

Investment Management Association



The Impact of the Credit Crunch on the Sterling Corporate Bond Market

May 2009

John Board, Charles Sutcliffe
and Stephen Wells



**John Board, Charles Sutcliffe
and Stephen Wells**

ICMA Centre, Henley Business School,
University of Reading,
PO Box 242, Reading RG6 6BA

We would like to thank Jane Lowe, Jonathan Lipkin and Guy Sears of the Investment Management Association for their comments and assistance during the preparation of this report.

Contents

Executive Summary	3
1 Introduction	6
2 Background to the Study	7
3 Project Design	9
3.1 Interview Programme	9
3.2 Desk Research	10
3.3 Empirical Analysis	10
3.3.1 Bid-ask Spreads	10
3.3.2 Trading Prices	11
4 Bond Market Trading and Structure	12
4.1 Bond Market Trading	12
4.2 Sterling Corporate Bond Market Structure	14
4.3 The Credit Crunch - A Short History	15
5 Quality of Corporate Bond Markets – Literature Review	19
5.1 Market Quality	19
5.1.1 Liquidity	19
5.1.2 Volatility	23
5.1.3 Efficiency	24
5.2 UK Studies	24
6 Interview Results	26
6.1 Trading Difficulties	26
6.1.1 Wider than Previous Crises	26
6.1.2 Mainly Second-order Impact	26
6.1.3 Dealers Withdrew Capital	26
6.1.4 Decline in Transparency	27
6.1.5 Risk Measurements have Failed	27
6.1.6 Low Volumes	27
6.1.7 Absence of Reference Prices for Portfolio Valuation	27
6.1.8 Gilts Generally Unaffected	28
6.1.9 Situation not Improving	28
6.2 Broad Structural Issues	28
6.2.1 Small Size of the Sterling Market in Relation to Global Markets	28
6.2.2 MiFID is not yet fully Incorporated	29

6.2.3	Lack of Sophistication	29
6.2.4	Little Awareness of Trading Technology Developments	29
7	Market Spreads	30
7.1	Analysis by Term	34
7.2	Analysis by Rating	35
7.3	Analysis by Seniority	36
7.4	Key Conclusions from Quote Analysis	36
8	Trading Case Studies	38
8.1	Trading Volumes	39
8.2	Price Improvement – Public Quotes	43
8.3	Price Improvement – Private Quotes	46
8.4	Traded Credit Spread	48
8.5	Order Duration and Trade Splitting	49
8.6	Trade Splitting	51
8.7	Trade Balance	52
8.8	Key Conclusions from the Trading Analysis	53
9	Operational Implications	54
9.1	Market Structure	54
9.2	Market Participation	54
9.3	Transparency	55
9.4	Best Execution	55
10	Conclusions and Market Implications	58
10.1	Market Disruption is Real and Damaging the Buy-side	58
10.2	The Dealer Market has Failed and may not Recover	59
10.3	The Risk of Becoming a Backwater is Increasing	61
10.4	The Absence of Data Restricts Evidence-based Policy	62
	APPENDIX A – Interview Questions	63
	APPENDIX B – References	64

Executive Summary

The Study

The credit crisis has created major difficulties for those transacting business in many financial markets including the Sterling corporate bond market. UK fund managers, for whom Sterling corporate bonds are a major asset class, have complained of experiencing serious difficulties in trading. This research was commissioned to study the impact of the credit crisis on the Sterling corporate bond market. The scope of the brief was to examine the trading difficulties experienced by fund managers and to discuss whether the market structure used in the trading of corporate bonds had been a contributory factor in those difficulties.

Results of Research

Interviews

A series of semi-structured interviews were conducted with a range of buy-side institutions. The results of the interviews describe the institutions' perceptions of the impact of the crisis:

- The crisis was much wider than previous crises hitting almost all sections of the Sterling corporate bond market.
- UK funds are not large investors in structured products, so the impact on them was mainly from a drying up of the trading market for straight bonds.
- The dealers, who are the main liquidity providers, had largely withdrawn their capital commitment from the market, leading to a general collapse of market quality.
- The level of transparency, already low, had declined further.
- The situation shows no signs of improving.
- Participants were investigating alternative trading possibilities such as the greater use of brokers, but they were starting from a low base.
- Best execution obligations were a new addition to the market and were as yet poorly understood, with implementation being basic and patchy.

Analysis of Quote Spreads

A time series analysis of quote spreads revealed that:

- All bonds, even gilts, experienced substantial and sustained rises in quoted spreads after July 2007. Post crisis spreads were at least double, and in many cases treble, their pre-crisis levels
- Higher risk bonds (i.e. longer maturity bonds, bonds with lower rating and bonds with subordinate status) uniformly saw significantly larger increases in their quoted spreads than did less risky bonds.

Trade Analysis

The trade analysis was carried out on limited datasets supplied by three fund managers. The nature of the data meant that most of the analyses could only be conducted for a single fund manager. The key results of the analysis are:

- Despite the clear difficulties, trading levels have been maintained, largely through fund managers adapting their trading strategies to the new situation.
- Quote quality has deteriorated, both in terms of wider spreads and quotes being a poorer guide to eventual trade prices.
- Order execution times have increased as the crisis has continued. The time taken to complete difficult orders has risen very substantially, and the proportion of such difficult orders has also increased.
- Fund managers have not generally resorted to splitting orders to achieve executions. Where they have used different techniques, this has mainly involved using brokers to seek out execution opportunities and then transacting the whole order in a single trade.

Conclusions and Implications

Market Disruption is Real and Damaging the Buy-side

The market for Sterling corporate bonds has suffered severe disruption since the start of the credit crisis in July 2007. Symptoms of this have been:

- Much wider spreads for all types of Sterling corporate bonds, particularly those seen as more risky.
- An absence of markets, or one-way markets.
- Greater price uncertainty.

All the indications are that 18 months into the credit crisis the situation for institutions operating in the Sterling corporate bond market is not improving. Indeed, the suggestion is that it is getting worse.

The Dealer Market has Failed and may not Recover

The message from the interviews and the empirical evidence is that the dealer market, on which the Sterling corporate bond market relies, has pretty much disintegrated since July 2007. Many buy-side traders are responding by examining alternatives, and there is a growing willingness to, for example, pay commission to brokers for execution. Similarly there is an awareness that the traditional block-trading practice may have to give way to more patient trading styles when the order does not justify the cost of immediacy. The requirements of MiFID for best execution are reinforcing this trend, though understanding of best execution seems to be low in bond funds.

The Risk of becoming a Backwater is Increasing

A continued decline in the importance of the Sterling corporate bond market would be damaging for UK fund managers. While gilt issuance is set to increase, the prospects for corporate debt are less clear, with some reports suggesting a tendency for direct lending from institutions, and others suggesting a move away from bank debt towards more bond issuance. In the medium term the Sterling corporate bond market is, and will remain, small relative to other currency debt markets, and the risk is that the market will become something of a backwater as global players become increasingly reluctant to make a major commitment.

The Absence of Data Restricts Evidence-based Policy

This empirical research has been limited by the absence of market data relating to trading on the Sterling corporate bond markets. Reflecting this lack of data, the literature survey was only able to find four empirical studies relating to the Sterling corporate bond market. In contrast, the US market can show a large number of studies relating to many aspects of trading and pricing. The thrust of regulation and development strategies in recent years has been towards evidence-based, rather than anecdote-based policy. The absence of data relating to the Sterling corporate bond market means that regulatory and other development initiatives cannot be based on empirical evidence since there is so little data.

1. Introduction

The credit crisis, which began in mid 2007, has created major difficulties in financial markets. The decline in asset values has been well documented but there have also been other adverse effects on fund managers, for whom Sterling corporate bonds are a major investment class, who have experienced serious difficulties in trading, both in terms of the ability to get orders executed and in the costs of transacting business.

The Investment Management Association (IMA), which represents UK fund managers, commissioned this study to examine and, where possible, analyse the impact of the credit crisis on the Sterling corporate bond market. The scope of the brief was to examine the difficulties experienced by fund managers and to discuss whether the market structure used in the trading of corporate bonds had been a contributory factor in those difficulties.

This report describes the study and its implications. Section 2 describes the background to the study and, in particular, the effects of the credit crisis on the Sterling corporate bond market. The next section describes how the research was constructed and sets out the key activities and difficulties faced. Section 4 outlines the trading and market structure for the corporate debt market and a brief history of the credit crisis to date and section 5 describes the extensive US literature on bond markets and the much more limited UK-based evidence. The research consisted of two main elements: an interview program, the results of which are presented in section 6, and an empirical study of quotes and trading presented in sections 7 and 8. Finally, sections 9 and 10 discuss the operational and policy implications of the research, together with a summary of the principal conclusions.

2. Background to the Study

The investigation relates to the impact of the credit crisis and related difficulties in credit markets on the cash fixed income market as used by IMA members – UK institutional investors. The difficulties in the credit market manifested themselves in an unwillingness of banks to lend to other banks, partly because they lacked confidence in the soundness of other banks, and partly because they were unsure of their own exposures and consequent cash needs. The uncertainty as to their own cash needs arose from a loss of confidence in the valuations of some of the complex credit products they held (caused in part by a decline in confidence in the perceived validity of credit ratings). This uncertainty in other markets led to a drying up of wholesale short-term credit and a significant widening of the inter-bank lending spread. In London the most visible manifestation was the widening of the LIBOR spread.

UK institutions, like long-term institutions in other developed markets, are major holders of fixed income securities – both government and corporate. The IMA's own research suggests some 60% of UK gilts are owned by insurance companies and pension funds. Fixed income products allow institutions to optimise their asset-liability match and many UK institutions have increased their investment in fixed income securities and reduced their traditionally very high exposure to UK equities. The IMA (2007) reports that pension funds have 35% of their assets in bonds and insurance companies have 47%. The shortage of gilt-edged stock during the period of fiscal surplus, combined with competitive pressures to improve returns on bond investment, encouraged these institutions to explore a wider range of credit products. However, their main focus remains relatively straight-forward government and corporate bonds. Institutions will use derivatives as a supplement to their trading/investment tactics, but derivatives do not meet the extended time horizons of

institutional investors. Similarly complex structured products do not generally offer the required investment characteristics, and so, while they may be held, they are seldom a significant part of portfolios.

The markets for bonds are known to be different to other parts of the capital market – for example, the FSA identified three key characteristics affecting bond trading (FSA 2005):

- the very large population of less liquid or illiquid bonds;
- the relatively large average trade sizes and low trading frequency;
- the short lived liquidity of many bonds (with relatively active turnover in the first few days or weeks following a new issue, but a rapid decline in trading activity thereafter).

The market usage of institutional investors is predominantly driven by cash flow (e.g. the need to invest proceeds, replace redeemed bonds, and pay out cash to the fund's investors). While there is an element of speculative trading by these institutional investors, this does not represent their major investment objective.

Generally bond markets remain as intermediated markets in contrast to equities which have moved to electronic, order-driven structures (but retaining, in most markets, significant dealer intermediation for larger transactions). Electronic systems have become important in many bond markets, although in contrast to equity markets, they are often proprietary rather than exchange-based and are used to disseminate quote indications rather than for trading. London has also seen growing use of electronic systems in bond trading to distribute quotes and route orders, but the backbone

of the institutional market remains telephone-based intermediation. Transparency in bond markets is generally lower than in equity markets, arguably reflecting different asset features and market structures, both pre and post trade. While non-transparent markets are easy to criticise, it should be noted that the current, largely telephone-based, dealer market structure has supported the needs of UK institutional investors since the 1980s.

However, economic pressures naturally require bond dealers to minimise their use of capital and to manage their risk exposures. Minimising their use of capital requires them to borrow extensively, using their bond positions as collateral. Bond dealers were either unable to obtain credit or unable to obtain credit at economic rates (given the fine trading margins common in bond markets, especially the government bond market). This restriction of credit would:

- Restrict the ability of dealers to take positions and so offer liquidity in size.
- Cause dealers to widen their spreads to compensate for the higher credit costs.

The consequence of this would be a decline in market quality, with higher costs of trading and a reduced ability to trade in size. Market users have reported precisely these effects, and this naturally leads to a discussion about the current market structure and, in particular, the sustainability of the current structural model.

Before drawing policy conclusions it is important to distinguish between declines in market quality that result from market events (e.g. an increased uncertainty and increased volatility), and those that are caused by weaknesses in the microstructure of the market. We noted above that reduced access to credit would restrict the ability of dealers to take large positions and increase their costs, leading to wider spreads. Thus, both have similar effects on market quality, but only the latter may lead to policy mandated reform.

3. Project Design

This project incorporated three activities:

1. Interview Programme
2. Desk Research
3. Empirical Analysis

3.1 Interview Programme

A short interview programme was conducted with the aims of:

- Ascertaining the impact of the credit crisis on fund managers active in the Sterling corporate bond market.
- Discovering relevant and feasible lines of analysis for the empirical study.

A short series of semi-structured interviews were conducted with buy-side fund managers. The interviews were arranged by the IMA and the interviewees were drawn from their membership and were chosen to be representative of the Sterling corporate bond market across the dimensions of size of fund, range of clients and type of business. The aim was to conduct a small number of interviews covering a cross-section of insurance companies, pension managers and mutual fund managers. The interviews were carried out in May and June 2008. As we note later there was a remarkable degree of unanimity among the buy-side practitioners. The interviews lasted up to 90 minutes, and were conducted at the interviewees' offices. As part of the work in developing case studies of trading (see below) some interviewees were re-visited during September 2008 which enabled the responses in the earlier interview to be updated where appropriate.

The scope of the interviews was wide-ranging and included:

- Trading conditions and difficulties;
- Market quality issues;
- Trading strategies adopted to minimise the impact of the crisis;
- Wider implications for market structure in the longer term;
- Feasible and relevant empirical research.

The interviews were semi-structured. Interviewees were supplied with a document describing the areas of interest (attached as Appendix A). However the interviews did not stick rigidly to the document so as to allow ideas to develop in a way that captured the interest and expertise of the individual interviewees.

Interviews were conducted confidentially to ensure that the views expressed were as open as possible. In keeping with this, we did not record the discussions and did not take a verbatim record, although handwritten notes were taken. Interviewees understood that their views would not be reported directly but would be used to inform the researchers' own arguments. To this end, we do not attribute views in the report, nor do we make use of direct quotes, which could lead to the identification of the interviewee concerned.

Where possible, we stayed away from matters peripheral to the specific project brief, and so we did not discuss the general background to the sub-prime crisis, or any regulatory failures implied by the crisis. While these are interesting topics, they lie outside the scope of the present project.

3.2 Desk Research

Desk research included two main elements:

- The evolution of the credit crisis as a backdrop to the analysis of the Sterling corporate bond market;
- A review of the literature on corporate bond trading, especially in times of market disruption.

3.3 Empirical Analysis

The interview program suggested two avenues of research:

- An analysis of bid-ask spreads in the Sterling corporate bond market, and their evolution over time;
- An analysis of the difficulties of trading, and strategies adopted to alleviate those difficulties.

3.3.1 Bid-ask Spreads

As discussed below, the absence of detailed information on both pre-trade quotes and post-trade transactions severely limits the ability to conduct the sort of detailed analysis that is common in other markets and which usually underlies policy recommendations for the structure of financial markets. The absence of pre-trade transparency mechanisms restricted our ability even to examine spreads in detail.

The best available source of data on spreads is that produced by iBoxx, a division of Mark, which produces a number of proprietary indices relating to bonds. These cover all European bonds and we were able to obtain a subset of the data covering Sterling corporate bonds for the period January 2006 to September 2008, which covered the period before the crisis, and during the crisis.

iBoxx produce their data using end of day quotes from a panel of market makers. The data is filtered to remove extreme observations and the remaining quotes are averaged to produce a bid price and an ask price for each bond. The data supplied covered a total of nearly 800 bonds representing a mix of:

- **Asset types.** Corporates for both financial and non-financial companies, asset-backed securities and gilts (the data also included sub-sovereign and similar bonds which were not used in the analysis);
- **Asset qualities.** The bonds represented four levels of quality as measured by ratings – AAA, AA, A and BBB;
- **Asset maturities.** All terms from 1 year out to 30 years were covered.

Inevitably there will be reservations about data of this type:

- It is not really quote data since institutions supplying the data are not intending to trade on the prices and may, indeed, make different quotes when approached by potential counterparties.
- One of the features of the crisis period has been greater uncertainty of pricing and less transparency of prices, so any weaknesses in the data before the crisis are likely to be magnified after the crisis.
- The data are end of day and so the effects of any intra-day information cannot be analysed.

Similar data from the same source was used in the earlier CEPR study (Biais et al, 2006), and that study concluded that the data represented a reasonable approximation of the prices and spreads prevailing in the market. While true at the time of that study (2003-2005), it may not be true now in a different and more volatile market climate. However, this dataset remains the most comprehensive one available.

3.3.2 Trading Prices

For detailed analysis of the corporate bond market, it would be desirable to combine a large set of transaction data with the iBoxx prices to gain insights into the quality of prices and difficulty of execution before and after the crisis. Unfortunately no such dataset exists and so the analysis is based on transaction data supplied by a small number of fund managers.

The OTC nature of the market means that no exchange level dataset exists. Trade reporting, another source of transactions data is more fragmented since MiFID's introduction and so even the ICMA/Extractor source of data used in the CEPR study is no longer as representative as it was. Regulatory data resulting from the consolidation of trade reports is not available for research.

We were able to obtain trading data from three fund managers. Inevitably the format and content of the data differed between the three managers, but we were able to obtain sufficient data to allow the following analyses to be performed:

1. Price improvement relative to quote. Comparing the iBoxx quote data with the trade prices to investigate the quality of price information and the degree of uncertainty in pricing;
2. Balance between the corporate and gilt. To quantify the shift from trading in corporate bonds to trading gilts, where the market remained liquid;
3. Order execution duration. Analysing the time gap from order to initiation to get an indication of the greater difficulty in executing orders and whether orders are split to achieve execution;
4. Trade frequency and trading volumes.

4. Bond Market Trading and Structure

4.1 Bond Market Trading

Trading in bond markets is fundamentally different to trading in most other asset markets and very different to trading in liquid equity markets for the following reasons:

- The assets are fundamentally different. Bonds generally, and corporate bonds in particular, display less volatility than equities. Speculative profits are therefore relatively small (in percentage terms) meaning that profitable trading has to involve large size. For these reasons, while there is retail investment interest, trading in value terms is almost exclusively institutional/professional.
- The number of significant participants tends to be somewhat smaller and more professional. It is possible that in such markets informal information flows ensure that participants are fully aware of the current market situation. Also the more professional nature of the participants reduces investor protection concerns. Retail involvement, while it may represent a significant transaction volume, is small in value terms and tends to be buy and hold (unlike equity markets where much retail interest is speculative).
- Bond markets, especially those for corporate bonds, tend to be relatively illiquid. Bonds are traded actively for only a relatively short time after issue and then trading dies away as the buy-and-hold strategies of institutional investors become dominant in the market. Therefore the trading of seasoned bonds often requires significant intermediary involvement either to provide liquidity or to facilitate finding natural counterparties.
- Many of the institutional participants, particularly insurance companies, buy corporate bonds fully

intending to buy and hold. Their intention is to profit by making the right long-term investments rather than by trading.

