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The effectiveness of mandatory disclosure under Britain's Financial Service Authority: An economic analysis

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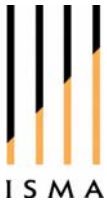

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Abstract

Sweeping regulatory reforms in Britain produced the Financial Services Authority (FSA) resulting in a significant increase in mandatory disclosure. Because greater transparency of information is a major objective for the FSA, shifting from one information system to another has re-distributive effects. We identify these effects at a sector level and their drivers at the firm level.

At a sector level, the FSA has generally increased the precision of investors' priors reducing the information risk component of the cost of capital. At a firm level, large firms act as "Stackelberg leaders" in voluntary disclosure games. FSA regulation counteracts the strength of the leaders and shifts power to the "followers".

Keywords: Disclosure; Regulation; Game Theory, Stackelberg Leader, Cost of Capital; Information Asymmetry

JEL classification: C1; C7; D8; G2; M4

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Seldom does an opportunity present itself to test the effectiveness of mandatory regulatory objectives than for an economy such as Britain's that moved from regulation by function, designed around many separate agencies, to a system of centralized mandated regulation (Dale and Wolfe (2003), Goodhart, Hartmann, Llewellyn, Rojas-Suárez and Weisbrod (1998)). Recently, the passing of the Financial Services and Markets Act 2000 (the Act) on November 30, 2001 introduced sweeping regulatory reforms in the United Kingdom with the formation of the Financial Services Authority (FSA). In relation to this Act, the then Chairman of the FSA (Sir Howard Davies) commented[3]:

> "No other major country has re-engineered the whole of its financial regulation at one time"

The importance of disclosure was high on the list of assumptions for this major re-engineering:

> "Transparency of information in the marketplace promotes market discipline, which in turn maintains standards of conduct."[4]

In this paper, we focus on measuring the effectiveness of this re-engineering, relative to regulatory objectives for the four key UK financial market sectors. Further, at a micro level, we adopt a game theoretic approach and analyse the impact of the regulation upon the voluntary disclosure game for companies within these four sectors. Two of the sectors shifted from a régime of self-regulatory organizations (SROs) to a single regulatory agency while the other two shifted from a set of regulatory agencies to the same single agency, the FSA. The overriding objectives were to increase market confidence, public awareness,

[3] FSA Annual Report 2000/2001,
[4] FSA web site page Updated August 13, 2002: http://www.fsa.gov.uk/approach/1_philosophy.html

consumer protection, and reduce crime potential by attaining greater transparency of information within a single agency. The FSA's objectives are backed up by a draconian list of criminal and civil penalties arising from "market abuse" defined as "improper conduct that undermines the UK financial markets or damages the interests of ordinary market participants."[5]

It is well known that shifting from one information system to another information system will have re-distributive effects (Demski (1973), Demski (1974)). The two central objectives of this paper are to identify these re-distributive effects at the sector level then to identify the drivers of observed sector level behavior by identifying the re-distributive effects at an individual firm level. The former objective has important implications for the information risk component of the cost of equity capital of firms within each sector (Easley and O'Hara (2004)). The latter objective has important implications for gaining a better understanding of the nature of conflicts of interest within the voluntary disclosure game (Admati and Pfleiderer (2000), Dye (1990)).

Analytically, the re-distributive effects can go in different directions. Increased levels of mandated disclosure can have both positive and negative implications for different firms in the economy. As a result, the aggregate or net effect becomes an empirical issue. In this paper we test for these re-distributive effects by extracting out information using a new methodology. This methodology is designed to measure the impact of re-distributive effects upon the risk neutralized distribution under the assumption that prices are arbitrage free.

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[5] www.fsa.gov.uk/enforcement/market_abuse.html . The criminal offences are making a misleading statement and engaging in a misleading course of conduct for the purpose of inducing another person to exercise or refrain from exercising rights in relation to investments. Civil offences involve behavior based on information not generally available to those using the market, which is likely to be regarded by regular users of the market as relevant when deciding the terms of transactions; and a failure to observe a reasonable standard of behavior.

We focus on four market sectors – Banking, General Insurance, Life Assurance, and Investment Companies. In three out of the four sectors (excluding Life Assurance) the FSA regulation appears to have had a positive impact relative to stated regulatory objectives. Furthermore, at a micro level, we obtain support for the hypothesis that the pre-FSA voluntary disclosure game can be viewed as a "Stackelberg leader" game. In this game the leader exploits their access advantage to channels of voluntary disclosure acting in their own self interest. Post regulation, observed re-distributive effects at a micro level are consistent with the FSA regulation serving to counteract the strength of the Stackelberg leader in favor of the "followers". In each sector the observed leader was the largest firm.

This paper is structured as follows. Section I sets out a brief history of the Financial Services Authority. Section II provides an overview of the economic implications from the FSA regulation. Section III reviews existing literature that will support testable implications. Section IV provides a game theoretic interpretation of existing evidence together with testable hypotheses. Section V sets out our methodology. Our results are discussed in Section VI. Section VII concludes.

