due to ABN AMRO. At the same time the government converted their preference shares to ordinary shares resulting in a 70% ownership of RBS.
21 January 2009	Fitch downgraded the individual ratings of the RBS to E from B/C.
27 February 2009	Significant decline in the common stock price of RBS, as investors reacted negatively to news that the UK government has forced RBS to forgo the right to claim tax benefits in exchange for its participant in the government insurance scheme.
May 2009	The FSA launched a supervisory investigation into the RBS, as one of the UK banks that required partial taxpayer bailout support. This work considered if regulatory rules had been broken and what, if any, action was appropriate. The review was necessarily extensive and looked specifically at the conduct of senior individuals at the bank, the acquisition of ABN AMRO in 2007 and the 2008 capital raisings.
4 Aug 2009	RBS announced that it has signed an agreement to sell part of its Retail& Commercial Banking operating in Asia for total consideration of $418million.

3 Nov 2009	HM Treasury announced the implementation of financial stability measures for Lloyds Banking Group and Royal Bank of Scotland. RBS is allowed to participate in the Government's Asset Protection Scheme (APS) under revised terms that improve incentives and deliver better risk-sharing with the private sector.
24 Nov 2009	The Bank of England has revealed for the first time that it lent RBS and HBOS £61.6bn in emergency funding last October and November.
15 June 2010	S&P corrected rating on floating rate note issued by RBS to 'A'.
18 June 2010	The Committee of European Banking Supervisors published its statement to conduct stress testing exercises in the context of supervisory authorities and central banks' risk assessment of the banking sector and as a way to assess the risks facing individual institutions.
3 Aug 2010	The FSA fined members of RBS £5.6 m for failing to have adequacy system and controls in place to prevent breaches of UK financial sanctions.
2 Dec 2010	The FSA closed supervisory investigation of RBS. The review confirmed that RBS made a series of bad decisions in the years immediately before the financial crisis, most significantly the acquisition of ABN AMRO and the decision to aggressively expand its investment banking business. However, the review concluded that these bad decisions were not the results of a lack of integrity by any individual and the FSA did not identify any instances of fraud or dishonest activity by RBS senior individuals or a failure of governance on the part of the Board.
20 Dec 2010	RBS closed at 3.9% below VWP but at 35.9% to 52-week low
11 January 2011	The Financial Services Authority (FSA) has fine the RBS and National Westminster Bank £2.8m for multiple failings in the way they handled customers' complaints, responding inadequately to more than half the complaints reviewed by the FSA.
18 January 2011	The RBS announced that it has reached agreement for the sale of the Priory Group to Advent International for an enterprise value of up to GBP 925 million.
19 January 2011	The RBS dropped 1.3% on high volatility
23 March 2011	The RBS announced that it has sold a portfolio of its commercial real estate loans and assets in Spain to several wholly owned.
15 July 2011	Results for European Banking Industry stress test released. RBS passed. In the statement on stress test results, EBA addressed that "RBS remains well capitalised with a Core Tier 1 capital (CT1) ratio passing both the baseline and adverse scenarios".
27 July 2011	The RBS agreed to issuance of a Consent Order by US bank regulators relating the deficiencies identified last year in certain of its governance, risk management and compliance systems and controls in the United States.
15 August 2011	RBS still 84% owned by the UK government

Sources: Nexis UK, London Stock Exchange regulatory news services, financial times and other accessible media resources.

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