- Unlike equities, corporate bonds are mainly traded off exchange (though they may be reported to an exchange).
- The primary market is relatively more important and represents a larger share of activity because bonds are redeemable and need to be reissued, and there is less secondary trading.
- Bonds are not fungible as are equities, and each additional bond issue is distinct from its predecessors.
- Bond markets are international and not tied to national exchanges. This makes them relatively mobile in a way that equity markets have generally not shown themselves to be.

This means that each security/issue is small, relative to the total market, giving the bond markets some of the characteristics of the markets for the equity of a smaller company.

In consequence bond markets tend to be relatively illiquid, except for a limited number of bonds – usually government benchmarks. Other issues typically show most liquidity following the initial issue as the stock moves around until it finds a home with an institutional investor, but liquidity is otherwise concentrated around credit events or around portfolio rebalancing strategies.

Indeed, many traders avoid trading underlying bonds because of: a) the illiquidity of the market, and b) the general scarcity of high quality bonds. Instead they will adjust their positions through the use of derivatives –

exchange traded where available (though the number of successful exchange-traded, bond contracts in global markets is small), or through OTC swaps and similar contracts. The growth of interest rate and credit default swap markets has, of course been a defining feature of the last decade which, up until recently at least, was increasingly used as an alternative to trading the underlying bonds.

In many ways, therefore, the market for most corporate bonds is similar to the market for illiquid equities. Nominally the illiquid equity market is often a dealer market with dealers offering continuous indicative quotes (or firm quotes in small size) and offering tradable quotes on enquiry. However the illiquidity of the market makes it difficult for dealers to perform their function of facilitating investor orders. This infrequency of trading means that the expected holding time is long, and so dealer spreads are wide. Illiquid equities are also subject to serious problems of asymmetric information, more so than liquid equities. While corporate bonds are less susceptible, they are not immune from better-informed traders. Indeed, the recent difficulties in the corporate bond market where the normal published data, such as ratings, is less reliable than previously, is typical of markets where extreme information asymmetries exist. Such markets show the following patterns:

- Dealer spreads will be extremely wide for less well-known investors. For regular customers spreads will be narrower, though still wide. The dealer trades will tend to show high levels of volatility, partly because of bid-ask bounce (with wide spreads), and partly because of the sensitivity of the market to any potential imbalance of stock.
- Where possible counter-orders will be found before an order is transacted as a cross either by the dealer himself or by an agency broker. The effect will be a time-clustering of business. This results from the cross itself and the tendency for other investors to execute pending orders when there is a moment of liquidity and a reliable price.
- Electronic trading systems involving order exposure have not gained much acceptance in bond markets as the act of exposing even a small order is likely to move the price significantly. This is also true of illiquid equities which tend to be traded in dealer markets but where, in practice, most significant trades are negotiated. Electronic negotiation systems have however been more successful and have made major inroads into some bond markets.

4.2 Sterling Corporate Bond Market Structure

Historically the Sterling corporate bond markets have relied almost exclusively on traditional bond-market trading structures. In the gilt market certain firms are designated as primary dealers and have an obligation to make firm two-way quotes on enquiry. In the corporate market certain banks operate as dealers and will make two-way quotes on enquiry, but have no obligation to do so. Dealers offer to take investors' transactions on to their own trading book and commit capital to supporting these positions. However liquidity in the dealer market is entirely at the discretion of dealers. Their dealing strategies will vary from firm to firm – some firms make a point of aggressive and active quoting while others tend to only enter the market when they have business to transact. A number of fund managers described the latter strategy as fair-weather market making (FWMM) and saw it as a negative practice. However there are differences of view on FWMM. In particular there is a view that aggressive, continuous quoting damages the ability of other players to get their business done. The different views and empirical evidence on this from the equity market are discussed in Board, Sutcliffe and Vila (2000).

The dealer's two-way price implies a spread between the bid and the offer price. Dealers' individual spreads are usually set by convention – a dealer uses his spread to position himself as a buyer or seller in the market. The various dealers will make their own prices and at any time this will give a best bid and a best offer price. The difference between the best bid and the best offer price represents the round-trip cost, and is conventionally used as a measure of liquidity. We shall use a proxy for this data to illustrate how the markets have been disrupted by the credit crunch. The measure is subject to problems which we have indicated above, but the results are informative.

In dealer markets – even those with firm published quotes – the normal tactic for institutional size trades is for the fund manager's internal dealing desk to contact a number of dealers to get quotes and execute the quote that is judged to offer best execution. Typically the dealers' private quotes will be better than any published quotes they make. This is always claimed to reflect long-standing relationships between dealers and clients whereby the clients build up reputations with dealers for only bringing good business and the dealers build up reputations with clients for improving on quotes and generally, over the longer term, giving the best prices. The interview discussions confirmed that this model was normal in the Sterling corporate bond markets. Fund managers generally approached only a limited subset of the dealers for quotes and tended to restrict their dealing to a subset even of that group.

Agency brokers have a limited role in the Sterling corporate bond markets. Generally the institutions prefer to build up their own relationships with dealers as these will be more valuable than any relationships the (usually smaller) agency brokers can build. Some institutions will use agency brokers to search out counterparties in an effort to reduce transaction costs, but this is not very common. In other less-liquid markets (for example small cap equities or bonds) a specialist broker may be used. Such specialist brokers will tend to know the location of holdings and of latent demand and so be able to find counterparties. Again this is not common in the Sterling corporate bond market. However the difficulties during the crisis (essentially the withdrawal of dealers), have encouraged some institutions to use agency brokers more than previously, and most interviewees said they would be more willing to pay commissions to brokers in the future.

Sterling corporate bond dealers make use of electronic systems, both proprietary and non-proprietary, to disseminate indicative quotes to potential clients.

However the UK market remains almost entirely OTC, and electronic trading systems have made relatively little impact (compared to equity and derivative markets). Elsewhere electronic trading has gained ground in government bond markets – the EuroMTS system captures a significant part of the European government bond market, and Asian markets often have important electronic trading systems (for example the Negotiated Dealing System in the Indian market).

The Sterling corporate bond market, however, remains largely OTC, though there are important developments in the US market which may be the harbingers of change. US institutional corporate bond trading was largely an OTC phone-based dealer market, with some electronic messaging systems providing indicative quotations. Retail-sized trades were mostly on exchanges (Bessembinder and Maxwell, 2008). Trading is rapidly moving to electronic platforms (spurred possibly by the increased transparency through the TRACE system). For some time, the NYSE has offered a system called “NYSE Bonds”, which is the largest centralized bond market of any US exchange or other self-regulatory organization. It offers investors a broad selection of bonds: corporate (including convertibles), agency and government bonds. The majority of NYSE bond volume is in corporate debt, with some 94% in straight, or non-convertible bonds, and 6% in convertible debt issues. As of 1 December 2008 all NYSE Alternext US (formerly American Stock Exchange) listed bonds transferred to an electronic trading platform based on NYSE Bonds called NYSE Alternext US Bonds.

4.3 The Credit Crunch - A Short History

The origins of the credit crisis lie in the global imbalances that built up in the years to 2006. Developing countries, and particularly China, Japan and the oil producers, controlled their exchange rates to stop them correcting their trade imbalances. For example in 2007 China had a trade surplus of US\$361bn, Japan had a surplus of US\$213bn, and Saudi Arabia had a surplus of US\$101bn, while the USA had a deficit of US\$739bn. As a result the surplus countries accumulated very large foreign exchange surpluses, which they invested in western assets, particularly US assets. The consequence was that western interest rates were kept low, with banks having large amounts of money to lend. This led to a large expansion of US subprime lending for house purchases. Rising US house prices encouraged consumers to buy houses with mortgages of 100% or more of the house's initial value. These subprime mortgages were securitised and, helped by generous credit ratings, sold on as mortgage backed securities (MBS). Table 1 shows the rapid growth in asset backed securities and MBS in the US up to 2006, and the sharp decline in issuance thereafter.

Table 1: The Issuance of ABS and Non-Agency MBS in the US (US\$bn)

Year	Asset Backed Securities	Non-Agency Mortgage Backed Securities	Total
1996	168.4	51.9	220.3
1997	223.1	69.4	292.5
1998	286.6	191.9	478.5
1999	287.1	140.5	427.6
2000	337.0	102.1	439.1
2001	383.3	216.5	599.8
2002	469.2	263.9	733.1
2003	600.2	345.3	945.5
2004	869.8	403.8	1,273.6
2005	1,172.1	645.7	1,817.8
2006	1,253.1	773.1	2,026.2
2007	901.7	668.6	1,570.3
2008 Q1-3	153.0	40.0	193.0

Source: Financial Times (Bloomberg) 15 November 2008

The US housing market boom peaked in about January 2006, and mortgage defaults started to rise. In December 2006 a US mortgage company went bust, followed by more such bankruptcies in the following year. By Easter 2007 the rise in mortgage defaults had come to the attention of national politicians in the US, and in July 2007 the three main credit rating agencies downgraded bonds backed by subprime mortgages. These downgrades effectively marked the start of the credit crisis.

In August 2007 the US subprime crisis was the topic of a presidential press conference, and the problem received widespread publicity. The increasingly rapid fall in US house prices was accompanied by the loss of

22,000 jobs in the US construction industry in August 2007, with 100,000 such jobs lost between September 2006 and August 2007. In the UK in September 2007 there was a run on Northern Rock, followed by its nationalisation on 22 February 2008. Table 2 summarizes the major US losses announced from September 2007 to July 2008, which were chiefly driven by subprime losses and write downs.

Table 2: US Losses Announced Due to the Sub Prime Lending Crisis (US\$bn)

	Bank	Loss
September 2007	Citigroup	6.0
October 2007	Merrill Lynch	8.0
November 2007	Citigroup	8.0
	HSBC	3.4
	Barclays	2.7
December 2007	UBS	10.0
	Washington Mutual	1.6
	Morgan Stanley	9.4
January 2008	Merrill Lynch	8.0
	Citigroup	18.0
	UBS	4.0
February 2008	Credit Suisse	1.0
April 2008	Merrill Lynch	2.0
	Citibank	5.1
	Bank of America	4.8
May 2008	UBS	19
	AIG	7.8
	MBIA	2.4
June 2008	FHA	4.6

Source: The Joint Economic Committee, Subprime Mortgage Crisis Time Line

In January 2008 Bank of America saved Countrywide Financial (the largest US mortgage lender) from bankruptcy by taking them over. Meanwhile S&P announced a cut in the ratings of US\$534bn in subprime mortgages.

MBS (and associated products) are traded in OTC markets, and so who holds which securities is opaque. This lack of transparency, coupled with the very large losses on subprime debt announced by some banks from the autumn of 2007 onwards, raised fears that some banks were sitting on very large undisclosed losses. Rough estimates of the total size of the subprime mortgage losses were available, and the acknowledged losses were considerably smaller than this amount. So which banks were holding these toxic assets was unknown. It was known that the assets had been distributed throughout the global financial system, though quite how widely distributed was, and remains, unknown. These fears were accentuated by the difficulty of valuing MBS in the face of a highly illiquid market and falling house prices. In consequence, banks were unwilling to lend to each other because of the potentially high counterparty risk. Losses on subprime mortgages, whether in the public domain or not, also reduced the capital of banks, reducing their capacity to make loans.

In March 2008 Bear Stearns was bought by JP Morgan due to losses on subprime loans, and by June 2008 1.1mn US homes were in foreclosure.

September 2008 was a momentous month with a number of US and UK financial companies collapsing under the weight of the subprime mortgage crisis and the ensuing credit crunch:

- On 7 September 2008 Fannie Mae and Freddie Mac (which securitized US mortgages) were taken into conservatorship by the Federal Housing Finance Agency because of the problems arising from the subprime crisis.
- On 14 September 2008 it was announced that, as a consequence of losses from the subprime lending crisis, Merrill Lynch was to be taken over by the Bank of America.
- Lehman Brothers had also sustained large losses from subprime mortgages, and on 15 September Lehman Brothers filed for bankruptcy protection (chapter 11) in the US and administration in the UK. This massive bankruptcy by a major investment bank had a very disruptive effect on financial markets.
- On 16 September American International Group (AIG), a large US insurance company whose finance division had been a large seller of Credit Default Swaps (CDS) on Collateralised Debt Obligations (CDOs) was bailed out by a loan from the Federal Reserve Bank. This was followed on the 9 October by a further loan of US\$37.8bn from the Fed, and on November 10 the US government announced the purchase of US\$40bn of shares in AIG.
- Following the failure of a large rights issue by HBOS and the collapse of its share price, on 18 September Lloyds TSB announced that agreement had been reached on a takeover of HBOS (setting aside UK competition rules).

- On 29 September, after the failure of its rights issue and the collapse of its share price, the UK government nationalized Bradford and Bingley, with its savings operations being sold to Abbey.

October 2008 was no less eventful:

- Early in the month the UK government announced a £37bn injection of capital into UK banks. HBOS, RBS and Lloyds took up the offer with the government becoming the dominant shareholder in HBOS.
- In mid October the US government, recognizing the failure of its earlier attempts to recapitalize the banking system by buying bad assets announced a US\$250bn injection of funds for US banks.
- The collapse of the Icelandic banking system.

The credit crunch losses by banks from January 2007 to November 2008 are summarised in Table 3.

Table 3: Total Write Downs and Credit Losses by Banks since January 2007 (US\$bn)

Institution	Losses
Wachovia	96.5
Citigroup	68.1
Merrill Lynch	55.9
Washington Mutual	45.6
UBS	44.2
HSBC	33.1
Bank of America	27.4
National City	26.2
JP Morgan Chase	20.5
Wells Fargo	17.7
Others	257.3
Total	692.5

Source: Financial Times 13 November 2008

In addition, AIG lost US\$60.9bn during the period, while other insurance companies lost US\$88.3bn. Taken together, banks and insurance companies worldwide are estimated to have lost US\$841.7bn in just under two years. In October 2008 the IMF estimated that worldwide total losses could rise to US\$1,400bn, i.e. about another US\$560bn of losses still to be reported.

All indications are that the credit crisis continues and that a full recovery is some way off. A key issue in the impact of the crisis has been the collapse of wholesale lending markets due to the unwillingness of banks to lend to other banks.

The spread between LIBOR and base rates has been used as an indicator of the difficulties in wholesale markets. As Figure 1 below illustrates, while the spread has narrowed in recent weeks as the Base Rate has been reduced, the spread still remains at historically high levels indicating that wholesale markets are still not functioning properly.

Figure 1: Three month Libor v. Bank of England Base Rate



Source: BBA, Bank of England

5. Quality of Corporate Bond Markets – Literature Review

Empirical research on corporate bond markets has historically been restricted by a lack of data. This changed recently in the US when the TRACE system for recording trades was introduced in 2002, while the TRAX system of trade recording run by the ICMA began in Europe. This has resulted in a number of recent papers using the TRACE data, and two papers using the TRAX data. Even so, the data available for corporate bond markets is still markedly less than for stock markets, and this restricts the empirical investigations that can be performed.

Almost all the studies of corporate bonds use US data, and the recent ones use TRACE transactions data from FINRA (formerly NASD). The only non-US research is

- a study of euro denominated corporate bonds, where the data was from Reuters 3000 EXtra and Bloomberg (Houweling et al, 2005);
- an analysis of yield spreads for euro bonds, with data from the Merrill Lynch non-financial corporate bond index (Menz, 2007);
- research on euro and Sterling denominated corporate bonds, with data from the International Index Company (iBoxx) and TRAX (Biais et al, 2006, Biais and Declerck 2007b);
- euro and Sterling corporate bonds in the Merrill Lynch High Yield Constrained Bond Index, with TRAX trade data (Biais and Declerck, 2007a); and
- an analysis of the Sterling, euro and dollar Merrill Lynch corporate bond indices (Webber and Churm, 2007).

The empirical studies (individually cited in Appendix B) generally use both a time series and a cross section approach. As well as variables relating to individual bonds (or bond indices) and issuers, they have also used aggregate variables for the equity and bond markets as explanatory variables.

5.1 Market Quality

Market quality is a multi-dimensional concept, and has been interpreted as covering some or all of the following aspects of a financial market: liquidity, volatility, efficiency, price discovery, transparency, transactions costs, depth, immediacy and competition. The existing literature has addressed the dimensions of liquidity, volatility and efficiency for corporate bond markets.

5.1.1 Liquidity

Liquidity is a desirable feature for a market, and can be measured as the difference between the fundamental value of a security and the trade price. A wide variety of variables have been used as proxies for liquidity, depending on the availability of data. Table 4 on page 20 shows that the most popular proxies are: volume (or number of trades), and the effective (i.e. traded) and quoted bid-ask spreads. Using data on euro denominated corporate bonds, Houweling, Mentink and Vorst (2005) found that none of the nine proxies for liquidity they considered stood out from the rest.

Table 4: Proxies for Corporate Bond Liquidity

Liquidity Proxy	Studies
1. Trading volume	Alexander, Edwards & Ferri (2000) Downing, Underwood & Xing (2005) Hotchkiss & Jostova (2007) Mahanti, Nashikkar, Subrahmanyam, Chacko, & Mallik (2008) Woodley (2007) Xing, Zhang & Zhou (2007)
2. Effective bid-ask spread	Bessembinder, Maxwell & Venkataraman (2006) Chakravarty & Sarkar (2003) Edwards, Harris & Piwowar (2007) Goldstein, Hotchkiss & Sirri (2007) Hong & Warga (2000) Schultz (2001)
3. Quoted bid-ask spread	Chen, Lesmond & Wei (2007)
4. Number of trades	Alexander, Edwards & Ferri (2000) Biais, Declerck, Dow, Portes & Von Thadden (2006) Mahanti, Nashikkar, Subrahmanyam, Chacko, & Mallik (2008) Xing, Zhang & Zhou (2007)
5. Amihud measure	De Jong & Driessen (2005) Downing, Underwood & Xing (2005)
6. Number of no change or missing prices	Chen, Lesmond & Wei (2007) Houweling, Mentink & Vorst (2005)
7. Latent liquidity	Chacko (2006) Mahanti, Nashikkar, Subrahmanyam, Chacko, & Mallik (2008)
8. Issue size	Houweling, Mentink & Vorst (2005)
9. Is the issuer's equity listed?	Houweling, Mentink & Vorst (2005)
10. Is the bond in Euros or the legacy currency?	Houweling, Mentink & Vorst (2005)
11. Is it the issuer's most recently issued bond?	Houweling, Mentink & Vorst (2005)
12. Bond age	Houweling, Mentink & Vorst (2005)
13. Price volatility	Houweling, Mentink & Vorst (2005)
14. Number of price contributors	Houweling, Mentink & Vorst (2005)
15. Heterogeneity of dealers' quoted prices	Houweling, Mentink & Vorst (2005)
16. Negative correlation of trade prices	Bao, Pan & Wang (2008)
17. The LOT measure	Chen, Lesmond & Wei (2007)
18. Volatility ÷ volume	Downing, Underwood & Xing (2005)
19. Quote size	Houweling, Mentink & Vorst (2005)
20. Trade size	Houweling, Mentink & Vorst (2005)
21. Quote frequency	Houweling, Mentink & Vorst (2005)
22. Volume ÷ issue size	Downing, Underwood & Xing (2005)

A few studies, almost all based on US data, have examined the determinants of liquidity in corporate bond markets. The findings of the six studies using volume as a proxy for liquidity are summarised in Table 5. This shows that volume is higher for newly issued bonds, bonds with a large issue size, bonds where the issuer's equity is listed and bonds that are not callable. Results on the effects of default risk and bond return shocks are mixed. In addition, a wide variety of other variables have been found to influence volume (liquidity).