Section I: Brief History of the Financial Services Authority

In May 1997, just days after coming to power following the general election in Britain, the incoming Labour Government radically altered the regulatory landscape of UK financial institutions by announcing the formation of the FSA. The new Chancellor of the Exchequer, Gordon Brown, announced in May 1997 that the responsibilities for financial services regulation in the UK would be merged into a single entity (Briault (1999)). This

would entail bringing together nine separate bodies[6], including those responsible for banking, securities and insurance business, and for markets and exchanges. The UK Listing Authority was added later within the FSA's remit. The Chancellor rationalized this consolidation reflecting developments in the financial markets as follows:

> "The existing arrangements for financial regulation involve a large number of regulators, each responsible for different parts of the industry. In recent years there has been a blurring of the distinctions between different kinds of financial services business: banks, building societies, investment firms, insurance companies and others. This has added further to the complexity of financial regulation. The Government believes the current system is costly, inefficient and confusing for both regulated firms and their customers. It is not delivering a standard of supervision and investor protection that the public has a right to expect. We are therefore establishing a single, statutory regulator for the UK financial services industry with clearly defined regulatory objectives and a single set of coherent functions and powers."[7]

Prior to the establishment of the FSA, the UK's financial regulatory régime was based on specialist functional regulation involving numerous separate agencies (Dale and Wolfe (2003)). The Bank of England was responsible for the supervision of banks; the Department of Trade and Industry for insurance; and the Securities and Investments Board (SIB) for securities business. The SIB was a private body financed by charges levied on the investment industry. The SIB did not regulate directly individual firms but rather devolved day to day supervision to a number of Self Regulatory Organizations (SROs). Under the

[6] The Securities and Investments Board, the Personal Investment Authority, the Investment Management Regulatory Organisation, the Securities and Futures Authority, the Supervision and Surveillance Division of the Bank of England, the Building Societies Commission, the Insurance Directorate of the Department of Trade and Industry, the Friendly Societies Commission, and the Registrar of Friendly Societies.

[7] H M Treasury (1998a), "Financial Services and Markets Bill: A Consultation Document. Part One. Overview of Financial Regulatory Reform". H M Treasury, London, July (page 8)

terms of the then relevant legislation (The Financial Services Act, 1986) all institutions undertaking investment business were to be monitored either by one of the SROs, or by the Wholesale Markets Supervision Division of the Bank of England, or else directly by the SIB. In practice, most firms opted to be regulated by one of the SROs, each of which specialised in regulating institutions in particular lines of business. The three SROs were the Personal Investments Authority (conduct of business of financial advisers including life assurance), the Securities and Futures Authority (securities firms), and the Investment Management Regulatory Organisation (fund managers).

We focus on four UK market indices together with major companies therein to detect the effectiveness of self regulation in the United Kingdom. These indices are:

- FTSE Investment Companies (FAINVC) which is a capitalization weighted index of 115 member companies
- FTSE Life Assurance Index (FALIFE) which is a capitalization weighted index of 7 member companies
- FTSE Banks Index (FABANK) which is a capitalization weighted index of 11 member companies
- FTSE Insurance Index (FAINSU) which is a capitalization weighted index of 15 member companies

Section II: Economic Implications from the FSA Regulation

The passing of the Act resulted in a single regulatory body, the Financial Services Authority (FSA) and created an enforceable obligation for the financial sector to increase

disclosure. This commitment is likely to make some entities better off and others worse off. This follows from a well known result for information systems, that if the systems are not complete finer disclosure will always have re-distributive implications (e.g., Demski (1973), Demski (1974)). Re-distributive effects are implied from the change in the equilibrium allocations. For example, in a general equilibrium analysis of expectations, information, prices and the production/investment decision changing the fineness of disclosure shifts the economy from one rational expectations equilibrium to another (e.g., Kanodia (1980)). Re-distributive effects are further complicated by the presence of disclosure externalities (e.g., Dye (1990)). Disclosures by one firm can influence investor expectations about other firm(s) in the sector or economy. Finally, this has important implications for equilibrium risk premiums because it changes the fraction of information that is public versus private (Easley and O'Hara (2004)). Therefore, the complex problem facing regulators is what equilibrium is being implemented and how important are the re-distributive effects.

In this section we first review the stated regulatory objectives and then identify the linkages that exist between stated objectives and economic drivers identified in the existing literature. Finally, we state the set of testable Hypotheses that result from this analysis.

FSA Objectives

The objectives of the FSA, as stated in the Financial Services and Markets Act 2000, are:

- Market Confidence
- Public Awareness
- The protection of consumers

- The reduction of financial crime

The Act covers the financial services sector that provides financial products and services to individuals and other firms. In the UK, this can be categorized into the following sub-sectors: Banks (covering commercial and investment (or merchant) banking), Life Insurance, General Insurance, and Investment Firms (managing portfolios for clients, similar to mutual funds). The first three sectors are dominated by five or six large institutions whereas the fourth sector consists of a much larger number of entities. As a result, there is a difference in industrial organization such that investment firms are a different sector from the other three.

As set out in the introduction to this paper, high on the list for how the regulatory objectives is to attain greater transparency of information flows in the market[8]. There is an explicit attempt to ensure consistency between the stronger regulatory disclosure requirements of the FSA and the financial markets. This goal has strong prior empirical support in its favor. For example, in a recent extensive review of the literature by Flannery (1998) supports the following conclusion:

> "The available empirical evidence suggests that regulators could expand their reliance on market discipline, at least for large, publicly owned institutions."

The FSA has placed particular emphasis on this type of issue when implementing stated regulatory objectives. We examine implications from these issues in the sequence they have been addressed in the existing analytical literature. This literature starts with the

[8] FSA web site page Updated August 13, 2002: http://www.fsa.gov.uk/approach/1_philosophy.html

fundamental question of whether there is a need for regulation in the first place and goes on to identify conditions under which regulation can play a role.

Section III: Literature Review

Both "Essays on disclosure" Verrecchia (2001) and a subsequent critique by Dye (2001) provide definitive reviews of the extant accounting literature on disclosure. We focus on several specific papers to further our hypotheses. First, consider disclosure in an unregulated voluntary market. Early insights from the voluntary disclosure literature raised serious questions whether mandating disclosure could have any additional affect upon the information set available to agents in the economy. These papers observed that if it is costless to disclose truthfully a fully separating equilibrium results (e.g., Grossman and Hart (1980), Grossman (1981), Milgrom (1981)). Full separation is induced by investors who keep revising downwards their expectations of about the quality of non disclosers which in turn induces additional disclosure until there is nothing left to disclose. Full separation, however, is inconsistent with historical observations. For example, in the US prior to the 1933/34 Securities' Acts, some firms disclosed voluntarily information required under the regulation whereas others chose not to disclose. This observation provides direct support for the existence of a threshold point for voluntary disclosure. In the analytical literature, it has been established that if it is costly to disclose information then a disclosure threshold results at the point where the marginal benefit from not disclosing equals the marginal cost from disclosing (Grossman and Hart (1980), Jovanovic (1982), Verrecchia (1983), Verrecchia (1990)). The threshold point separates two types of equilibrium, pooling versus separating. Important drivers of the threshold point have been identified in the subsequent voluntary disclosure which falls into two strands: exogenous disclosure costs (Verrecchia (1983),

Verrecchia (1990)) and endogenous disclosure costs (Dye (1985), Dye (1986), Jung and Kwon (1988)). For the latter endogenous disclosure costs arise from the conflicts of self interests when investors are not sure whether the manager is in possession of the information.

Viewed from either of the above perspectives, a set of empirically testable predictions can be derived for the impact of mandated disclosure on the voluntary disclosure threshold. First we observe that mandated disclosure restricts the set of voluntary disclosure strategies which in turn will impact the voluntary disclosure threshold. On the surface it may appear that restricting the strategy set immediately favors voluntary disclosure over mandated disclosure. But this is not the case because of the different implied redistributive effects[9]. In the context of a stock market economy, mandating disclosure has two complementary effects. First, it *reduces the probability* of insiders being privately informed with price sensitive information and conversely it *increases the precision of investor priors* regarding assessed future value distributions. Under either interpretation, when viewed from this perspective, any change in investors' expectations will have a measurable impact upon the voluntary disclosure threshold. In addition, this impact is same irrespective of whether disclosure costs are endogenous (e.g., Proposition 2 of Jung and Kwon (1988)) or exogenous (Corollary 2, Verrecchia (1990)). The methodology introduced in this paper is designed to exploit this measurable implication.

If this voluntary disclosure theory is applied to a sector, (e.g., shifts in investors' expectations relative to a sector fund), it is consistent with reducing systematic risk levels.[10]

[9] For example, Fishman and Hagerty (2003) discuss this point and illustrate with their analysis of insider trading (1995).

[10] Technically, if prices are arbitrage free and the risk neutralized terminal price distributions is lognormal as characterized in the Black-Scholes (1973) option pricing world, there is a strictly monotonic relationship

We note that although the traditional view in finance is that only market risk is priced, this view is supported by assuming there are no informational asymmetries. In a privately informed economy information risk is also priced (e.g. Easley, Hvidkjaer and O'Hara (2002), Easley and O'Hara (2004)). As a result, mandating finer disclosure has a positive impact in terms of the usual regulatory objectives when viewed from the perspective of information risk, and therefore cost of equity capital, being reduced[11].

In summary, what stops the complete unraveling of information in a voluntary disclosure economy are the "costs" associated with disclosure[12]. In this context, the role of regulation can be viewed as imposing a forced override of these costs at an individual entity level to increase social welfare from the implied re-distributive effects. This aspect of the problem has not been analyzed in the literature reviewed above because the focus is on the implications from introducing disclosure costs as opposed to considering industry or economy wide implications. The set of papers reviewed in the next section relax this restriction. This literature considers how a disclosure from one firm can impact inferences made by investors/managers in relation to the disclosing and other firms. That is, externalities associated with the disclosure are taken into account.