Table 5: Variables Affecting Liquidity as Proxied by Corporate Bond Volume

Variable	Studies	Positive effect	Negative effect
Bond age	7	7	0
Issue size	4	4	0
Issuer's equity listed?	3	3	0
Callable?	2	0	2
Default risk	3	1	2
Bond return shocks – absolute bond returns	2	1	1

A further nine studies have used the bid-ask spread (effective or quoted) as a proxy for illiquidity (see Table 6). They found that liquidity falls with time to maturity, bond age, default risk and bond volatility, and rises with the size of the bond issue and trade size. In addition, 16 variables were tested by only one study.

Table 6: Variables Affecting Illiquidity as Proxied by the Bid-Ask Spread (Effective or Quoted) for Corporate Bonds

Variable	Studies	Positive effect	Negative effect
Time to maturity	8	8	0
Trade size	5	0	5
Bond age	4	4	0
Issue size	4	0	4
Default risk	7	7	0
Bond volatility	3	3	0
Volume	3	3	0
Number of trades	2	0	2

Note that a positive effect implies the bid-ask spread widens (i.e. market quality declines) as the variable increases

Chen, Lesmond & Wei (2007) employed the LOT (Lesmond, Ogden and Trzcinka, 1999) measure as a proxy for illiquidity, and found that liquidity rises with issue size and time to maturity, and falls with default risk and bond volatility. Bao, Pan & Wang (2008) used the percentage of zero price changes to proxy illiquidity, and concluded that liquidity rises with issue size and trade size, and falls with bond age, time to maturity and default risk. The variables explaining the Amihud liquidity measure have been investigated by Mahanti, Nashikkar, Subrahmanyam, Chacko, & Mallik (2008).

Eleven studies have looked at the question of whether liquidity affects the yield spread of corporate bonds (i.e. the bond yield less the yield on government debt). The clear finding is that increased liquidity leads to lower bond yields. These studies controlled for a wide range of other variables that were found to affect corporate bond yield spreads.

Table 7: Variables Affecting the Yield Spread of Corporate Bonds

Variable	Direction	Studies
Bond illiquidity	Positive Positive Positive Positive Positive Positive Positive	Bao, Pan & Wang (2008) Chacko (2006) Chen, Lesmond & Wei (2007) De Jong & Driessen (2005) Downing, Underwood & Xing (2005) Houweling, Mentink & Vorst (2005) Xing, Zhang & Zhou (2007)
Stock market liquidity	Positive	De Jong & Driessen (2005)
Time to maturity	Positive Positive Positive Positive	Campbell & Taksler (2003) Chen, Lesmond & Wei (2007) Houweling, Mentink & Vorst (2005) Menz (2007)
Default risk	Positive Positive Positive Positive Positive Positive	Bao, Pan & Wang (2008) Campbell & Taksler (2003) Chen, Lesmond & Wei (2007) Elton, Gruber, Agrawal, & Mann (2001) Houweling, Mentink & Vorst (2005) Menz (2007)
Equity volatility	Positive Positive Positive Positive	Bao, Pan & Wang (2008) Cai & Jiang (2008) Campbell & Taksler (2003) Chen, Lesmond & Wei (2007)
Term slope - Long term less short term yield on T-bonds	Positive Positive	Chen, Lesmond & Wei (2007) Houweling, Mentink & Vorst (2005)
30 day euro dollar rate less the 3 month T-bill rate	Positive Negative	Campbell & Taksler (2003) Chen, Lesmond & Wei (2007)
Stock market returns	Negative Positive	Campbell & Taksler (2003) De Jong & Driessen (2005)
Issue size	Negative	Chen, Lesmond & Wei (2007)
Coupon	Positive	Chen, Lesmond & Wei (2007)
Bond turnover	Positive	Bao, Pan & Wang (2008)
1 year T-note rate	Negative	Chen, Lesmond & Wei (2007)
Credit factor - return on a corporate bond portfolio less the long term T-bond return	Positive	Houweling, Mentink & Vorst (2005)
Bond return volatility	Negative	Cai & Jiang (2008)
Income to sales ratio of the issuer	Negative	Chen, Lesmond & Wei (2007)

Long term debt to assets ratio of the issuer	Negative	Chen, Lesmond & Wei (2007)
Total debt to capital ratio of the issuer	Positive	Chen, Lesmond & Wei (2007)
Bond age	Positive	Bao, Pan & Wang (2008)
Quoted bid-ask spread	Negative	Bao, Pan & Wang (2008)
Number of trades	Positive	Bao, Pan & Wang (2008)
Junk bond?	Positive	Bao, Pan & Wang (2008)
Excess return on the market	Positive	Elton, Gruber, Agrawal, & Mann (2001)
Return on small less large firms	Positive	Elton, Gruber, Agrawal, & Mann (2001)
Return on low less high book to market firms	Positive	Elton, Gruber, Agrawal, & Mann (2001)
Taxation of corporate bonds	Positive	Elton, Gruber, Agrawal, & Mann (2001)

Xing, Zhang and Zhou (2007) found strong co-movement in US corporate bond liquidity (proxied by volume) among individual corporate bonds. Different bonds had different levels of yield co-movement with aggregate market volume (liquidity). Bao, Pan & Wang (2008) also found co-movement in the liquidity of individual US corporate bonds using the negative correlation of trade prices as a proxy for liquidity.

Bao, Pan & Wang (2008) found that US corporate bond liquidity dropped sharply in May 2005 at the time of the Ford and GM downgrades to junk status. Liquidity then recovered, but fell sharply (and stayed low) in August 2007 with the onset of the credit crunch. They also found that changes in market-wide US corporate bond liquidity are negatively related to the VIX (volatility) index, and positively related to lagged returns on the stock market index.

5.1.2 Volatility

A good quality market is one where the price moves up and down to reflect the arrival of information that alters the value of the asset being traded. A poor quality market has either excess or insufficient volatility. Bao and Pan (2008) examined the empirical volatility of US corporate bond returns, less the return volatility given by the theoretical model of Merton (1974). Excess bond volatility was found to be a negative function of issue size and trade size, and a positive function of bond age (i.e. bond issues that are older, smaller or traded mainly in small lots tend to show excess volatility). Bao and Pan (2008) argue that these variables are proxies for liquidity, and that the excess bond return volatility (particularly for daily returns) is due to a liquidity effect.

5.1.3 Efficiency

It is desirable that the market price promptly reflects new information, and this includes not lagging behind the price response in a related market. Some studies conclude that there is no difference in informational efficiency between the US stock and corporate bond markets, while others have found that stock returns lead bond returns, indicating semi-strong inefficiency.

Ronen and Zhou (2008) found the US corporate bond market to be semi-strong efficient. Information from firm earnings announcements was incorporated into the price of the bonds issued by the firm concerned within about 5 minutes as a result of institutional trading. When stock market liquidity was low, the bond price reaction was faster than the stock market reaction. Hotchkiss and Ronen (2002) found US corporate bonds to be as informationally efficient as the corresponding stocks, with no leads and lags between equity and corporate bond returns.

In contrast, Downing, Underwood & Xing (2008), Guran, Johnston & Markov (2008), and Kwan (1996) found that stock returns lead returns on the firm's bonds. Gebhardt, Hvidkjaer and Swaminathan (2005) showed that US corporate bond prices under-react to the information in past stock prices, and that there is a momentum spillover effect from past equity returns to future bond returns. Overall these results indicate the presence of semi-strong inefficiency in the bond market.

In their analysis of Sterling and euro denominated corporate bond data for 2003-2005, Biais and Declerck (2007b) found it takes five days for prices to respond to the arrival of information. They attribute this slow response to the low level of post-trade transparency in these markets.

5.2 UK Studies

The first UK study of market quality in corporate bond markets is by Biais, Declerck, Dow, Portes and Von Thadden (2006). They used quote data from iBoxx and trade data from TRAX for 2003-2005. This covered plain vanilla investment grade bonds with an issue size of at least Euro 500mn. Sterling corporate bond spreads were found to increase with maturity and default risk and decrease with trade size. They also found that it took one day for the information content of a trade to be reflected in market prices. They concluded that competitiveness (i.e. more dealers) is a key driver of liquidity.

Biais and Declerck (2007b) used the same data to look at the determinants of effective and quoted spreads, and showed that effective and quoted spreads for Sterling corporate bonds decrease with trade size, and increase with maturity and default risk. Biais and Declerck (2007a) studied the number of trades and effective spreads for Sterling corporate high yield bonds in the Merrill Lynch High Yield Constrained Bond Index. They found that these bonds traded an average of three times per day, and that effective spreads in 2005 averaged between 0.68% and 0.73%.

In the only other study of the UK, Webber and Churm (2007) decomposed UK corporate bond yield spreads for investment grade and high yield bonds, for the period 1997-2007, into three components: (a) compensation for the expected rate of defaults, (b) compensation for uncertainty about the future default rate, and (c) other factors, including the illiquidity premium. From a high point in the early 2000's bond yield spreads dropped to a low point in 2007, and then rose very sharply in August 2007 to about 160 basis points for investment grade bonds (equalling the level in 2000), and about 600 basis points for high yield bonds (well below its peak of about 1,000 basis points in the early 2000's). This rise was partly due to compensation for uncertainty about the future default rate rising to about twice its average level since 1997. There was also a rise in compensation for the expected default rate, as well as a substantial rise in the illiquidity premium. Between August and November 2007 for Sterling high yield bonds compensation for the illiquidity premium rose by 121 basis points.

6. Interview Results

As an introduction to the project a number of interviews were carried out with buy-side practitioners. As discussed above, the purpose of the interviews was to gain insights into market concerns and the issues that warranted empirical investigation. The interviewees were chosen to represent a range of buy-side investment funds including insurance companies, mutual fund managers and pension managers and to include smaller as well as larger firms.

The following sections summarise the main results from the interviews. There was a striking agreement between interviewees on the problems – and the sections below were all touched upon by all interviewees.

6.1 Trading Difficulties

6.1.1 Wider than Previous Crises

The debt market is no stranger to crisis and the participants we spoke to had experience of the Asian financial crisis of 1997, the Russian debt crisis of the late 1990s, the tech bubble crisis of the early 2000s as well as earlier crises including Latin America, and the stock market crash of 1987. The interviewees all remarked that the differentiating feature of the current crisis is its scope – all sectors and all countries were affected. Previous crises had seen a collapse of the market in specific sectors, but this crisis was unique in that all types of debt, apart from the most secure sovereign issues were blighted. The impact was therefore more severe as they did not have the option to change their operations to less affected parts of the market.

6.1.2 Mainly Second-order Impact

The organisations interviewed were long-term investors. In general they had avoided the more troublesome types of asset-backed debt (largely because they did not fit with their investment strategy, rather than through any great foresight). Therefore, they did not suffer major losses directly from the sub-prime collapse, rather the impact on them was a second-order effect resulting from the contamination of conventional securities. The Sterling debt market is a crucial market for UK funds, which typically invest predominantly in equity and conventional debt instruments, and the breakdowns described below have had a major impact on their activities.

6.1.3 Dealers withdrew Capital

In normal times the Sterling corporate bond market operates as a dealer market largely using telephone quotes from firms that act as market makers. Dealers would use their own capital to take positions, facilitating the trades of buy-side customers. For a number of reasons dealers were unwilling or unable to use their capital to support trading:

- They were part of groups that need all their capital to meet regulatory requirements.
- Great uncertainty/volatility in the market meant that the risks of holding positions were higher than normal
- Other sources of capital, such as repos, were, and remain, largely closed because of a general reluctance to lend to other institutions, even on a secured basis.

The consequences were that:

- what was usually a market offering immediacy for investors became a market where trading was “strictly by appointment”;
- there were fewer firm quotes, or quotes were more indicative. Often quotes were unavailable, or of very short duration;
- markets were frequently “one way” and usually there was an absence of ready buyers;
- orders which could usually be executed in one transaction had to be split and executed over a longer period, often measured in days;
- where immediacy was available the bid-ask spreads were far wider than they had been before the crisis.

Buy-side traders, in consequence, incurred (and continue to incur) higher costs of execution. These higher execution costs were caused by wider spreads, the possible market impact while an order was being executed over a longer period, and the opportunity costs of not being able to execute orders, and so missing opportunities for gain or avoidance of loss.

6.1.4 Decline in Transparency

The Sterling corporate bond market does not normally have a high level of transparency, either pre or post trade. As mentioned it is largely a telephone market and electronic systems have made only slight inroads. The current difficulties have led to further reduced transparency as the unwillingness of dealers to make firm quotes means that there are only rarely good indications of prevailing prices. Buy-side traders tend to rely heavily on the transparency of prices, more so than dealers who tend to see more order flow and so have a clearer idea of the position and condition of the market.

6.1.5 Risk Measurements have Failed

Conventional measures of risk such as ratings and the factors that were supposed to mitigate risk such as seniority/subordination, have failed. There are currently no accurate measures of risk, and in consequence all bonds are treated as having the same (high) level of risk.

6.1.6 Low Volumes

The difficulties meant that volumes had been substantially reduced, almost to standstill in some cases. This was both a symptom and a cause of the generally greater difficulty and cost of trading for buy-side investors. Volumes have continued to decline and no upturn is expected.

6.1.7 Absence of Reference Prices for Portfolio Valuation

For many stocks daily reference prices were just not available, making it difficult for UK NAV funds to value their portfolios. In part this is a reflection of a persistent problem for funds that invest in illiquid stocks (which includes most corporate bonds) where daily prices are based on little if any trading and therefore are, at best, informed estimates.

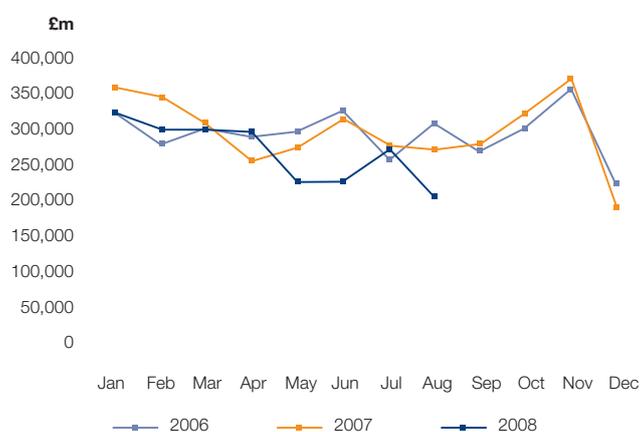
A more pernicious problem was the artificially low prices (in the view of the fund managers) for many bonds that were supplied by the third-party valuation services used by many fund managers. The problem only applied to UK fund managers who are required to use these prices for valuations. Funds registered (and regulated) elsewhere such as Luxemburg were able to use internal valuations for calculating NAVs.

6.1.8 Gilts Generally Unaffected

As one would expect given the secure ratings of gilts, the gilt market remained reasonably resilient and tradable. On a number of occasions a general flight to quality created temporary shortages of gilts which affected short-term prices. The general expectation that gilts would rise in price meant that dealers were generally less willing to go short which led to some diminution of liquidity, but this was rarely a significant problem.

Gilt turnover remained at normal levels during the period, as the numbers from the London Stock Exchange presented in Figure 2 indicates. This shows monthly gilt turnover, and indicates that turnover in the second half of 2007 and the first three quarters of 2008 was not greatly out of line with that in 2006. There has been a dramatic upward shift in gilt trading since August 2008, possibly because of an expectation of substantially increased gilt issuance - between September and November 2008 the average monthly value of trading exceeded £1.2 trillion, an increase of 350% on the volumes in the first eight months of the year. Figure 2 stops at August 2008 to avoid the point being distorted by the sharp upsurge in recent months.

Figure 2 – Monthly Turnover of UK Gilts



6.1.9 Situation not Improving

We conducted the interviews in May/June 2008 and revisited some of the participants in the autumn of 2008. The perception in May/June was that the trading situation was not improving but there was an expectation that it would. The later, second interviews contradicted this expectation – the market remained bad, indeed trading had possibly become more difficult over the summer and there was no longer an expectation that things would improve in the near term.

6.2 Broad Structural Issues

Interviewees identified a number of features of the market that lowered its resilience to the type of crisis currently being experienced.

6.2.1 Small Size of the Sterling Market in Relation to Global Markets

The UK market is small in global terms being dwarfed by the US, Japanese and more recently the Eurozone markets. Like all small markets it struggles to attract attention from the major international players. The consequence is that the market has become something of a backwater. This, in turn, has led to:

- high costs (bid-ask spreads tend to be wider than in the Euro market, for example);
- low liquidity – little natural liquidity forces reliance on dealers to provide liquidity. This in turn imposes costs through dealer spreads (necessary to attract the dealers to participate; though the feeling is that the UK market is not especially profitable, but dealers support it as part of a wider service) and through the risks imposed by higher volatility;
- low levels of innovation and a relatively narrow product range.

6.2.2 MiFID is not yet fully Incorporated

The concepts involved in MiFID are yet to be fully incorporated and implemented in the Sterling corporate bond market. In particular, the best way of ensuring Best Execution is yet to be agreed and the implementation of monitoring systems is at a relatively early stage. The innovative developments that MiFID is intended to encourage, such as greater transparency and development of more sophisticated trading platforms have yet to be introduced.

6.2.3 Lack of Sophistication

The market continues to be dominated by “plain vanilla” products. Credit analysis is relatively unsophisticated as investors prefer highly-rated debt. There is little interest in more risky debt (for example SME debt), and no proper market for distressed debt.

6.2.4 Little Awareness of Trading Technology Developments

The market remains almost totally reliant on a telephone-based dealer market. Electronic trading mechanisms have made significant inroads elsewhere, and estimates suggest that 57% of US bond trading is electronic, but awareness of electronic platforms remains low in the UK market. In part this is a consequence of the smallness of the market. Electronic systems work best when there is substantial natural liquidity arising from large order flow, which is not true of the UK market. The lack of awareness suggests that innovative developments are not considered as important as they are in other markets.

7. Market Spreads

This section examines the movements in quoted spreads to assess the changes in the quality of the corporate bond market since the start of the credit crisis. The aim is to address two questions:

- Have quoted spreads on bonds have widened during the credit crisis?
- Has the widening of spreads been greatest in the more risky stocks (e.g. those that are longer dated, have lower credit ratings or have lower priority in liquidation)?

This section starts with a descriptive section showing the changes over time first for two illustrative sample stocks, and then for groups of stocks using the various iBoxx indices. This is followed by a more systematic quantitative examination to identify which bond features had the most significant influence on the changes in quoted spreads.

The data supplied allowed us to plot the daily spreads and prices from January 2006 to September 2008 capturing a long period of normal trading and the effect of the credit crisis starting in Summer 2007. Figure 3 and Figure 4 on page 31 show two examples of individual bonds. Both bonds are from the more risky end of the spectrum being subordinated bonds raised by financial institutions as regulatory capital.

Figure 3: Nationwide – 7.971% 2015 (Subord)
GB 0001777449

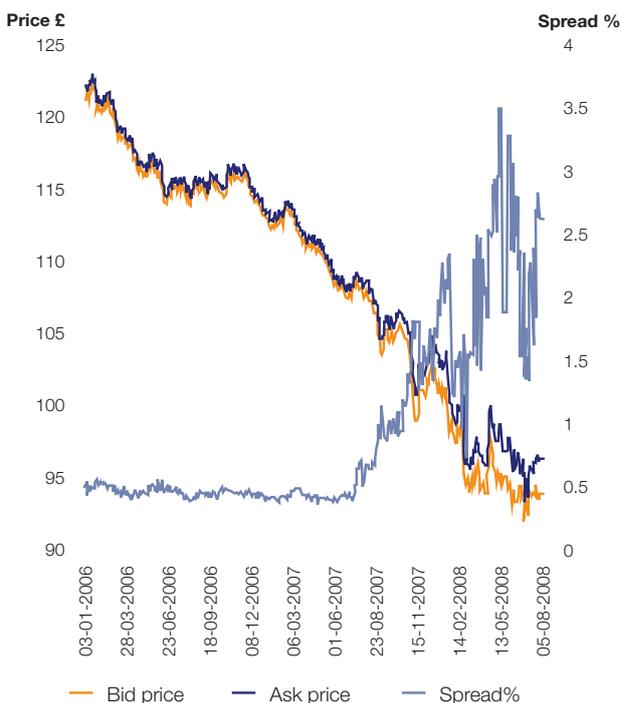
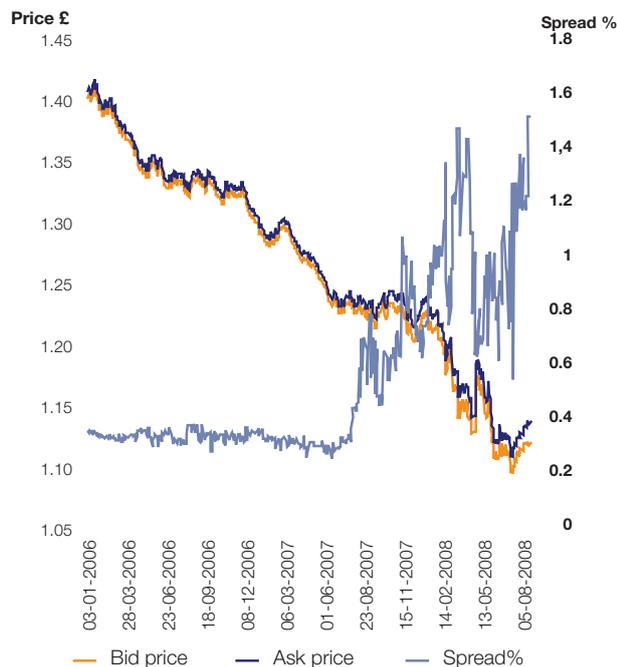
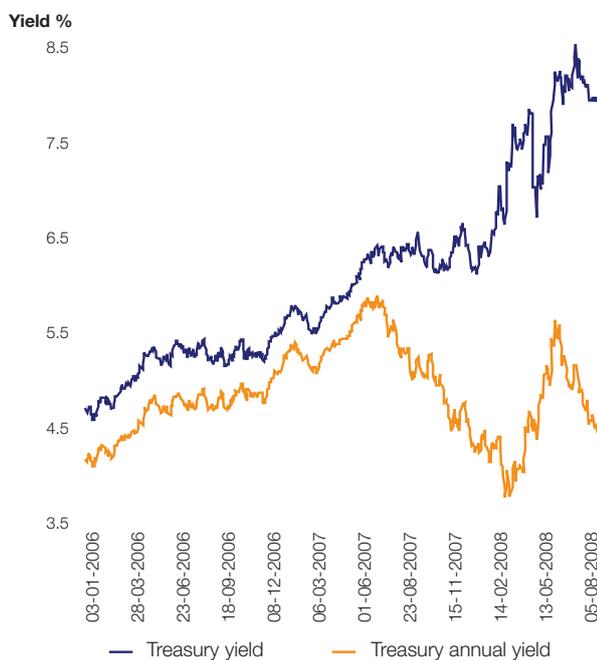


Figure 4: HBOS – 11% 2014 (Subord)
GB 0004037171



The left-hand panel shows the daily yield and compares it with a gilt (Treasury 9% 2011) yield. Until late July 2007 the two yields moved in parallel with Nationwide showing an average 80-90bp spread over the gilt, and HBOS exhibiting an average 50-60bp spread. Yields were generally moving upwards as inflation fears strengthened in that period. But from July 2007 the perceived relative risks for corporate bonds rose sharply, reinforced in September by the collapse of Northern Rock. The yields on the bonds rose correspondingly and the yield on gilts fell reflecting the strong demand for secure assets. Gilt yields rose again in the spring of 2008 but the worsening of the crisis again pushed gilt yields on to a downward path in the summer. Yields on the corporate bonds rose steadily from July 2007 and were still on an upward track in September 2008. By September the spread on Nationwide bonds had risen to around 500bp and the spread on HBOS (which announced a merger with Lloyds TSB in September 2008) had risen to around 350bp.

The right-hand panel shows the end of day bid and ask prices and the spread between the bid and offer. Note that spreads are conventionally measured in basis points (bp). However when prices have changed sharply during the period, as they have in this analysis, then measuring spreads in percentage terms gives a more consistent basis for comparison.

The prices of the stocks fell throughout the period reflecting the sharp rise in yields already discussed. The bid-offer spreads showed considerable day-to-day stability with a gradual decline in the period from January 2006 to July 2007, representing ever easier credit conditions in the market, greater liquidity and a perception of declining risk. From July 2007 quoted spreads rose sharply and showed extremely high levels of day-to-day volatility. The two stocks showed

substantial differences in their day-to-day movements with intermittent periods of relative stability, but the overall direction was sharply upwards. By September 2008 the quoted spreads on the Nationwide bond were over five times their pre-credit crisis levels, and those of HBOS were over three times higher.

iBoxx produces a number of indices representing bonds with different characteristics which are used for the following analyses. Four of the index characteristics are significant for the hypothesis being tested:

- Nature of the bond: type (collateralised or regular) and issuer type (financial or non-financial);
- Term to maturity: longer dated bonds incorporate more counterparty risk and are more sensitive to changes in price-sensitive factors;
- Rating: a measure of riskiness;
- Seniority: subordinated bonds are more risky than senior bonds.

Figure 5 shows the price and spread movements for the major types of stock covered in this analysis - financial institution bonds, other corporate bonds and collateralised bonds. The prices of all three types of non-sovereign bonds have fallen substantially and consistently since the start of 2006. Figure 6 shows that, until the middle of 2007, the prices of both gilts and corporates fell in line (driven by rising interest rates as the authorities responded to the perceived inflationary threat). From mid 2007, the price of gilts started to rise while the price of corporate bonds continued to fall.

Figure 5: Collateralised, Corporate and Financial Bond Price and Quote Spreads

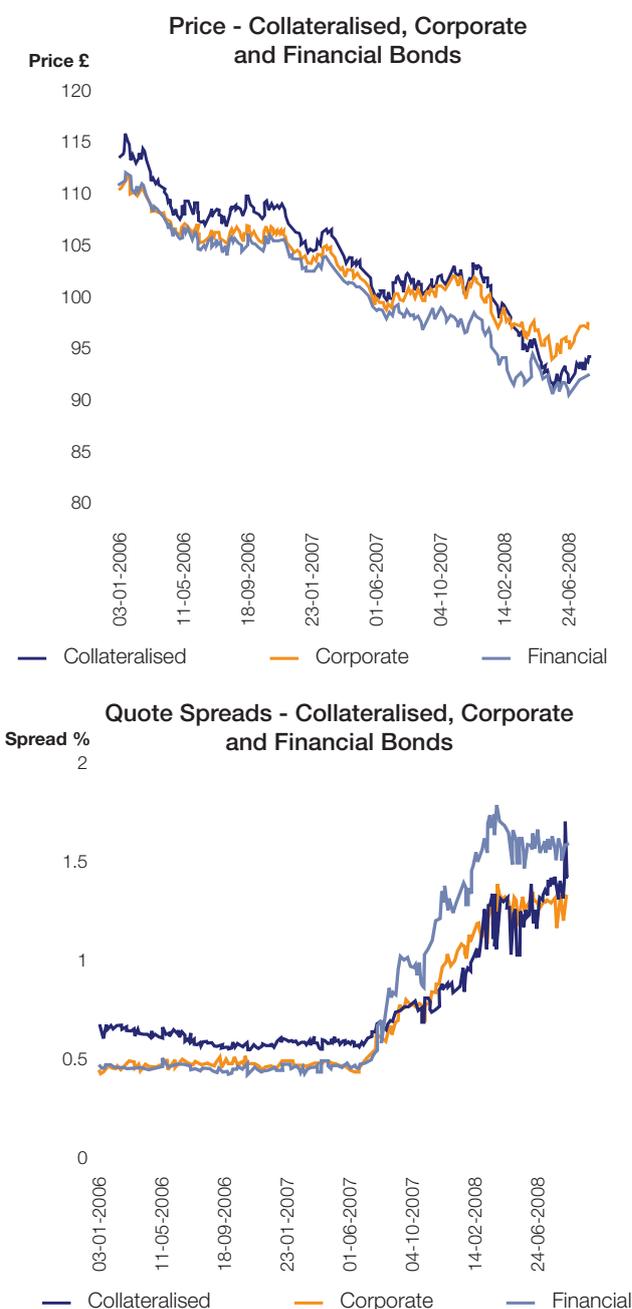


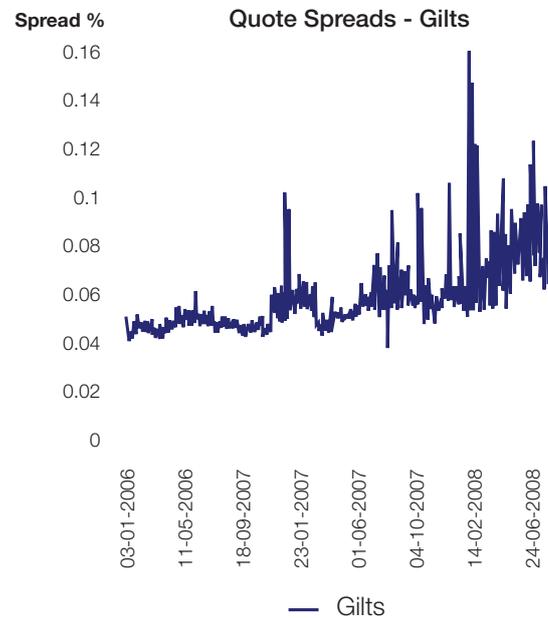
Figure 6: Prices of Gilts and Corporate Bonds



Spreads on all types of corporates, shown in the second panel of Figure 5, were relatively stable with a slight downward trend until mid 2007 driven by ever easier credit conditions. From July 2007, when the first downgrades of subprime debt were issued, spreads rose sharply. The rise continued until the end of February 2008, but subsequently stabilised at levels of between 2.5 and 3 times their pre-crisis levels. Unsurprisingly, given the travails of the commercial and investment banking sectors, financial bonds suffered worse than regular corporate bonds. Spreads on collateralised bonds tracked those of regular corporate bonds but have continued to rise right through to September 2008.

Figure 7 shows the spread on gilt stocks for comparison. Spreads on these stocks are typically much lower than those on corporate bonds reflecting the far higher liquidity in benchmark Treasuries and lower default risk. Quoted spreads on gilts have also widened since July 2007, especially from spring 2008; current levels being about double those pre-crisis. This somewhat contradicts the opinions gained from the interviews that the gilt market had not been much troubled by the crisis, though the proportionate rise in gilt spreads has been significantly less than that in corporate bonds, and the gilt market has remained open.

Figure 7: Gilt Spreads



7.1 Analysis by Term

Figure 8: Quoted Spreads by Term

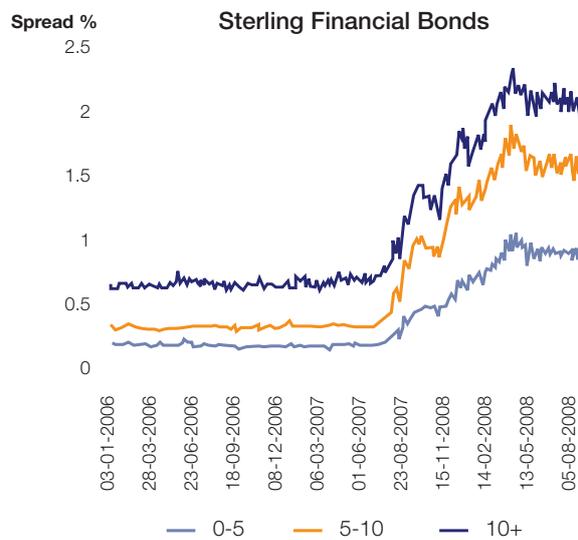
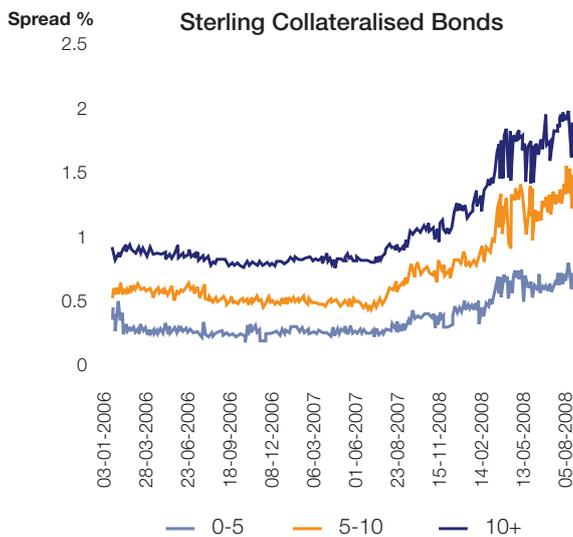


Figure 8 shows the impact of length of term on the quoted spreads for the three types of bonds analysed.

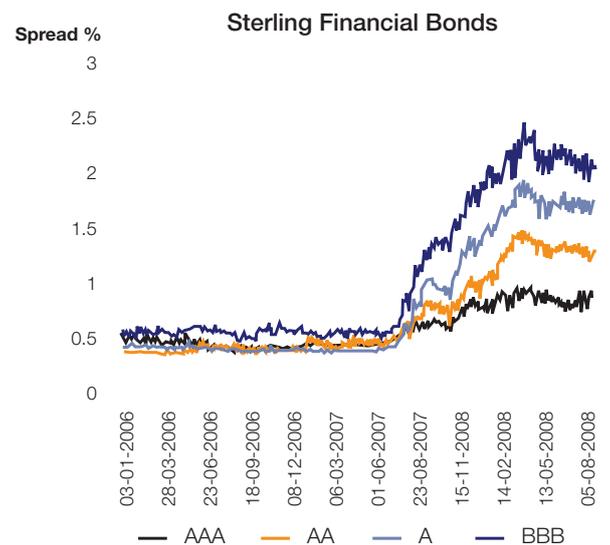
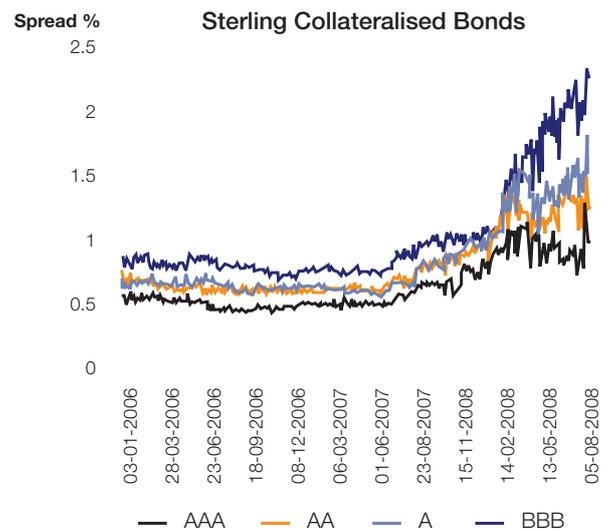
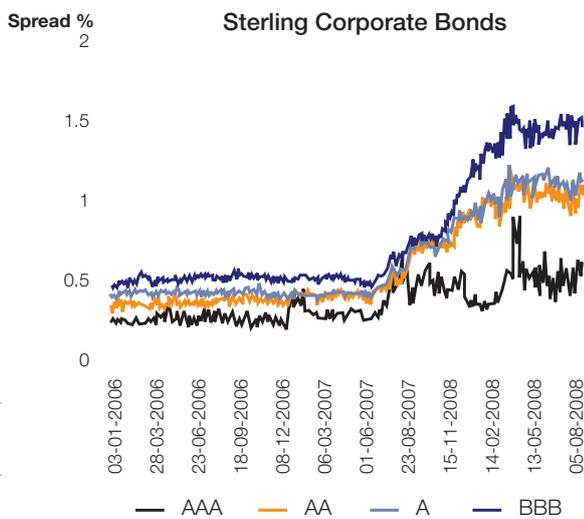


In all three cases the shortest dated bonds showed the smallest rise in quoted spreads and the longest dated showed the largest increase. For non-collateralised bonds the shorter dated (up to 5 years) bonds saw a considerably smaller increase than did the medium (5-10 year) and long (over 10 years) bonds.

7.2 Analysis by Rating

Figure 9 shows the impact of rating on quoted spreads. The iBoxx data covers four levels of rating – AAA, AA, A and BBB. As hypothesised, quoted spreads widened more on the riskier stocks. Quoted spreads on AAA rated corporate bonds roughly doubled, but those on BBB corporate more than tripled.

Figure 9: Quoted Spreads by Rating

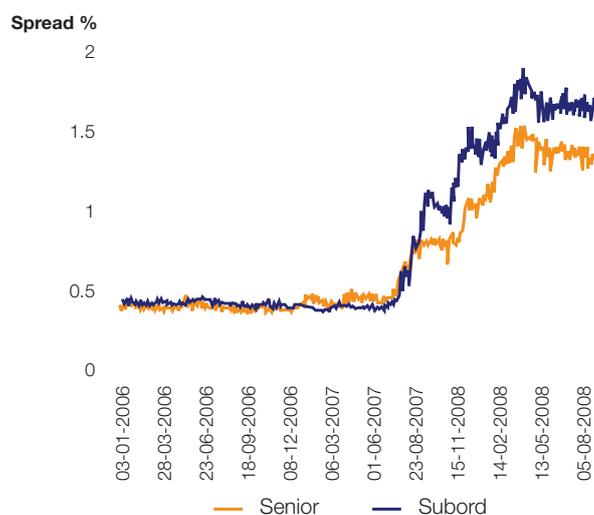


Financial bonds showed a similar pattern but with an indication that spreads on lower rated financial bonds may have peaked.

7.3 Analysis by Seniority

Both senior and subordinated bonds, which are almost exclusively a feature of the financial institution bond market, saw rises in quoted spreads – figure 10. However the increase in senior bonds was considerably lower than that in subordinated bonds, suggesting that the market continued to see the subordinated bonds as riskier.