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between the shift in the threshold and the volatility of the underlying price change process. That is, if the threshold shifts to the right volatility will decline and vice versa an implication that can be drawn from proposition 3, Jung and Kwon (1988). This point is discussed further in section 5 of this paper.

[11] It is noted that although questions regarding consistency with regulator objectives are addressed the more comprehensive issue regarding the impact of disclosure upon social welfare is not addressed in this section. Attempts to model this latter issue consider the relationship between disclosure and externalities which is reviewed in the next section.

[12] Cost can be broadly interpreted. For example, in Fishman and Hagerty (2003) this "cost" is an information processing cost (sophisticated versus unsophisticated consumers). But this is applied to a consumer product market and therefore the issue of arbitrage free pricing is not considered.

Role of Externalities

Dye (1990) finds the regulator's mandated disclosure problem is to choose the optimal disclosure policy to maximize social welfare for the economy exploiting any externalities defined in terms of systematic risk (i.e., covariance). The regulator exploits externalities to increase social welfare allowing for re-distributive effects. This can be contrasted with the entrepreneur's voluntary disclosure problem which is to choose the optimal disclosure policy for the firm motivated by self interest. Dye (1990) considers two types of externalities, "real" and "financial", based upon whether or not the cash flows of firms are altered (real) versus assessed values (financial). Initial owners must commit to a disclosure policy (i.e., a level of precision) which in turn generates the information that is reported to the market. The decision is made to maximize expected utility of existing owners who ultimately sell to the next "generation" of owners after the realized disclosure. In this setting mixed results were obtained for the benefits of mandated vis-à-vis voluntary disclosure.

In an attempt to refine the insights from an economy of this nature, Admati and Pfleiderer (2000) imposed additional structure focusing, in particular, on risk neutrality, on exogenous disclosure costs, and on exogenous value increasing transactions made available to the firm (i.e., selling the firm to new investors generated an exogenous gain). In this economy, the first best allocation is simply defined as the case where the sale of firm always occurs and all exogenous gains are fully exploited. Voluntary disclosure is analyzed in terms of the Nash equilibria associated with self interested actions taken by firms ignoring welfare implications from externalities that are present in the disclosure game. Mandated disclosure, on the other hand, takes into account the welfare implications from externalities but is

constrained by the disclosure satisfying a constant lower bound level of precision imposed upon all firms by the regulator. Results again are mixed and both mandated and voluntary disclosure can be socially optimal given specific characteristics of the economy. One implication of the constant mandated threshold is that some firm's voluntary disclosure threshold is *increased* and others *decreased*. There are predicted re-distributive implications among firms in the voluntary disclosure game that are potentially measurable in terms of threshold shifts. In addition, from the disclosure games, mandated disclosure is likely to have its greatest impact when correlations are higher. This suggests that the disclosure regulation is better targeted towards an industry or sector of the economy, where correlations are likely to be higher.

In summary, by considering externalities associated with mandated disclosure the social planner's problem of mandating a minimal level of disclosure precision to maximize social welfare can be contrasted with the manager's problem of choosing a level of disclosure precision acting in the firm's self interests. Welfare comparisons of these two problems leads to mixed results, which reinforces the need for gathering empirical evidence relevant to assessing the potential *importance of externalities* and the *nature of any implied re-distributive effects*. As a result, next we interpret existing empirical findings in the light of the analytical insights from the disclosure game.

Section IV: Game Theoretic Interpretation of Existing Evidence

Interpreting voluntary disclosure in the presence of externalities, from a game theoretic approach, allows finer interpretations to be made. First, Simon (1989) when analyzing the impact of the 1933 Securities Act on investor information, concludes that the 1933 Act and subsequent regulation "contributed to the growth of the Over-the-Counter Market." Small firms were made better off and new issues grew as a possible result of the regulation. In part, this is consistent with the implications from Easley and O'Hara (2004) who suggest that with reduced information risk the cost of equity capital for firms will reduce. Beardsley and O'Brien (2004) report an interesting similar result for the impact of regulation 70-years later in relation to firm size and over-the-counter markets. They examine the behavior of the voluntary disclosure threshold pre and post the 2000/2002 Regulation FD and Sarbanes–Oxley Act in the US and observe a systematic difference between the DJIA/S&P500 large firm indexes versus the NASDAQ/Amex small firm indexes. The difference was that for both NASDAQ and AMEX, post the regulation, the threshold moved to the right (investors' prior precision increased) whereas for DJIA/S&P500 the threshold moved to the left (investors' prior precision decreased). If reduction in the cost of equity capital, by reducing the information risk component, is the motivation, this evidence is consistent with small firms being made better off relative to larger firms in both the US 1933/1934 and 2000/2002 regulatory periods.

To understand these dynamics better it is useful to consider further insights from a game theoretic analysis of the disclosure game. The game theoretic approach to mandatory versus voluntary disclosure implies that firms take into account externalities resulting from their interdependencies. Further, equilibrium outcomes are sensitive to the behavioral

assumption regarding how these interdependencies are exploited. For example, in an industry of identical firms, a Cournot equilibrium may be appropriate because the behavioral assumption implies that a competitor's disclosure does not change in response to a change in their own disclosure. But, if differential access to channels of voluntary disclosure is taken into account the asymmetries that this creates in a voluntary disclosure game can lend support to a different behavioral assumption.

Consider a disclosure game where large firms have an access advantage to channels of communication. Large firms in the voluntary disclosure game can now become *Stackelberg leaders* (Stackelberg (1934), Daughety (1990)). For example, Stackelberg leaders can exploit other firms' reaction functions when making voluntary disclosures to make themselves better off in the sense of reducing their cost of equity capital by increasing investors' prior precision[13]. Followers will then respond under the conjectural variation assumption of Cournot behavior. Similar implications follow under the alternative behavior motive that firms are acting to influence the tradeoff between operating efficiency and competitive advantage via disclosure (e.g., Board (2003), Ozbilgin and Penno (2003)). In either case, if the major incentive for a Stackelberg leader is to either reduce information risk or protect competitive advantage, the leader will attempt to exploit the externalities in the game at the expense of the followers. Under this hypothesis, pre regulation, a Stackelberg leader exploits the externalities for *self interest* as opposed to *social welfare interest*. Post regulation, the Stackelberg equilibrium is broken up because the regulators reduce the power of the leader when motivated by "social welfare" as opposed to "self interest." This results in predicted re-distributive effects between leader and follower firms in the economy or sector. The

[13] As suggested from the analysis by Easley and O'Hara (2004).

empirical facts documented by Simon (1989) and Beardsley and O'Brien (2004) suggest that if large firms are viewed as leaders, they are worse off post the disclosure while follower firms are better off from a cost of equity capital perspective. .Similarly, in the analytical analysis of a disclosure game motivated by operational efficiency/competitive advantage tradeoffs, by Ozbilgin and Penno (2003), the leader again attempts to make themselves strictly better off this time by disguising information. That is, the leader adds noise by employing a mixed strategy. The mandated disclosure condition serves to enhance operational transparency which can reduce the profitability of the leader.

In addition, the comparative advantage of the market leader in terms of greater analyst and press coverage is neutralized under guidelines for the dissemination of price sensitive information. Under The PSI Guide[14], the FSA warns analysts that, "while they are not subject to the listing rules, eliciting the dissemination of price sensitive information may leave them open to an FSA investigation of their conduct under separate FSA powers". The FSA also notes[15] that "relationships with the press and other media, though often contributing to a well informed market, need particularly careful management in instances where potentially price sensitive information is involved".

In summary, under the Stackelberg leader game interpretation mandated disclosure is predicted to reduce the power of the Stackelberg leader resulting in the leader being worse off and some of the followers being better off post the regulation. Aggregate impact, therefore, is an empirical issue that depends upon the net of the redistributive effects. In this paper, we test this hypothesis using the UK data as discussed next.

[14] Appendix 2: The PSI Guide – The UKLA's guidance on the dissemination of price sensitive information, Section 11
[15] Ibid. Section 15

Empirical Implications for Capital Markets

The analytical and empirical literature reviewed above provides testable implications relative to stated regulatory objectives in terms of the direction and impact of a shift in the disclosure threshold. Predictions differ depending upon whether or not we consider the regulation in conjunction with potential externalities created among firms. In the first strand of literature the regulation is predicted to have a positive impact relative to *stated regulatory objectives* because increases the predicted precision of disclosure shift the voluntary disclosure threshold to the right and reduce systematic risk. The second strand of the literature examines a more general question which is impact upon *social welfare* and now the predicted impact can be either positive or negative.

To test the insights from each strand we state our hypotheses next. The shift in the voluntary disclosure threshold is an implication from proposition 3, Jung and Kwon (1988) and corollary 2, Verrecchia (1990). We interpret this as being consistent with the regulatory objective of "market confidence" because increases in systematic risk reduce market confidence and vice versa. As a result, our first hypothesis is stated as follows:

Hypothesis I

The disclosure threshold is predicted to shift to the right post versus pre the regulatory event.

Support for this hypothesis follows because, although investors still form assessments about the manager possessing private information, the precision of investors' prior information increases and similarly the overall likelihood of managers being in

possession of private information is reduced. Formally, this follows from Proposition 2 of Jung and Kwon (1988) and Corollary 2, Verrecchia (1990).

The first Hypothesis will be tested across the four sectors targeted by the FSA regulation after controlling for general market movements pre and post the regulation[16].