Figure 10: Quoted Spreads by Seniority – Financial Bonds



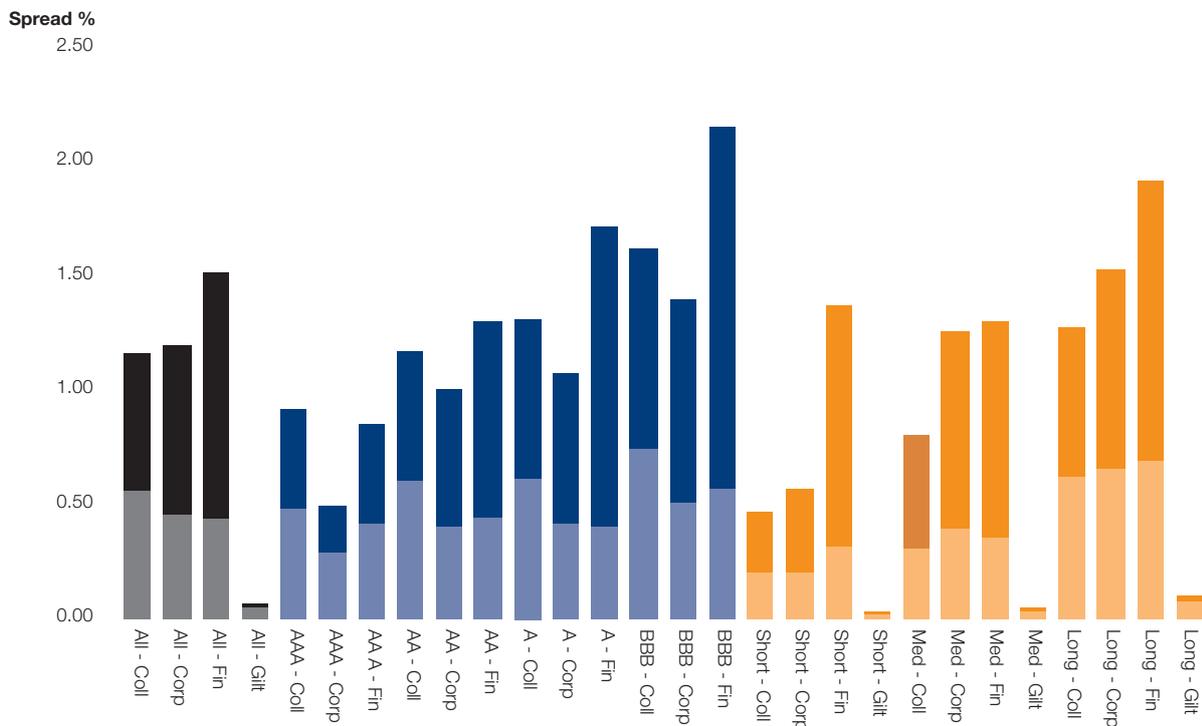
7.4 Key Conclusions from Quote Analysis

The analysis of quoted spreads has shown a number of points about the market response to the crisis:

- All bonds, even gilts, experienced substantial rises in quoted spreads. Prior to July 2007 spreads had been relatively stable, but from July 2007 all spreads increased sharply. Post crisis spreads are at least double, and in many cases treble, their pre-crisis levels.
- There is some evidence that spreads on financial and corporate bonds peaked in spring 2008 or at least reached a plateau.
- Riskier bonds (e.g. longer bonds, those with lower rating and those with subordinate status) uniformly saw significantly larger increases in quoted spreads than did less risky stocks. To some extent this contradicts the perception of the interviewees that risk measures broke down and all bonds became equally risky. However quoted spreads measure indicative quotes rather than a genuine trading opportunities, and may not be available when challenged.

Figure 11 summarises the changes in quoted spreads. The lower part of each bar shows the average pre-crisis spread, and the whole bar shows the average post-crisis spread. The differences between the three types of bonds (corporate, financial and collateralised) are shown by the first three bars with financial bonds faring worst. The next two groups of bars show the increasing spread with increasing risk (lower rating) and the association of increased spread with longer term to maturity.

Figure 11: Summary of Pre and Post-crisis Quoted Spreads



Note: the lower portion of each bar shows the spread before the crisis, while the upper part shows the increase attributable to the crisis.

8. Trading Case Studies

This section looks at some case study data on trading gathered specifically for this project. In the absence of a comprehensive data set of trading (which, in contrast is usually freely available for equity markets and for the US bond market), three fund managers agreed to supply their proprietary trading data covering the period before and after the crisis. Inevitably different fund managers collect different data and manage it in different ways (and they also differed in which data they chose to supply for this study). Consequently it was generally only possible to produce each analysis for a single fund manager.

As noted above, the interview results suggested a number of crisis-related difficulties faced by fund managers. In particular:

- Volumes were reduced as fund managers avoided trading difficult bonds. For example, CESR(2008) reports that the trading volume in euro denominated corporate bonds fell by more than 50% between January 2007 and October 2008.
- Managers might trade gilts rather than corporate bonds to alter their exposure.
- Prices were less certain because:
 - quoted spreads were wider and so the range of possible price improvement (if any) was much wider;
 - dealers were less willing or completely unwilling to make prices, and those made were for a very short duration;
 - prices were generally more volatile.
- Order execution was slower because either:
 - dealers were unwilling to take positions and execution was delayed by a search for another counterparty;
 - dealers were unwilling to trade in sufficient size so an order had to be broken into smaller tranches.

8.1 Trading Volumes

Figure 12: Corporate Bond Trading Volumes by Fund Manager A

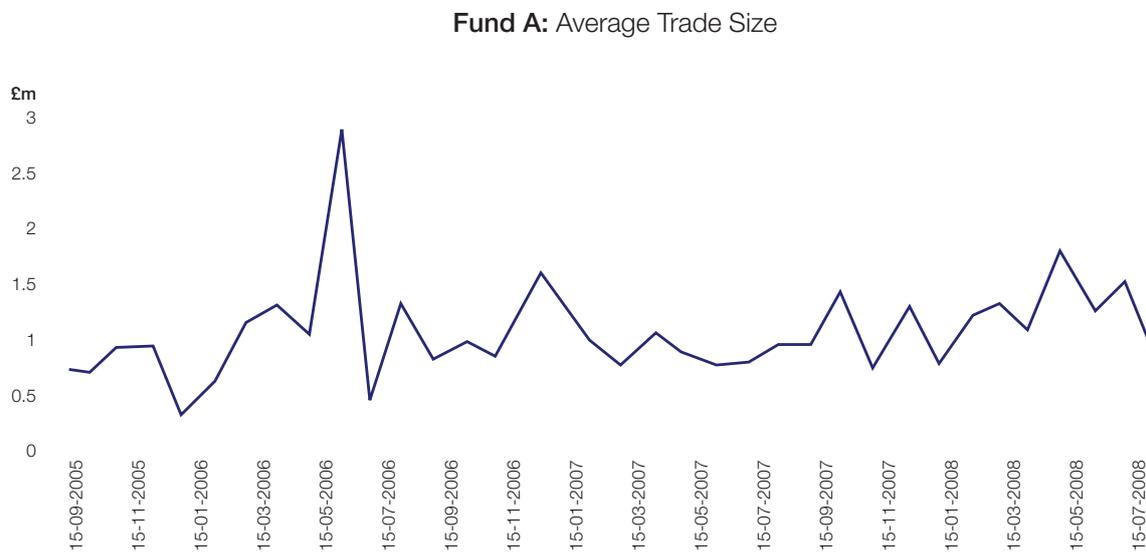
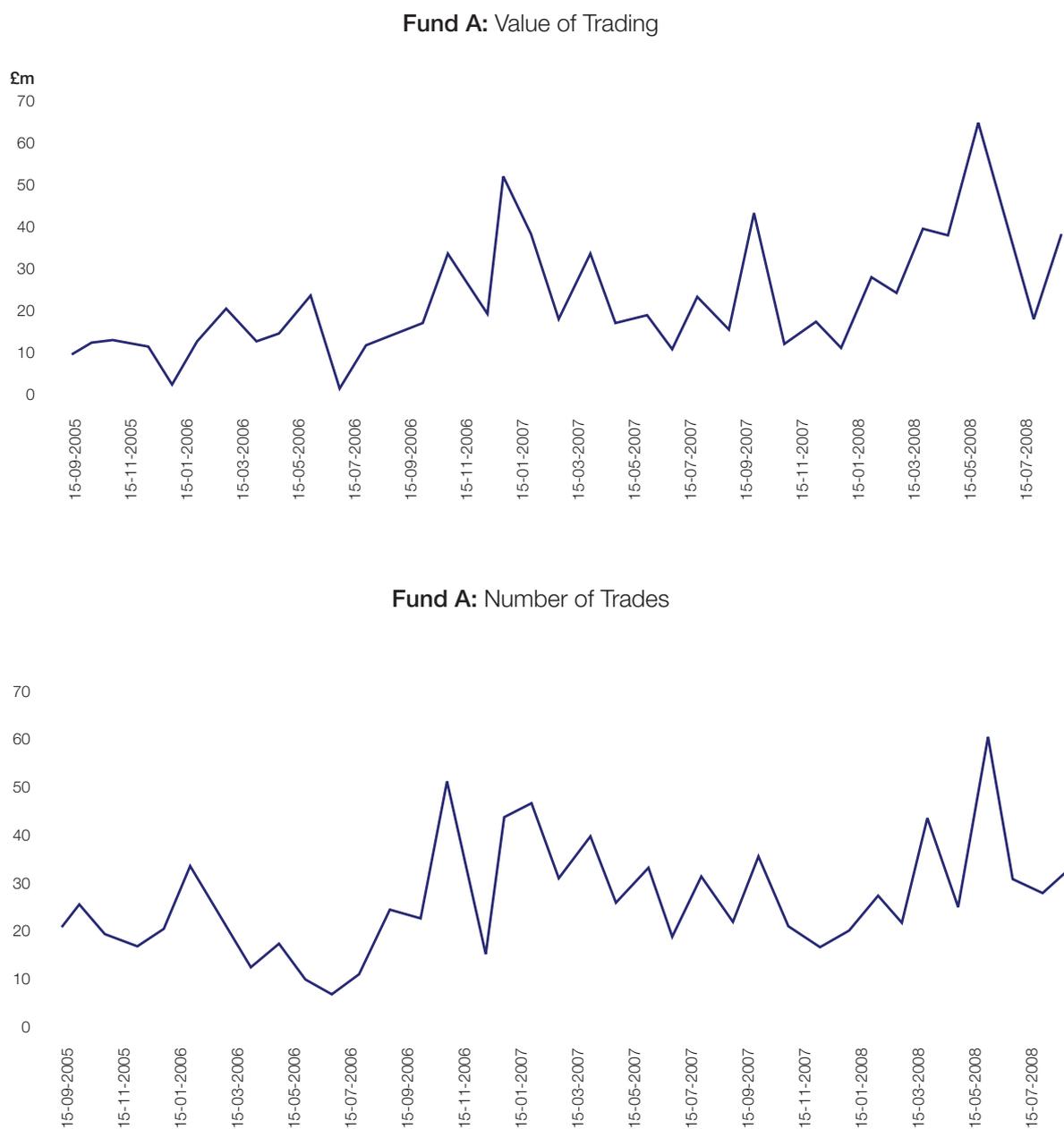


Figure 12 shows the daily value, number of trades and average value per trade in corporate bonds executed by the smallest of the case study managers (fund manager A). This manager averages about 30 trades a month in Sterling corporates.

Figure 12: Corporate Bond Trading Volumes by Fund Manager A

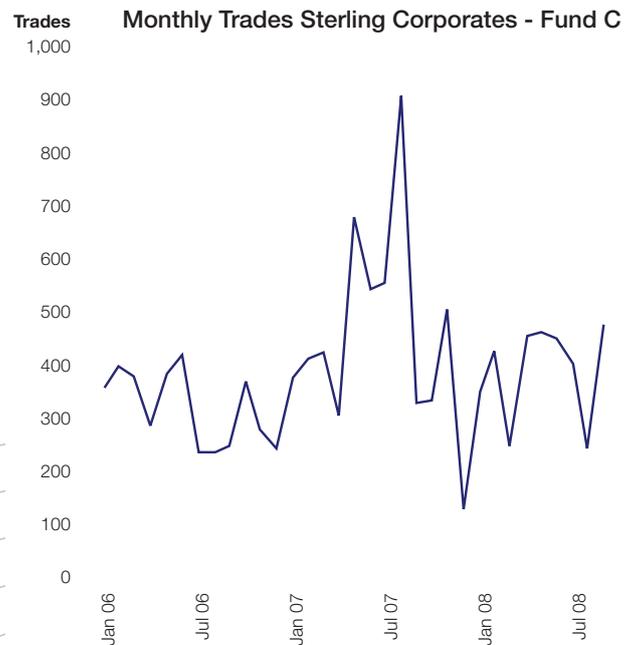


The results do not show the sort of decrease in trading that would be expected in a market that has collapsed completely. In addition, the fact that the average trade value, which has increased, does not suggest that that orders were being split more than before the crisis.

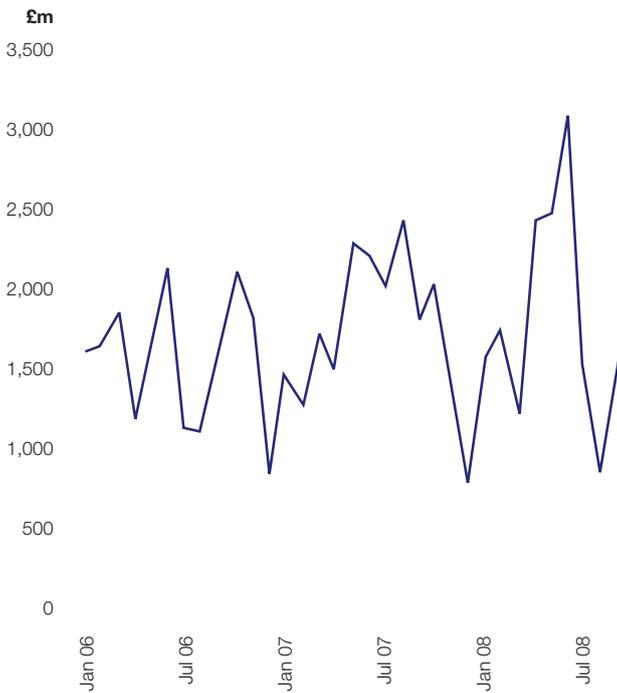
Overall the results for this (relatively small) fund manager suggest that the increased interest in bond and credit markets generally stimulated a stronger desire to trade. The manager was well able to achieve this, either by an accommodating market or by use of different dealing strategies (such as using agency brokers more actively). Of course, this does not mean that the crisis has had no effect – it shows that managers are resilient and have adapted their trading to the new circumstances. Equally, trading may be more difficult and take longer to arrange and occur at worse prices than would have occurred earlier.

Figure 13 shows comparable results for the largest of the case study managers (fund manager B). This manager averages about 400 trades a month in Sterling corporate bonds.

Figure 13: Corporate Bond Trading Volumes by Fund Manager C



Monthly Value Traded Sterling Corporates - Fund C

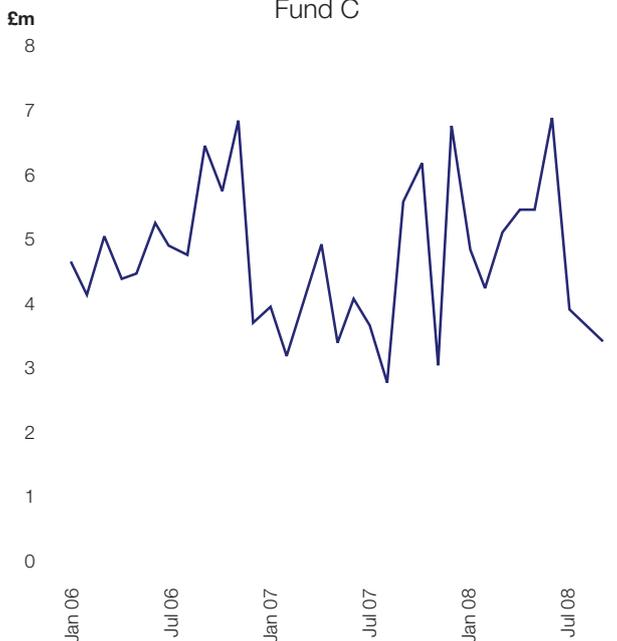


The overall pattern does not show the growth seen in fund manager A in the case studies. However, while trading levels have been volatile, it is not apparent that there has been any decline. This is consistent with the interview findings that fund managers have been able to execute orders, but that they have had to adapt their normal trading techniques to a changed situation.

The chart for average transaction size supports this since it shows a somewhat lower overall transaction size (though with high volatility). In recent months, in particular, the average transaction size has been reduced. Note that the average trade size for this manager is substantially larger than for fund manager A.

Overall the results for fund manager B suggest that trading has been maintained, though becoming more challenging. This is especially true in recent months, where there are indications that market conditions have encouraged the manager to reduce order sizes.

Monthly Average Trade Value Sterling Corporates - Fund C



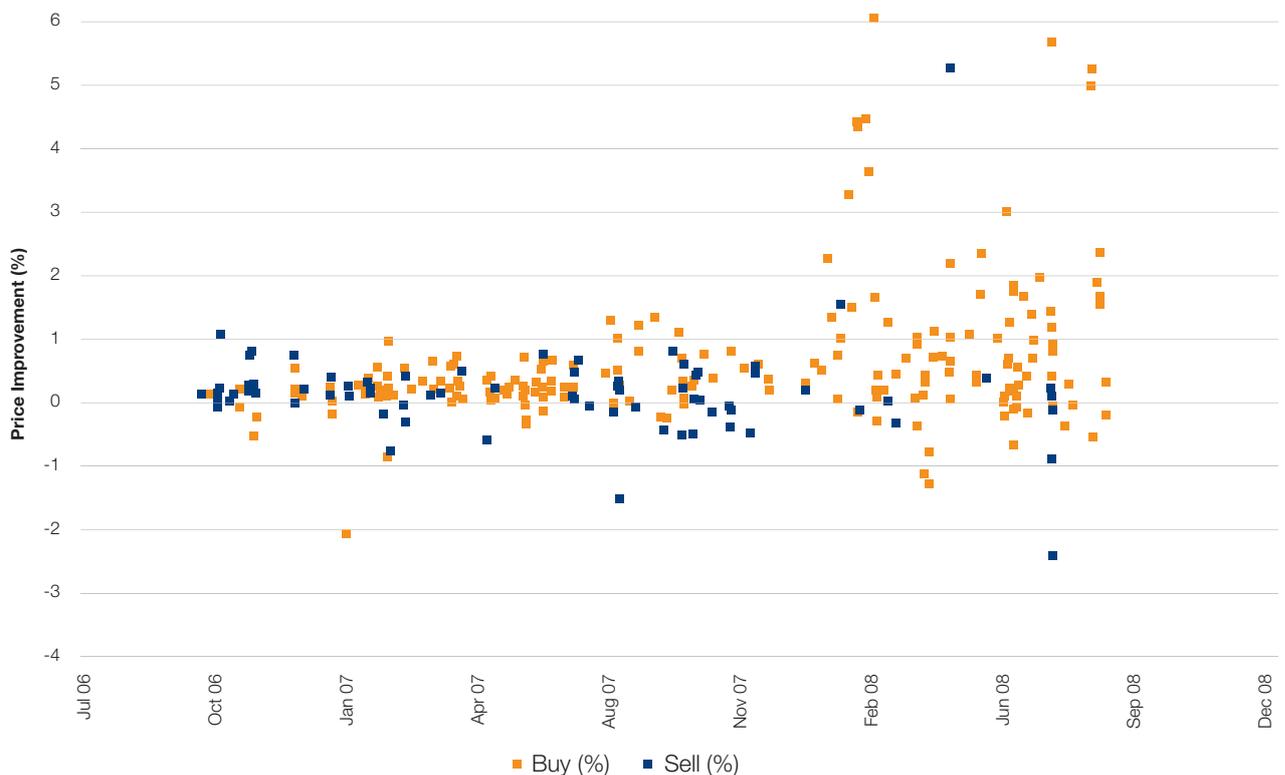
8.2 Price Improvement – Public Quotes

Given that the quotes made by dealers are non-binding, it is interesting to compare quoted prices with the prices at which trades actually took place. Figure 14 shows the extent of price improvement measured as the difference between the traded price and the quote, as proxied by the iBoxx end of day quotes.

$$Improvement = \begin{cases} \frac{Ask - Price}{MidQuote} & \text{for Buy trades} \\ \frac{Price - Bid}{MidQuote} & \text{for Sell trades} \end{cases}$$

We have noted that the iBoxx quotes are not tradable or firm quotes but, given the infrequency of trading of most bonds we would expect that, under normal circumstances, they would be a fair estimate of current prices. It should be noted, however that circumstances were far from normal during the period studied. There are many market reports that these quote series are often stale and, even when valid, are often good only at such small size that the quote is at best a poor indicator of the likely price for an institutional sized trade. Many of the results below are consistent with these reports.