Externalities: Sector Risk Implications

The second strand of the literature, reviewed above, analyzes social welfare implications via by considering the impact of externalities which are ignored in Hypothesis 1. As identified in the literature it is possible that regulation, in the presence of significant externalities, can make the economy worse off. The insights from this strand of the literature analyze directly the potential impact of regulation on social welfare when the impact of regulation upon the disclosure game among firms is analyzed. Existing analytical results in the literature are consistent with the prediction that regulation can work both ways. Regulation can both promote and harm social welfare. From the Admati and Pfleiderer (2000) analysis, it is more likely to promote social welfare when correlations among firms are high. The reason, in Admati and Pfleiderer's economy, is that imposing a minimal precision level upon the economy can force a more cost effective firm to increase disclosure precision and a less cost effective firm to reduce the disclosure precision, relative to the unregulated Nash equilibrium. In this way the regulator is able to attain higher aggregate gains for the economy even though there are re-distributive effects at the individual firm levels. Similarly, in the literature on protecting competitive advantage mandated disclosure serves to enhance the operational efficiency of the previously less informed firm. As a result, as observed by

[16] A shift in the threshold is interpreted relative to stated regulatory objectives as opposed to attempting to provide any deeper "social welfare" interpretation.

Dye (2001)[17] benefits to a non disclosing firm arise when disclosure would otherwise result in positive covariance in outputs. In this context, however, mandated disclosure would promote competition and result in aggregate profits declining. As a result, viewed from a firm profitability perspective we again predict the existence of redistributive effects. If these redistributive effects are consistent with the stated objective of the regulation of promoting market confidence, they will trigger a decline in correlations among firms which implies a reduction in industry level systematic risk.

By targeting a specific industry the FSA regulation is consistent with the insights from this second strand of the literature because this implies higher correlations relative to the economy at large. The following testable implication follows. Relative to the stated regulatory objective, by mandating higher levels of minimal disclosure precision to the sector a desirable re-distributive effect is for correlations among firms within the sector to *reduce*. That is, because re-distributive effects make some firms strictly worse off and some strictly better off relative to unregulated Nash equilibrium, and therefore correlations among returns will change. If correlations increase for the sector as a whole, then sector (i.e., systematic) risk increases. If correlations decrease for the sector as a whole, then sector risk decreases. Under the stated regulatory objectives from the FSA, the desirable change is for the FSA regulation to trigger re-distributive effects that *reduce correlations*. When pre-regulation is contrasted with post-regulation periods to the extent that desirable re-distributive effects are being triggered in response to externalities then correlations among firms within the sector will fall.

[17] Footnote 58 of the disclosure essay.

Hypothesis II

Relative to stated regulatory objectives, correlations post FSA regulation are lower than pre FSA regulation.

Our second Hypothesis is not designed to test whether social welfare has been increased but rather whether regulation has an impact upon market confidence via its influence upon return correlations. This will provide evidence that externalities, as identified in the second strand of the literature, have a significant presence. In addition, when viewed in conjunction with the results from Hypothesis 1, an argument in support of improvement can be made if the overall evidence is consistent with a shift of the threshold to the right *even in the presence of externalities*. We turn to gaining a better understanding of this issue next.

Externalities: Firm Specific Risk Implications

The objective for this section is to identify what re-distributive effects occurred when examining behavior at the individual firm level, pre versus post the FSA regulation. Our third major hypothesis focuses upon the redistributive effects at an individual firm level. In the presence of a Stackelberg leader, the post FSA regulation results in offsetting shifts in the voluntary disclosure thresholds at an individual firm level for leaders versus followers. For leaders the threshold shift is predicted to be to the left (i.e., precision of the investors' priors reduces) and for followers the threshold shift can be in either direction. The aggregate of the individual firm threshold shifts, however, is predicted to be to the right if consistent with stated regulatory objectives. As a result, in hypothesis we study behavior at the individual

level in an attempt to shed light on the sector level results identified from testing hypothesis I. Hypothesis III is stated as follows:

Hypothesis III

In the presence of a Stackelberg leader, the post FSA regulation results in redistributive effects that are observable as offsetting shifts in the voluntary disclosure thresholds at an individual firm level for leaders versus followers. For leaders the threshold shift is to the left (i.e., precision of the investors' priors reduces) and for followers the threshold shift is predominately to the right (i.e., investors' priors increase).

In the next section we first provide an overview of the methodology, designed to test hypotheses I and III, followed by the technical details.

Section V: Methodology:

Consider an event that is defined as the passing of regulation that increases expected mandatory disclosure. That is, the regulation event combines penalties with increased disclosure obligations. Because mandated disclosure changes the incentives for voluntary disclosure we predict an event of this nature will have redistributive effects. Our goal is to measure these redistributive effects by measuring the impact of the event upon the voluntary disclosure threshold. The voluntary disclosure threshold is, for reasons developed in this section, the measurable consequence of the impact of the event upon investor expectations.