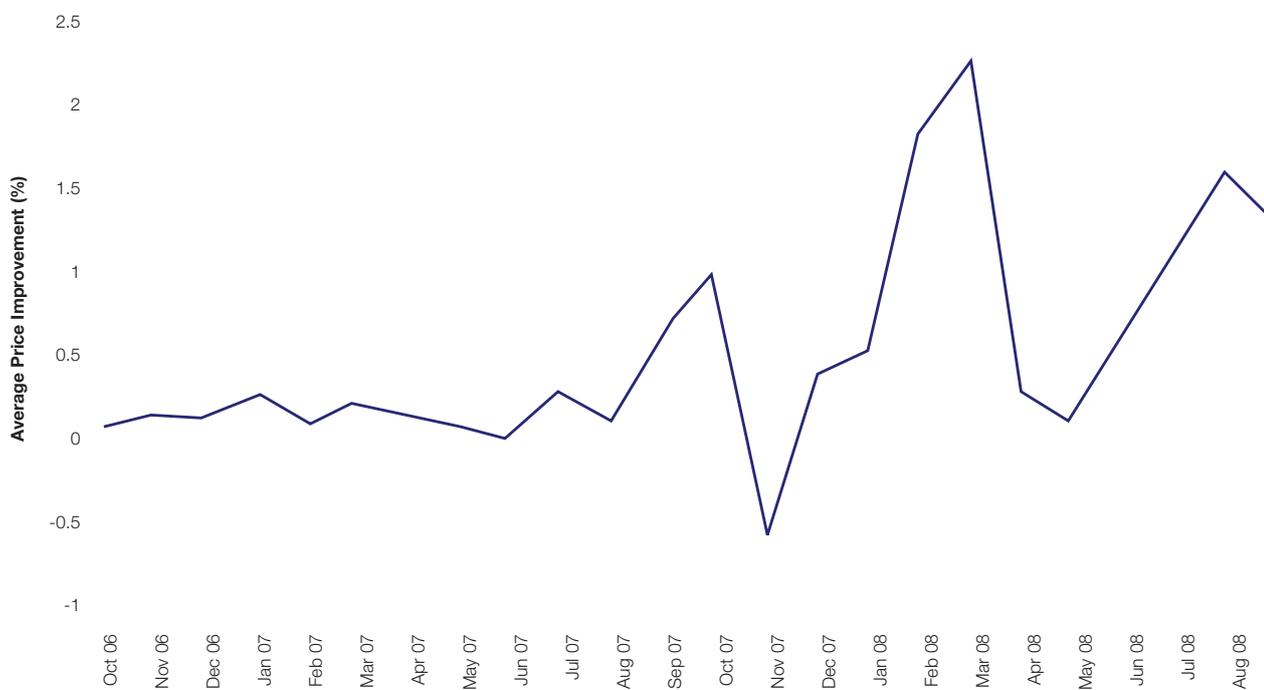
Figure 14: Price Improvement (Fund A)



Note: Chart omits two extreme positive values and two extreme negative values.

Similarly, Figure 15, shows the apparent price improvement for fund manager B and which is similar to the pattern obtained for the (smaller) fund manager A.

Figure 15: Price Improvement (Fund Manager C)



Note: Chart shows the average apparent price improvement per month

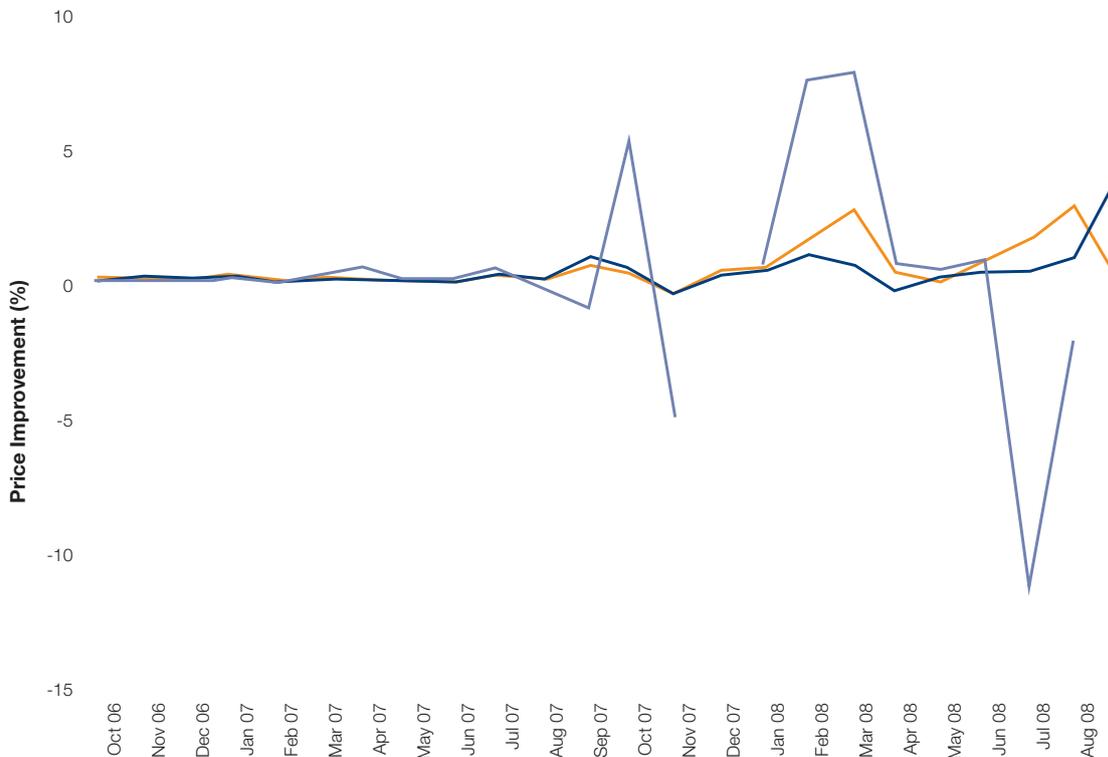
This widening of the dispersion of prices in relation to quotes could be due to:

- Prices are much more volatile post-crisis (almost certainly true), and so the iBoxx quotes have become a less accurate proxy. However if this were the explanation it would cause a more symmetrical distribution of results about the zero axis than we observe.
- Quoted spreads are much wider (which they are) and so price improvement is easier to achieve and dealers are giving considerably better terms to known customers than to casual enquirers.

This suspicion is reinforced by the following figure which shows the ‘improvement’ for different ratings which shows that the greatest variation in public quotes appears in the lower grade issues.

One potential explanation of this result is that there has been a large number of ratings downgrades and that this, in some way, contributed to the result. However, only 20 of the 3398 bond issues traded by this manager were subject to ratings change during the sample period. These 20 changes were all of one category and no stock moved between the three large ratings groups used here. Thus, we conclude that the result is not due to ratings downgrades.

Figure 16: Price Improvement by Rating (Fund Manager C)



Note: Chart omits data for low rated issues in July 2008, for which the price improvement was -11%; there were no trades in low rated issues in December 2007.

8.3 Price Improvement – Private Quotes

While this is revealing, the comparison made is between achieved prices and the ‘public’ end-of-day quotes recorded by iBoxx. This means that the effect may reflect differences in timing between, for example, a morning trade and an evening quote, as well differences caused by the use of public quotes rather than quotes obtained by a known customer for a specific trade.

One of the fund managers (C) that we examined recorded all the quotes and achieved prices for its trades. This allows a direct comparison of quotes obtained for a particular trade with the price achieved. Quoting behaviour, as recorded, seems to differ between trades, with some quotes expressed as a trade price and some as a spread over a gilt yield. As a result, Figure 17 and Figure 18 show the result comparisons for the two types of quote. In each case, the figure shows the difference between the best quote and the worst quote obtained for every trade (the trade executed, by definition at the best quote), expressed as a proportion of the average of the best and worst quotes.

Figure 17: Price Improvement (Spread Quotes) for Fund Manager C

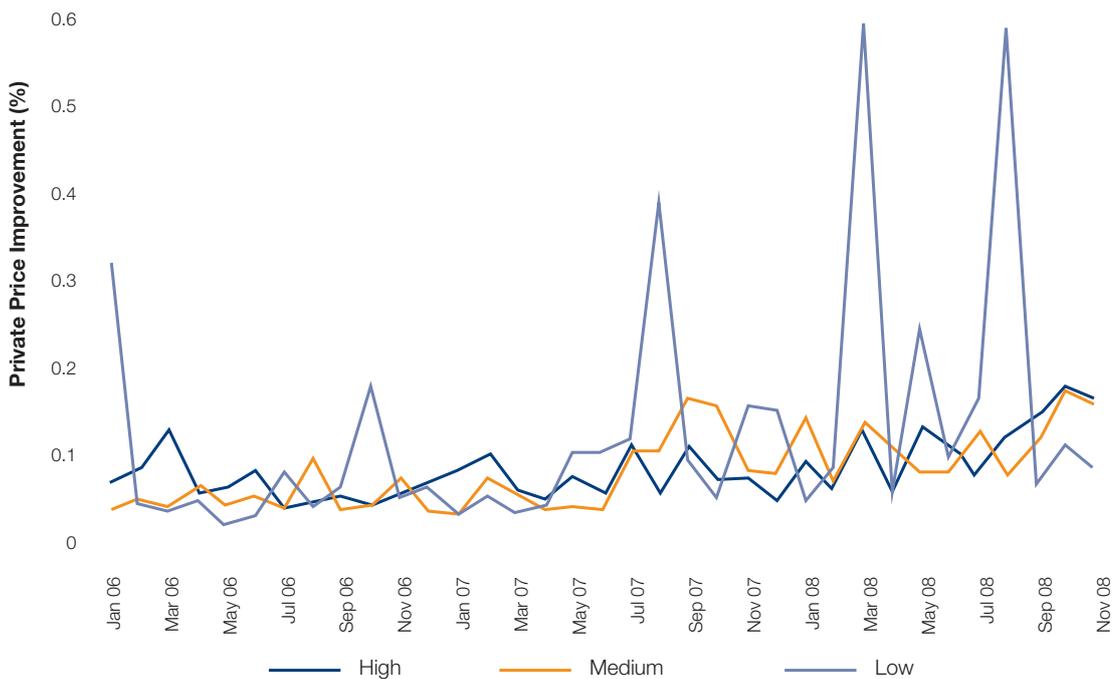
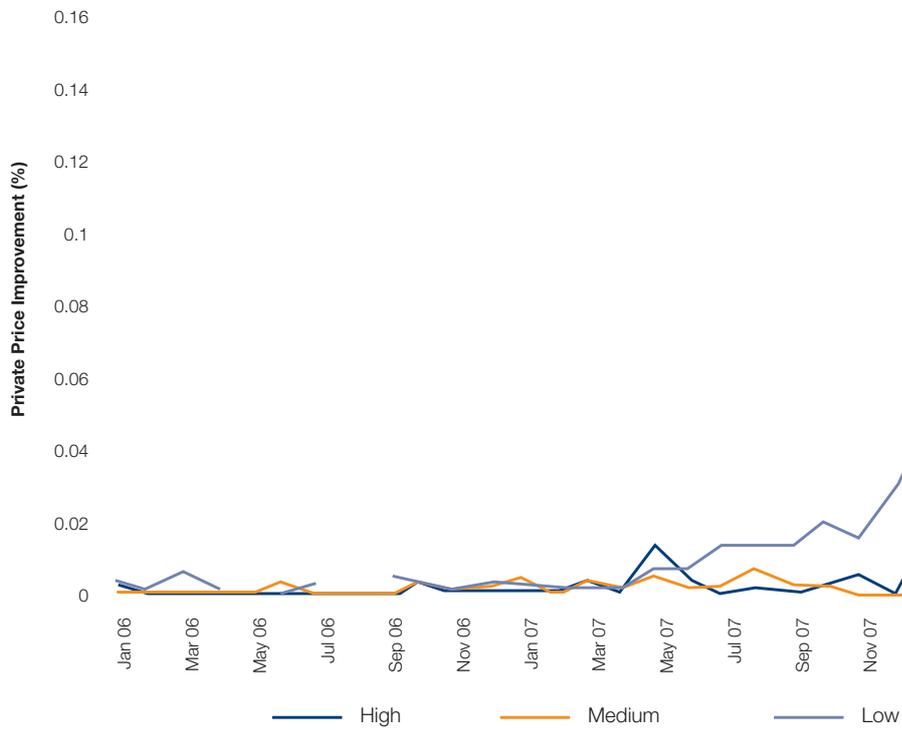


Figure 18: Price Improvement (Price Quotes) for Fund Manager C

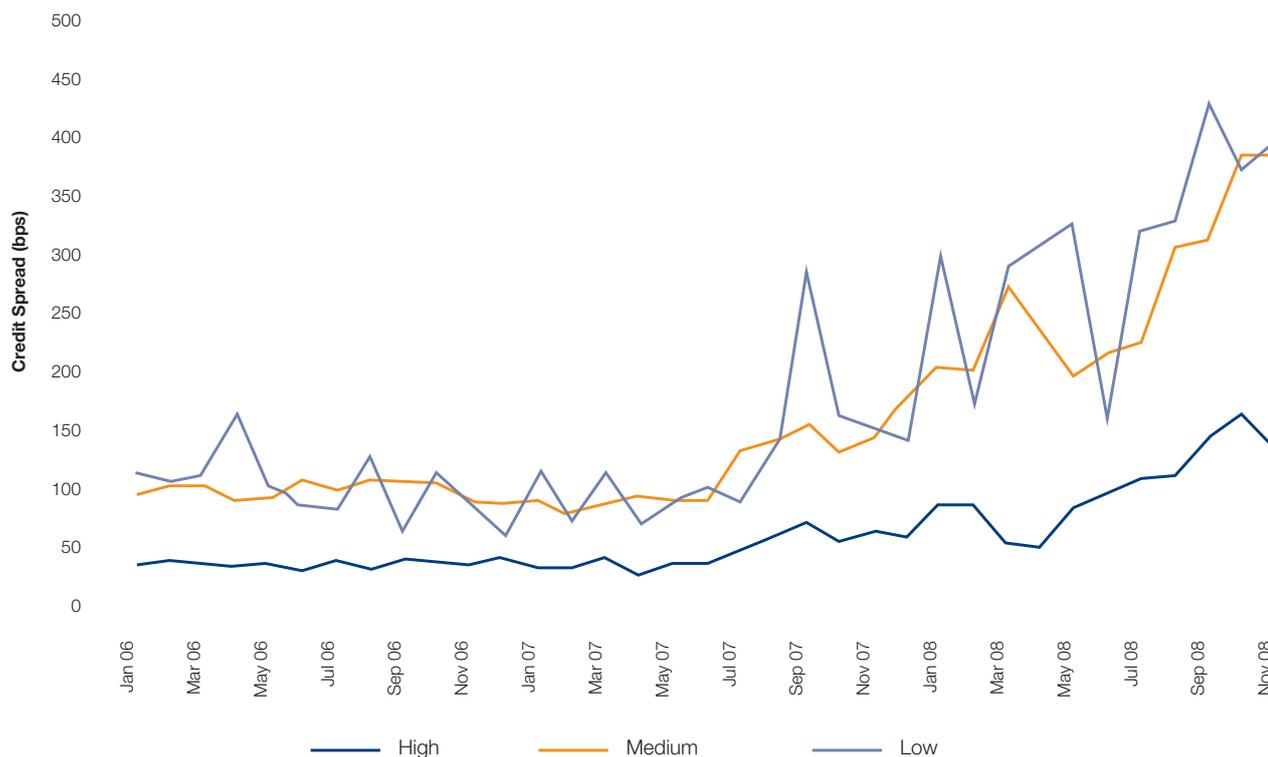


It should be noted that the results are magnified by large numbers of very 'distant' quotes (i.e. quotes made at prices that were very considerable distances from the eventual trade price). Nevertheless, both figures show that the dispersion of quotes has increased significantly in the recent period, with particularly dramatic effects on the price quotes.

8.4 Traded Credit Spread

We can also use the trade data for those trades which were expressed as spreads over gilt to show the evolution of credit spreads for the bonds traded by the manager (C), simply by plotting the quote spread at which trades are actually executed.

Figure 19: Traded Credit Spreads for Fund Manager C



This data is consistent with those reported earlier and shows clearly that credit spreads have increased sharply, particularly for the lower rated issues – even where the spread is quoted to a large, fund manager who is known to the dealer concerned.

8.5 Order Duration and Trade Splitting

One fund manager (B) was able to supply information on the time taken to complete orders in Q3 2007 and Q3 2008 – from the time of the investment decision to completion. The results show a considerable increase in the time taken for many orders, though the increase is localised. In Q3 2007 most orders were completed quickly – 61% within the hour, and the proportion of orders extending into the next day was small at 5%. The median time to complete an order was 45 minutes. (But note that Q3 2007 was already into the credit crisis period, and so results here may already be worse than the pre-crisis norm.) In Q3 2008 the corresponding figures were 57% of orders completed in one hour, with 9% extending into the next day and a median time to complete of 39 minutes.

Table 8 summarises the execution times for trades by fund manager B.

Table 8: Trading Duration for Fund Manager B

	2007	2008
Intraday Trades	1 hour 51 minutes	2 hours 9 minutes
Multi-day Trades	2 days, 6 hours, 56 minutes	6 days, 1 hour, 30 minutes

The summary results seem, on the surface, to show relatively little problem for most orders and this is borne out by a more detailed analysis. However, the table shows a large increase in the time taken for multi-day order completions (from an average of just over 2 days to an average of over 6 days), and the proportion of multi-day orders nearly doubled over the period from 5% to 9%.

Figure 20 on page 50 shows the daily average time (measured in days) taken to complete corporate bond orders in 2007 and 2008 for the fund manager (B). The daily average is naturally dominated by the normal orders, but it is clear that abnormal orders have substantially increased the averages on many days in Q3 2008.