Consider the risk neutralized asset price process both before and after an event of interest. Suppose this process is governed by an Ito Process where the volatility function can be different for pre versus post the event:

$$DP/P = rdt + \sigma_{\Pr e}(P,t)dW \quad (1)$$

$$DP/P = rdt + \sigma_{Post}(P,t)dW \quad (2)$$

In the above equations P is the price of the asset, r is risk neutralized drift and $\sigma_{Pre}(P,t)$ is the volatility function pre the event and similarly for post. Finally, W for $t>0$ $W(t)$ is a standard normally distributed random variable mean 0, variance t.

If the econometrician knows the volatility function the probability distribution of the risk neutralized value of the underlying asset at the end of any time period of time T can be computed. For example, in the well known Black and Scholes (1973) model volatility is constant and the lognormal distribution of prices is implied.

The distributions that can be constructed from the pair of risk neutralized processes above, prior to and post the event in question, are directly comparable in terms of second order stochastic dominance because the first moment drops out and therefore the two distributions satisfy the mean preserving spread condition identified by Rothschild and Stiglitz (1970) in their work on stochastic dominance of the second degree. Therefore, the impact of the event upon the shift in the threshold can be measured by invoking proposition 3 Jung and Kwon (1988). In particular, this proposition relates second-order stochastic dominance to the shift in the threshold. Further, as remarked by Jung and Kwon, this proposition can be interpreted in terms of investors' revision of prior beliefs. In other words, it identifies a measurable property of

a shift in investors' unobservable expectations. In the methodology described in this section it is this property that we exploit in our empirical analysis.

This theory however depends upon the econometrician being able to observe the volatility function pre and post the event. Next we consider the case where the econometrician *cannot* directly observe the volatility function but instead must estimate this function.

There are basically three techniques that can be employed to resolve this problem. Each of the techniques depends upon a well known proposition on equivalent martingale measures that can be traced back to Harrison and Kreps (1978) and Harrison and Pliska (1981). Here positive state prices and equivalent martingale measures (i.e., risk neutral probabilities) are implied from arbitrage free prices.

As a result, each technique starts with observed prices and the assumption of the absence of arbitrage to infer risk neutral probabilities. Then given the risk neutralized probabilities the risk neutralized distribution of prices can be computed at the end of any period of time T. Examples of these three techniques are provided respectively by Jackwerth and Rubinstein (1996), Stutzer (1996) and Luenberger (1998). In this paper we adopt Luenberger's approach applied by Winston (1999) to value stock and real options.

We implement this approach in the same way as Stutzer (1996). The major difference is that Stutzer applies the axioms of entropy to first recover a single set of risk neutral probabilities from observed prices. In our implementation we replace the axioms of entropy with the assumption of a logarithmic utility function to recover a single set of risk neutral probabilities. The Jackwerth and Rubinstein (1996) approach is not

employed because it requires data on option prices that are not available for our problem at hand.

Our starting point therefore is the underlying asset's historical time series of prices one year prior to the event of interest and one year post the event of interest. Following Stutzer (1996) we construct what he refers to as the empirical return distribution by assuming that each day's realized return is equally likely.

In our case we construct the log optimal portfolio consisting of the risky and risk-free assets with respect to the empirical distribution. The log optimal portfolio maximizes the expected utility of an investor with logarithmic utility function ($U(x) = ln(x)$). Support for this utility function comes from the number of realistic real world implications as suggested by Luenberger (1998) and others ((Brown (1987), Kelly (1956), Latane (1959), Luenberger (1993))

In order to test our hypotheses at both sector and individual firm levels we construct log optimal portfolios subject to additional sensitivity constraints. For the case of our analysis at the sector level the log optimal portfolio is constructed to have zero sensitivity (i.e., zero factor loading) with respect to aggregate market behavior. For the case of individual firm behavior we construct the log optimal portfolio to have zero sensitivity to both aggregate market and sector level behavior. We do this by constructing the log optimal portfolio using returns that have been adjusted for general market (and if relevant) sector returns using a standard market model.

From the log optimal portfolio the state prices can be recovered directly under the assumption that observed prices are arbitrage free. The state prices exist under the

assumption that prices are arbitrage free and thus can be normalized to recover the *risk neutral probabilities*. The state in this theory is defined as a return. So now we have transformed the empirical probabilities associated with observed daily returns into the equivalent risk neutralized probabilities associated with each return under the assumption that the representative investor in the economy has preferences that can be described by a logarithmic utility function.

Having estimated the risk neutralized probabilities the implied risk neutral distribution for the asset price, at the end of the *T* period of time, is calculated directly by employing Monte Carlo simulation. This permits a large number of daily return sequences to be generated from the risk neutralized probabilities over a given time period. Each sequence results in a terminal value for the asset price P and hence the set of all sequences results in the distribution. That is, the risk neutralized terminal price distribution, subject to the constraints imposed, has been recovered numerically.

Numerical techniques of this nature are commonly applied to value options when Monte Carlo simulation techniques are employed, but in the current case we are applying the method to recovery the volatility function of the risk neutralized asset process both immediately before and after the event of interest. This permits the testing whether or not predicted second order stochastic dominance effects are observed.