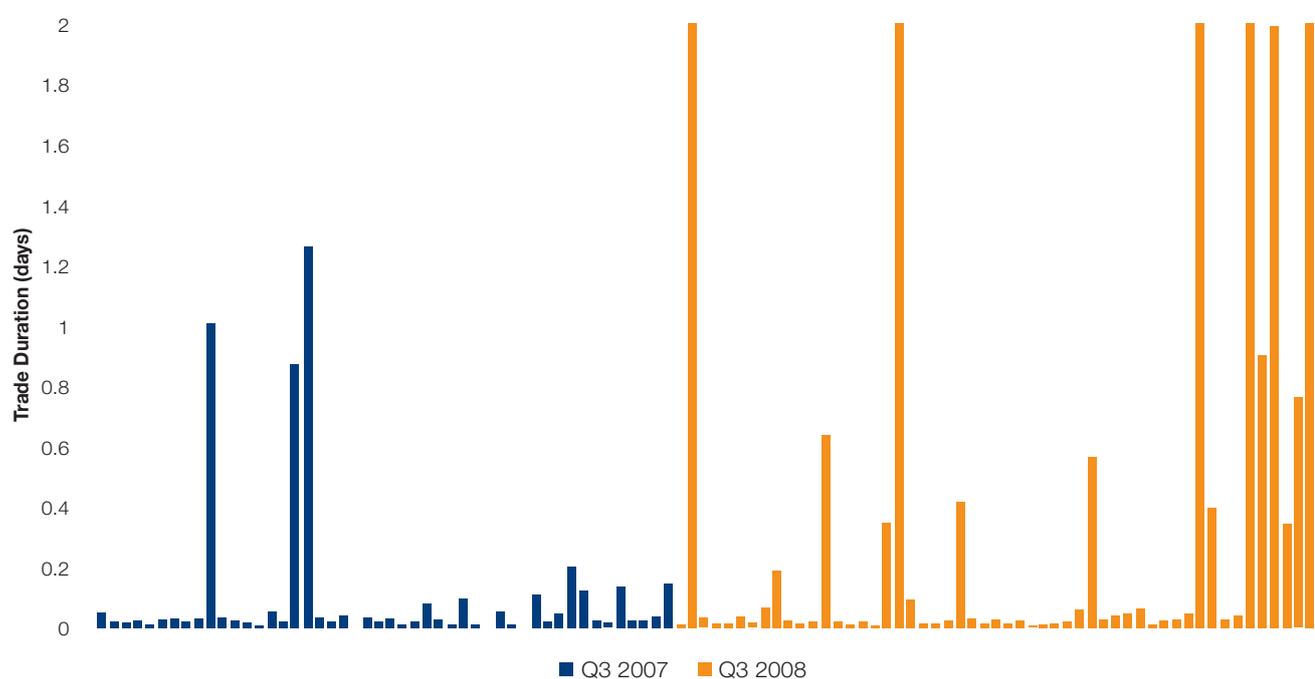
Figure 20: Order Duration (in days) for Fund Manager B

Table 9 shows the time for order completion within deciles. The orders in each period were sorted in ascending order of the time taken to complete the order, grouped into deciles, and an average calculated for each decile. The results show the average time to complete (in minutes). For the first eight deciles there is very little change, and the completion times are roughly the same in the two periods. However in the last two deciles there is a substantial increase in order completion times. The times tripled in the ninth decile, and increased more than four-fold in the tenth decile.

Table 9: Time to Complete Orders (Minutes) by Decile

Decile	Q3 2007	Q4 2008
1	8	9
2	18	17
3	25	23
4	35	30
5	44	36
6	52	53
7	84	86
8	134	137
9	227	697
10	1,961	8,286

The implications of the results, supplemented by discussions with the fund manager, are that, while the fund manager was able to get most orders away within the normal time, they were forced to use different dealing techniques. Difficult orders have become substantially more difficult between the two periods, leading to greatly extended completion times, despite attempts to use different dealing techniques.

8.6 Trade Splitting

The interview process discussed above suggested that some firms were increasingly managing their own order flow. Our data does not contain an indicator of fragmented trades, so we simply measure the number of times that the fund manager trades a given stock each day. At this stage, we do not differentiate between buy and sell trades. Clearly, this measure will significantly overstate the extent of fragmentation, as many independent trades in the same stock may occur on any day. Figure 21 shows the distribution of trading frequency in each of the sample months for one fund manager (C). While there is some slight evidence that the number of multiple trades increased in September 2008, the change is not dramatic.

Figure 21: Frequency of Trades in a Particular Stock in a Day for Fund Manager C

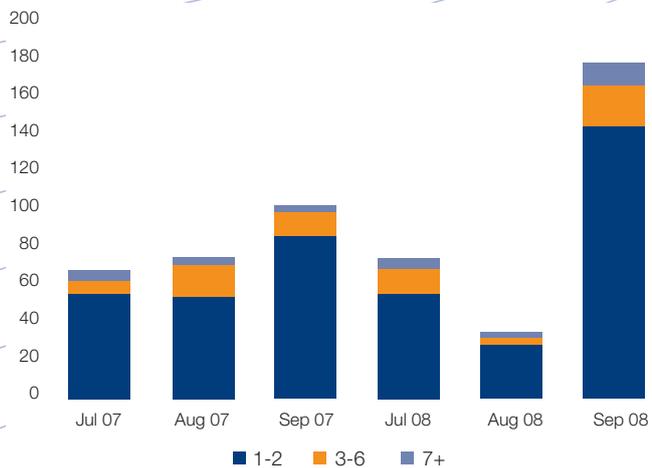
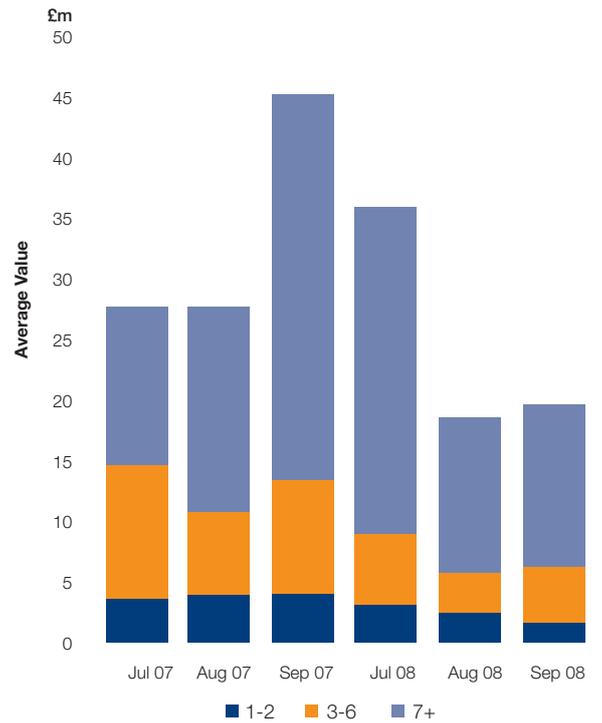


Figure 22 shows the average value of trades in each frequency category for this manager. Again, there is no dramatic change in the relative height of the third component of the bar. Overall, this suggests that fragmentation or trade splitting has not been widely used to ease trading difficulties by this fund manager.

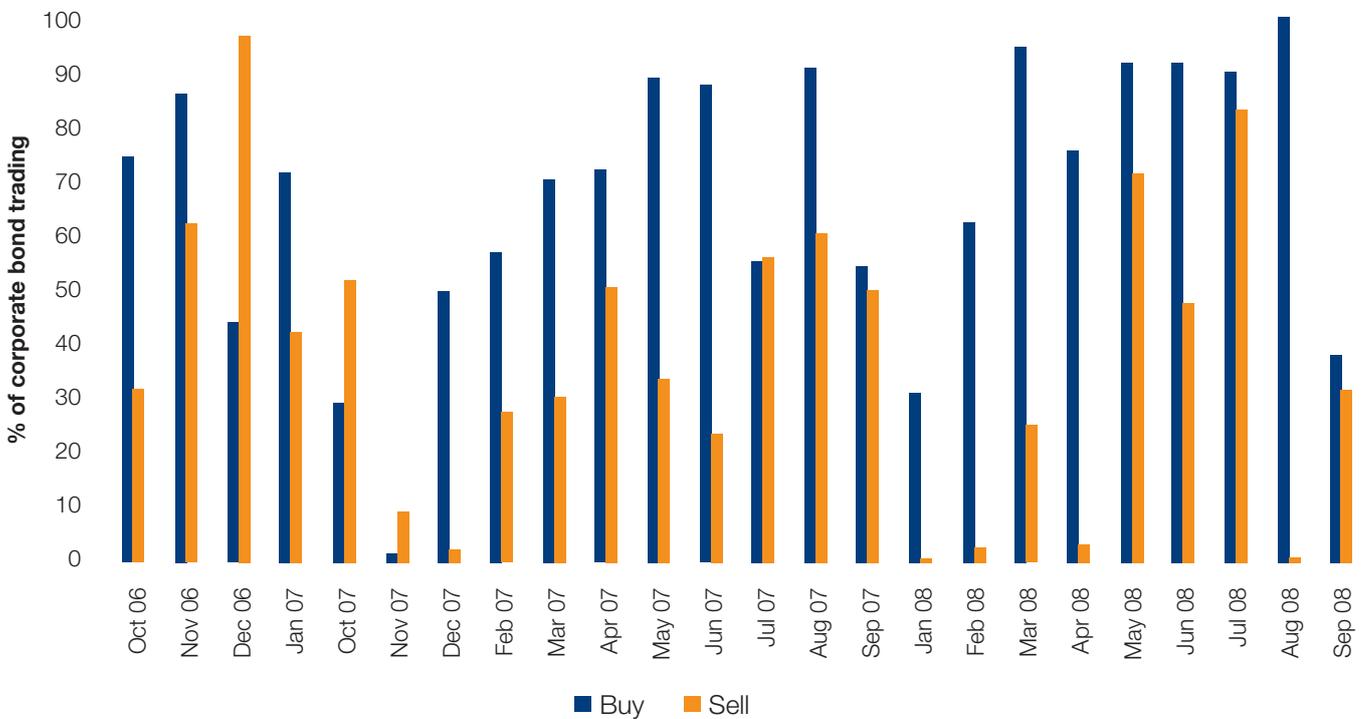
Figure 22: Value of Trades in each Frequency Band for Fund Manager C



8.7 Trade Balance

Finally, while unlikely, it is possible that firms responded to perceived illiquidity by trading gilts, rather than corporate debt. Figure 23 shows the proportion of manager A's trading that was in corporate debt (separately for its buy and sell trades). Use of relatively liquid gilts, rather than illiquid corporate debt would show as a diminution in the height of the vertical bars. This is not obviously present and we reject this as an outcome of the crisis. It should also be noted that not all firms will be in a position to make this substitution.

Figure 23: Proportion of Trading in Sterling Corporate Bonds compared to Proportion in Gilts for Manager A



8.8 Key Conclusions from the Trading Analysis

The key points shown by the trading analysis are:

- Difficulties in trading would be expected to lead to lower volumes, poorer prices and longer execution times. However the data suggest that trading levels have been maintained, largely through fund managers adapting their trading strategies to the new situation.
- There is evidence that quote quality has deteriorated, both in terms of wider spreads and quotes being a poorer guide to eventual trade prices.
- There is evidence that order execution times have increased as the crisis has continued. It appears that the proportion of orders that could be classed as difficult has increased substantially, and that the order completion times for the more difficult orders have increased very substantially.
- Fund managers have not generally resorted to splitting orders to achieve executions. Where they have used different techniques, this has mainly involved using brokers to seek out execution opportunities and then transacting the whole order in a single trade.

9. Operational Implications

9.1 Market Structure

Some of the views expressed by buy-side managers involve criticism of the dealer market structure (e.g. dealers have withdrawn capital, and widened spreads). However the buy-side traders are fully aware that these are natural and rational responses of dealers to the circumstances they find themselves in. An increase in risk will inevitably make dealers more cautious about taking positions and increase the spreads they charge for offering immediacy. However, there was some doubt as to whether the traditional dealer market will return, even when conditions improve, not least because the buy side will have less confidence in future about dealers' commitment to the market.

Buy-side traders also appreciate that highly illiquid markets cannot easily support dealer market structures. This has long been true in the equity market where all but the smallest orders in second tier stocks and below are negotiated and placed with clients rather than being executed against dealers' books. Only the smallest (or most desperate) investors demand immediacy and pay the cost through a wide bid-ask spread.

More generally equity markets have come to offer tiered market structures with each tier suited to the condition of the market. Order books for the most liquid stocks with little intermediation required; hybrid systems for stocks with moderate liquidity where dealers provide capital but with a reasonable assurance that there is sufficient order flow to unwind position; brokered markets for less liquid stocks; and bulletin boards for the highly illiquid.

Recognising the difficulties and the developments in other markets, the feeling among interviewees was that the dealer structure was there precisely because it could provide liquidity in difficult times and had therefore failed to meet its purpose. A number of interviewees expressed a willingness to pay commission to brokers for better execution (traditionally the bond market is predominantly a net market). However there was little evidence that the structures to support a brokered market really exist, either in the buy-side investors or in the wider market. Similarly there was little evidence that fund managers were fully aware of the alternative market structures which could be made available.

9.2 Market Participation

While it is tempting, and may be correct, to argue that markets should be freely available to both retail and institutional customers, the results presented above suggest that, while bonds may be conceptually easier to understand than equities, the current market structure militates against retail participation in the debt markets.

One set of reasons relates to the very large number of issues that investors must choose between. Although the number of issuing companies is similar to that found in equity markets, each firm may have made many different issues, which differ and interact in complex ways. In particular, investors need to understand the implications of covenants, call provisions, seniority and the like. These are, of course, critical determinants of repayment in the event of corporate failure. The task of understanding and choosing between bond issues is not made easier by the apparent difficulties of understanding the bond ratings (difficulties shared, it seems by both institutional investors and the rating agencies themselves).

In addition, the large lot sizes typically used in the UK (50,000 is usual – the level at which exemption from the Prospectus Directive is permitted) also makes the likelihood of retail participation smaller. It is interesting that European issues frequently have much smaller lot sizes (for example, 23 of the 29 corporate issues in Germany in 2008 were at lot sizes of 1,000).

What the discussion in earlier section reveals is that there is another set of issues, which may further hinder retail participation and these relate to the structure of the corporate bond market itself. In particular, the OTC nature of the market makes the achievement of ‘normal’ levels of pre- and post-trade transparency (as they are understood in other markets) difficult to achieve; the difficulty of designing and implementing best execution rules (which are critical components of retail investor protection); and the consequences of market illiquidity all act as barriers to effective retail involvement in the UK corporate bond market. Indeed, illiquidity alone may make bond investment unwise for almost all retail customers. These points are sufficiently important that we address them in the following sub-sections.

9.3 Transparency

There were two areas where transparency was an issue:

- Trade transparency is not a strong feature of the Sterling corporate bond market and most interviewees felt this could be improved to their benefit. Their obligation to provide best execution required greater knowledge of current prices and it would be hard to fulfil this with current levels of transparency.
- Risk ratings had clearly failed to capture the risk in many bonds. Whether this was a function of the ratings agencies being too close to the issuers of complex products, or whether it was a function of failing to factor liquidity risk into the ratings, there is a clear feeling that the structures as currently set up have not worked.

9.4 Best Execution

Regulators generally impose some form of best execution obligation on agency brokers – at least for retail clients. For retail transactions in a market with pre-trade transparency, and where there is only a single trading venue, best execution is straightforward – trades should be done with all speed at the best price available at the time. However, assessing best execution for a transaction becomes more difficult in the following circumstances:

- Larger transactions may require immediacy but the cost of immediacy for such transactions may be substantial. For orders motivated by liquidity, best execution might mean patient trading to achieving a better average price while insisting on immediate execution might result in substantially worse execution.
- Where there is more than one trading venue, best execution would, in theory, require a search of all venues to find the best price. However the cost of doing this may outweigh the likely gain, so best execution could be achieved by executing an order in the venue which is likely to have a good, but not necessarily best, price. Thus in dealer markets, managers do not ask for quotes from every dealer, but only from a subset. Of course, the manager will also limit the number of dealers he approaches in order to protect against knowledge of his trade being used to push up the cost of his trade.

- Where there is limited pre-trade transparency it is difficult to ensure that a quote is the best quote. Again the cost of extended search in an opaque market may outweigh the likely gain.

Bond markets generally meet all three of these – transactions are mainly large relative to the market, there is usually no single trading venue and there is little pre-trade transparency (indicative quotes only). For all these reasons the concept of best execution is not well defined, or poorly understood, in bond markets. However, MiFID required fund managers to achieve best execution for their clients and so firms are obliged to institute structures that are likely to get best execution, and to monitor execution quality.

This suggests that, although a fund manager may make a reasonable attempt to obtain best execution, they might not always succeed. This implies that best execution cannot be properly assessed on a single transaction but only over a series of transactions. To address this, a number of approaches have been adopted:

- Monitoring transaction costs – increasingly institutional investors monitor their transaction costs measured in such a way as to encompass costs/gains from patient trading;
- Transparency – publishing execution quality (based on an analysis of results for all trading venues to assess whether a fund manager's decision to focus on a limited subset of venues is justified);
- Policy - requiring fund managers to have an execution policy that is designed to achieve best execution, requiring monitoring of performance and adjustment of the policy in line with results.

MiFID favours the policy approach (which, given the lack of data on the Sterling corporate bond market, is also probably the only realistic choice), and managers of UK bond portfolios are required to have trading policies designed to achieve best execution. The interviews suggested that this had not been an entirely easy process and fund managers' processes were still bedding in.

The sense gained from the interviews was that implementation of the requirements was at a relatively early stage among bond fund managers and that best execution performance was being monitored mainly in relation to the prevailing price. As we have indicated above, more than just price is also relevant in assessing execution quality – for example, equity market fund managers typically measure best execution against a wider range of factors such as whether the nature of the investment justifies a payment to a dealer for immediate execution or whether a less immediate trade would be more in the investor's interest. Measuring purely against prevailing price imparts a bias towards immediacy and dealer positioning. If fund managers are to develop new trading strategies they will need to ensure best execution monitoring which captures the benefits achieved by using an alternative trading mechanism.

One manager we spoke to described their best execution policy and showed us a list of codes to be used by their in-house dealing desk when they had either not been able to get the best price displayed on information vendor systems, or had chosen not to take the indicative best price apparently available at the time of the trade. The list is shown in Table 10 below:

Table 10: List of Reasons for Failure to Achieve Apparent Best Quote Available at time of Execution

1. Better prices shown had not been updated	8. Better prices shown were not valid for size of order
2. Better prices shown were erroneous	9. Disclosure of business to broker(s) indicating better price was likely to have undermined stock price
3. High yield bond – no Bloomberg info – other quotes found	10. No dealing relationship with broker(s) indicating better price
4. Switch – prices on Bloomberg based on single trade only	11. Better prices shown by broker(s) with record of unreliable pricing
5. High yield bond – no Bloomberg info – dealt at only price available	12. Better prices shown by broker(s) with poor back office systems
6. Illiquid bond – no Bloomberg info – dealt at only price available	13. Bloomberg prices moved since trade
7. Better prices shown were not valid for direction of order	14. Fast market – dealt quickly to avoid exposure to market risk

Note: “Bloomberg” refers to the ALLQ public quote data.

The manager supplied us with data as to the frequency of use for each code/reason. For reasons of confidentiality we have not included the details but to illustrate:

- Nearly 30% of transactions had a code, indicating that the price obtained did not correspond to the apparent best quote, for the reason given;
- Almost 50% of the codes/reasons were 1 and 2 – indicating that the quotes listed were either stale or wrong;
- Codes/reasons 7 to 14 had not been used at all.

The nature of the most common reasons – price quotes available (on public systems) were wrong or out of date – is indicative of the low level of transparency in the market and the difficulty of achieving a verifiably good execution result relative to trading taking place in the market. Over time fund managers will become more familiar with the concept, but the limitations of a market structure designed to prevent exposure of individual dealers’ positions will always limit their ability to deliver.

10. Conclusions and Market Implications

10.1 Market Disruption is Real and Damaging the Buy-Side

The market for Sterling corporate bonds has suffered severe disruption since the start of the credit crisis in July 2007. Symptoms of this have been:

- Much wider spreads. Empirical evidence and interview evidence strongly support this. Spreads have widened considerably for all types of bonds, but the greatest impact has been on those bonds perceived as having higher risk, namely bonds issued by financial institutions, longer dated bonds, lower rated bonds (BBB), subordinated bonds and collateralized bonds (which have generally suffered irrespective of collateral quality). Spreads on the more risky bonds have more than trebled and even spreads on relatively safe bonds, for example AAA corporates, have roughly doubled.
- Absence of markets or one-way markets. The traditional trading mechanism, namely the liquidity supplied by dealers, has dried up. Where previously dealers were willing to quote two-way prices in sufficient size to take an entire order, possibly improving on indicative quotes for long-standing customers; they are frequently unwilling to quote at all, or if they do the quotes are likely to be:
 - One-way only (which in a selling market usually means dealers will only quote offers);
 - In smaller size forcing customers to split orders, though the limited evidence we have suggests this has not been particularly common, or reducing the average order size;
 - Not negotiable and only available for a short time.

- Greater price uncertainty. Interviews and empirical evidence support the claim that prices were far less certain since the start of the credit crisis. There is never much pre-trade (or post-trade) transparency in the Sterling corporate bond market, but the relatively low volatility in the past meant that the sort of indicative information available, such as the iBoxx data used in this study and that published by the information vendors, was sufficient. In the much faster moving market of the credit crisis, the absence of much information and the severe deterioration in the quality of what is available (for example the much wider spreads quoted for indicative prices) has meant that buy-side investors have been largely trading blind.

Evidence on volumes is unclear. Despite repeated comments from interviewees that volumes had collapsed, the limited empirical evidence suggests that this is not the case. However, absence of aggregate, market volume information means we cannot comment further on this.

All the indications are that 18 months into the credit crisis the situation for institutions operating in the Sterling corporate bond market is not improving. Indeed, the suggestion is that it is getting worse. There is certainly no expectation of any improvement in the near term. Since bonds form a large (and growing) part of the investment portfolio of UK fund managers, the severe deterioration in the market supporting a large part of their portfolio must be a source of great concern.

10.2 The Dealer Market has Failed and may not Recover

The Sterling corporate bond market operates as a traditional dealer-based market almost entirely on telephone quotes and negotiation. Innovations, such as electronic trading platforms, have made far less impact than has been the case in markets for other assets and in larger bond markets. In many ways the market resembles the UK equity market of 25 years ago.

The consensus of those we spoke to, and the message from the empirical evidence, is that the quality of this dealer market has diminished substantially since July 2007. The traditional long-term relationships between dealers and customers have largely broken down and buy-side traders are having to operate in an unfamiliar world. There is little expectation that normal service will be resumed in the near future. Buy-side traders understand that the profitability of the dealers from this part of their business has never been high (given the smallness of the Sterling market) and the credit crisis has merely precipitated something that was part of an existing trend.

Many buy-side traders are responding by examining alternatives, and there is a growing willingness to, for example, pay commission to brokers for execution. Similarly there is an awareness that the traditional block-trading practice may have to give way to more patient trading styles when the order does not justify the cost of immediacy.

The requirements of MiFID for best execution are reinforcing this trend, though understanding of best execution seems to be at a simplistic level in the corporate bond market. Best execution has conventionally been seen in terms of getting the best price for immediate execution. Other markets have realised that what is the correct metric for best

execution depends on the circumstances of the order, and that the best current quote – or better still traded price - is only one factor in assessing the quality of order execution.

However these developments do not sit easily with the current nature of the market. The lack of transparency and trading infrastructure are barriers as, indeed, is the need for new skills to support a market where the concern over the quality of execution of orders becomes a more important part of the fund management process.

If the dealer market does not return – and a return in anything like its traditional form is unlikely, at least in the view of fund managers, then the question arises as to what might replace it. A detailed prescription would require considerably more research and consultation than has been feasible for this project but there are some straws in the wind from the results of this study and from what has happened in equity and other markets:

- A number of fund managers have said they were exploring the use of brokers to negotiate transactions with other investors. This has been characteristic of equity markets where investors have come to realise that paying for immediacy (either through a dealer's spread or through moving the price) is often not justified by the strength of the investment idea underlying the order. If a trade is, for example, purely liquidity driven then transaction costs can be reduced by patience and using anonymous agents to seek out counterparties. When, as has been the case, dealer liquidity was relatively cheap then the imperative to seek alternatives was weak. But with dealer liquidity remaining scarce, selective and expensive changes the decision on the method of trading has shifted in favour of alternatives.

- Electronic systems have made inroads into traditional OTC markets for bonds. As yet the impact is patchy but increasingly hard to ignore. Traditional exchange-type trading platforms have not been successful but platforms that attempt to replicate the OTC negotiation market while streamlining the process are increasingly capturing business particularly in liquid stocks where the steady order flow means that end-investor counterparties are likely to be present to take the other side of an order. At the other end of the market in illiquid bonds there may also be potential to access so-called “dark pools of liquidity” for placing large blocks of bonds.
- Regulatory changes are increasingly affecting bond markets:
- Transparency has never been strong in bond markets and this has supported the dealer market. While the debate continues in Europe it is clear that the arguments for greater transparency have probably been strengthened by the credit crisis.
- Best execution responsibilities requiring fund managers to seek best execution and monitor their performance will focus attention on transaction costs and whether investment performance is consistent with fund managers’ best execution policies.
- The bond market has become more polarised with much larger yield differences between low-risk and higher-risk bonds. This has been reflected in the transaction costs through higher spreads suggesting that a one-size-fits-all trading structure is no longer appropriate. Increasingly in other assets the trading system varies with the nature of the stock and equity markets have adopted hybrid structures that better reflect the individual characteristics of stocks. The uneven distribution of bond trading over time with trading concentrated in short windows suggests that the “right” trading structure for bonds may not only vary with the nature of the stock but also from day to day.

10.3 The Risk of becoming a Backwater is Increasing

The UK fund management industry relies upon the existence of a sizeable Sterling corporate bond market, particularly the pension sector faced with an aging population. So a continued decline in the importance of the Sterling market would be damaging for them. In the medium term issuance of Sterling government debt is likely to be more than enough to meet any demand. The prospects for corporate debt are less clear:

- There are reports that some fund managers are disintermediating the banks and making loans direct to UK corporates – in preference to investing in corporate bonds. This has long been the effective practice for US funds who have invested in bonds of smaller companies by buying a large proportion, or even all, of an issue making the bonds effectively syndicated loans. The reports suggest that direct loans can have higher seniority than bonds, though how existing bond holders and rating agencies will view such dilution of seniority remains to be seen.
- Sterling corporate bonds may become a more attractive finance source for good quality issuers. Following the Asian crisis of 1997, which was largely driven by excessive and unwise bank lending to corporates (and exacerbated by currency mismatches), there has been increased interest in bond markets as a more stable source of finance for domestic corporates. Most Asian countries at the time had only the most basic government debt markets so progress in developing corporate markets has generally been slow (with exceptions such as Korea), but the UK with a well-developed government bond market may see a revival of interest in corporate bond issuance.

But whichever outcome transpires the Sterling corporate bond market is and will remain small relative not only to the US market, but also to the Euro-based market. This, together with a reliance on traditional structures, albeit those which have served it well in the past but which may not be adequate for the future, is tending to make the Sterling corporate bond market into something of a backwater.

This risk was stressed by interviewees who pointed out that the small size tended to deter global players from making substantial commitment to the market. It is not unusual for smaller markets to face this problem. Most markets outside the US and UK have, at some time or other, been backwaters and have had to innovate to attract interest in a competitive global market. UK markets have rarely been in this position, but changes in the global nature of bond markets increase the risk that the Sterling corporate bond market will fall by the wayside in the way that the UK equity market came close to in the early 1980s. Other markets in this position have found that radical changes, rather than slight tweaks (such as changes to pre/post trade transparency rules or attempting to impose liquidity obligations on market makers) to the existing model, are required to bring them into the mainstream. If the Sterling corporate bond market is to avoid becoming marginalised it needs to see a significant effort to innovate in a way that gives the market a continuing attractiveness to global players.

10.4 The Absence of Data Restricts Evidence-based Policy

This research was planned as a largely empirical study. Unfortunately this has not been possible because of the absence of market data relating to trading on the Sterling corporate bond markets. Had we been asked to examine other substantial markets in the UK, such as the equity market or the futures market, then comprehensive data on transactions and pre-trade prices would have been available.

For the Sterling corporate bond market the only available data consisted of:

- Indicative end-of-day quote data for a limited number of stocks.
- Case-study trading data supplied by a small number of buy-side institutions.

The literature survey was only able to find two empirical studies relating to the Sterling corporate bond market. In contrast, the US market can show a large number of studies relating to many aspects of trading and pricing. Much of the US work has been produced following the introduction of the TRACE reporting requirement and the compilation of that data into a dataset which has been opened to researchers. Such data is collected in the UK but has not been made available to researchers.

The thrust of regulation and development strategies in recent years has been towards evidence-based rather than anecdote-based policy. The absence of data relating to the Sterling corporate bond market means that regulatory and other development initiatives cannot easily be based on evidence since there is so little evidence available. This is akin to the situation in the UK equity market in the early 1980s when policy and regulatory decisions were driven by market sentiment rather than empirical examination.

Reporting of bond transactions to regulators was introduced in MiFID and applies (but with differing interpretations) to all European countries. It has long been a requirement of the UK regulator, as it has been for other assets. However, in contrast to other assets where regulatory reporting is required, the data is not readily available to researchers. As the post-MiFID data set builds up, it is hoped that the FSA, and other regulators, will in future be prepared to make it available to researchers in anonymised form.

Appendices

APPENDIX A – Interview Questions

The Investment Management Association has reported that a number of their members had difficulties in trading cash fixed income securities during the recent credit crunch. They have asked the ICMA Centre, University of Reading to research these difficulties. We are conducting a series of interviews with key participants to understand their experience and the issues raised by that experience.

The following questions indicate the areas in which we are interested – but should not be regarded as exclusive:

- Were all investing institutions – as far as you are aware - affected equally?
- What was the mechanism which translated the credit difficulties into market difficulties – lack of credit for dealers for example? If the impact was on dealers' ability or willingness to facilitate trading, were they equally affected?
- Were you able to counter or offset the impact by, for example, adopting different trading strategies?
- We are keen to provide empirical evidence of the impact of the credit difficulties. What metrics might you suggest as likely to be useful – spreads, turnover levels etc?
- Do you see any policy implications from what has happened – for example, would a different market structure have coped better or worse?
- Is there anything else that we should be asking about?
- What were the effects of the recent credit crunch on your experience in trading fixed income securities?
- How did this effect show itself – wider spreads, lower available size, and intermittent stoppages in the market?
- To what extent were the effects different to those you might normally expect in a period of some uncertainty – i.e. was there a failure of the market as opposed to just a re-pricing of risk?
- Were related markets – derivatives, swaps for example – also affected?
- When did these effects first become visible? When did they stop? Are they still apparent in the market?
- Were different types of transaction affected differently – buys, sells, large, small etc?
- Which bonds were most/least affected?

APPENDIX B – References

- Alexander, G.J., Edwards, A.K. and Ferri, M.G. (2000) The Determinants of Trading Volume of High-Yield Corporate Bonds, *Journal of Financial Markets*, Vol 3, No. 2, May, 177-204.
- Bao, J. and Pan., J. (2008) Excess Volatility of Corporate Bonds, Working paper, MIT, February.
- Bao, J., Pan., J. and Wang, J. (2008) Liquidity of Corporate Bonds, Working paper, MIT, July.
- Bessembinder, H. and Maxwell, W. (2008) Transparency and the Corporate Bond Market, *Journal of Economic Perspectives*, Vol. 22, No. 2, Spring, 217-234.
- Bessembinder, H., Maxwell, W. and Venkataraman, K. (2006) Market Transparency, Liquidity Externalities and Institutional Trading Costs in Corporate Bonds, *Journal of Financial Economics*, Vol. 82, No. 2, November, 251-288.
- Biais, B. and Declerck, F. (2007a) European High-Yield Bond Markets: Transparency, Liquidity, Efficiency, IDEI Working Paper and Investment Management Association, March,
- Biais, B. and Declerck, F. (2007b) Liquidity, Competition and Price Discovery in the European Corporate Bond Market, IDEI Working Paper No. 475, Toulouse School of Economics, August.
- Biais, B., Declerck, F., Dow, J., Portes, R. and Von Thadden, E. (2006) *European Corporate Bond Markets: Transparency, Liquidity, Efficiency*, City of London, May.
- Board, J., Sutcliffe, C. and Vila, A. (2000) Market Maker Performance: The Search for Fair Weather Market Makers, *Journal of Financial Services Research*, Vol. 17, No. 3, September, 259-276.
- Cai, N. and Jiang, X. (2008) Corporate Bond Returns and Volatility, *The Financial Review*, Vol. 43, No. 1, 1-26.
- Campbell, J.Y. and Taksler, G.B. (2003) Equity Volatility and Corporate Bond Yields, *Journal of Finance*, Vol. 58, No. 6, December, 2321-2349.
- CESR (2008) Transparency of Corporate Bond, Structured Finance Product and Credit Derivatives Markets – Consultation Paper, Committee of European Securities Regulators, CESR/08-1014.
- Chacko, G. (2006) Liquidity Risk in the Corporate Bond Markets, Working paper, Harvard Business School, April.
- Chakravarty, S. and Sarkar, A. (2003) Trading Costs in Three US Bond Markets, *Journal of Fixed Income*, Vol. 13, No. 1, June, 39-48.
- Chen, L., Lesmond, D.A. and Wei, J. (2007) Corporate Yield Spreads and Bond Liquidity, *Journal of Finance*, Vol. 62, No. 1, February, 119-149.
- De Jong, F. and Driessen, J. (2005) Liquidity Risk Premia in Corporate Bond Markets, Working paper, University of Amsterdam.
- Downing, C., Underwood, S. and Xing, Y. (2005) Is Liquidity Risk Priced in the Corporate Bond Market? Working Paper, Rice University.
- Downing, C., Underwood, S. and Xing, Y. (2008) The Relative Informational Efficiency of Stocks and Bonds: An Intraday Analysis, *Journal of Financial and Quantitative Analysis*, forthcoming.
- Edwards, A.K., Harris, L.E. and Piwowar, M.S. (2007) Corporate Bond Market Transaction Costs and Transparency, *Journal of Finance*, Vol. 62, No. 3, June, 1421-1451.
- Elton, E.J., Gruber, M.J., Agrawal, D. and Mann, C. (2001) Explaining the Rate Spread on Corporate Bonds, *Journal of Finance*, Vol. 56, No. 1, February, 247-277.
- Financial Services Authority (2005) Trading transparency in the UK secondary bond markets, DP 05/5, September 2005.
- Gebhardt, E., Hvidkjaer, S. and Swaminathan, B. (2005) Stock and Bond Market Interaction: Does Momentum Spill Over?, *Journal of Financial Economics*, Vol. 75, No. 3, March, 651-690.

- Goldstein, M.A., Hotchkiss, E.S. and Sirri, E.R. (2007) Transparency and Liquidity: A Controlled Experiment on Corporate Bonds, *Review of Financial Studies*, Vol. 20, No. 2, March, 235-273.
- Guran, U.G., Johnston, R. and Markov, S. (2008) The Informational Effects of Sell-Side Debt Research on Debt and Equity Markets, Working paper, University of Texas at Dallas, June.
- Hong, G. and Warga, A. (2000) An Empirical Study of Bond Market Transactions, *Financial Analysts Journal*, Vol. 56, No. 2, March-April, 32-46.
- Hotchkiss, E. and Jostova, G. (2007) Determinants of Corporate Bond Trading: A Comprehensive Analysis, Working Paper. Boston College.
- Hotchkiss, E.S. and Ronen, T. (2002) The Informational Efficiency of the Corporate Bond Market: An Intraday Analysis, *Review of Financial Studies*, Vol. 15, No. 5, Winter, 1325-1354.
- Houweling, P., Mentink, A. and Vorst, T. (2005) Comparing Possible Proxies of Corporate Bond Liquidity, *Journal of Banking and Finance*, Vol. 29, No. 6, June, 1331-1358.
- Investment Management Association – IMA Asset Management Survey 2007
- Kalimipalli, M. and Warga, A. (2002) Bid-Ask Spread, Volatility and Volume in the Corporate Bond Market, *Journal of Fixed Income*, Vol. 11, No. 4, March, 31-42.
- Kwan, S. (1996) Firm Specific Information and the Correlation Between Individual Stocks and Bonds, *Journal of Financial Economics*, Vol. 40, No. 1, January, 63-80.
- Lesmond, D., Ogden, J. and Trzcinka, C. (1999) A New Estimate of Transactions Costs, *Review of Financial Studies*, Vol. 12, No. 5, Winter, 1113-1141.
- Mahanti, S., Nashikkar, A., Subrahmanyam, M., Chacko, G. and Mallik, G. (2008) Latent Liquidity: A New Measure of Liquidity with an Application to Corporate Bonds, *Journal of Financial Economics*, Vol. 88, No. 2, May, 272-298.
- Menz, K.M. (2007) The Empirical Evaluation of Euro Corporate Bonds: Evidence from a Panel-Econometric Analysis, Working paper, Bergische University of Wuppertal, December.
- Merton, R. (1974) On the Pricing of Corporate Debt: the Risk Structure of Interest Rates, *Journal of Finance*, Vol. 29, No. 2, May, 449-470.
- Ronen, T. and Zhou, X. (2008) Where Did All the Information Go? Trade in the Corporate Bond Market, Working paper, Rutgers University, May.
- Schultz, P. (2001) Corporate Bond Trading Costs: A Peek Behind the Curtain, *Journal of Finance*, Vol. 61, No. 2, April, 677-698.
- Webber, L. and Churm, R. (2007) Decomposing Corporate Bond Spreads. Bank of England, Quarterly Bulletin, Vol. 47, No. 4, 533-541
- Woodley, M. (2007) Liquidity in the Over-the-Counter Market for Corporate Bonds, Working paper, Samford University. Alabama.
- Xing, Y., Zhang, X. and Zhou, X. (2007) Systematic Liquidity in Corporate Bonds, Working paper, Rice University, October.

Investment Management Association

65 Kingsway
London WC2B 6TD
United Kingdom

Tel: +44 (0)20 7831 0898
Fax: +44 (0)207 831 9975

www.investmentuk.org

May 2009