In addition, because the first moment of the risk neutralized distribution of prices drops out this provides an additional important control. The economic impact of the event is captured in terms of its impact within a "pure exchange" economy to the extent that production effects impact the first moment of the price distribution. As a

result, we analyze a setting that is very close to what has been extensively analyzed analytically in the traditional voluntary disclosure literature.

Technical Details Supporting the Methodology:

We recover the risk-neutral probabilities directly from the implied set of state prices constructed from log-optimal returns. The log-optimal return R* is defined as the return that is optimal for an expected utility maximizing investor with preferences that can be represented by a logarithmic utility function. Under this preference assumption the optimal portfolio satisfies the following for all *i*:

$$E(\frac{d_i}{R^*}) = \lambda P_i \qquad (3)$$

Where expectations are defined with respect to the real world (empirical probabilities) and d_i is the payoff from security *i*, λ is the Lagrange multiplier and P_i is the price of security *i*.

Now consider the log optimal portfolio that is constructed by allocating \$1 to the risky asset and the risk free asset. That is, suppose some proportion α is allocated to the risky asset and $1-\alpha$ to the risk free security. Alpha is chosen to maximize expected utility given a logarithmic utility function[18]. We will refer to this portfolio as a log optimal portfolio and let its expected return be *R**. In addition, because the above necessary condition holds for every security *i*, it is also valid for this log-optimal portfolio itself and therefore the Lagrangian multiplier must equal *1* because the price is *1*. This implies that

[18] On the rare occasion that wealth becomes negative in the log optimal portfolio following Winston (1999) we bound utility from below by -100000.

the simple log-optimal pricing equation satisfied by the price *P*, of any security (or portfolio) with dividend *d,* in this logarithmic utility world satisfies the following simple pricing relationship:

$$P = E(\frac{d}{R^*}) \tag{4}$$

Our goal, however, is to recover the risk neutral pricing relationship from this log optimal pricing relationship. We do this by constructing and normalizing the state prices implied from the logarithmic utility function. States are defined in terms of returns and positive state prices exist under our assumption that prices are arbitrage free.

The state prices are defined in general as follows:

$$\Psi_s = \frac{p_s U^{'}(x^*)^s}{\lambda} \tag{5}$$

In the above equation *s* is the state, *p* is the empirical (real world) probability associated with the state and x^* the payoff from the optimal portfolio choice problem. For our current example, x^* is the payoff from the log optimal portfolio, λ equals *1* and the marginal utility equals $1/x^*$.

To convert into a (risk neutralized) probability we scale state prices so that they sum to 1.

$$\pi_s = \frac{p_s U^{'}(x^*)^s}{\sum_s p_s U^{'}(x^*)^s} \tag{6}$$

Finally, we employ Monte Carlo simulation techniques by generating a sequence of return realizations from the risk neutral probabilities. Each sequence when applied to the beginning of period price results in a single terminal price at the end of the period.

The set of all sequences from the simulation results in the numerical estimate of the risk neutralized distribution of prices. In this paper we estimate the risk neutralized distribution of prices from 100,000 sequences. With 100,000 observations for all practical purposes this is an estimate of the population distribution and therefore small shifts in the distribution are highly significant. However, to measure the relative significance of the shift we estimate the non parametric Chi-Square statistic and test the null hypothesis of no shift. The Chi-Square test is applied as follows. First, 100 bins were defined relative to the pre-event distribution. This defined the expected frequencies under the null hypothesis. The observed frequencies (for the same set of bins) from the post event distribution defined the observed frequencies. A standard chi square statistic is then computed to test the null hypothesis of no difference pre versus post lognormal distributions.

Section VI: Results

The goal of our empirical tests is to measure the impact of the regulation upon the financial sector. We broadly interpret these objectives as serving to influence investor expectations in a manner that is consistent with an increase in the perceived disclosure precision for the financial sector and similarly reduced financial sector (i.e. systematic) risk. As a result, in this section, we provide the results of our tests of the hypotheses developed from the related theoretical literature and methodology discussed in the previous sections. To focus on the impact upon the financial sector we control for general market movements over the time period from pre and post the FSA regulation by using a broad based index that is representative of general economy wide movements and is not dominated by the financial sector. For this purpose we selected the FTSE All Share Index, a broadly diversified index

that is widely regarded as a benchmark for UK pension fund investment in shares of companies in the UK.

We first test the Hypothesis that that the risk neutralized distribution pre and post the event, is lognormal which is consistent with price changes satisfying weak form market efficiency. That is, it is consistent with the weak form market efficient assumption in the Black-Scholes world.

Test of the assumption that prices are arbitrage free

For the two time periods 1-year pre and post the FSA regulation we found that for each financial market sector the null hypothesis of consistency with the lognormal distribution could not be rejected. Supporting results from testing these assumptions are provided in Appendix A.

Given that the assumption of arbitrage free price changes cannot be rejected we consider next the stochastic dominance behavior of the risk neutralized return distributions from which we can draw conclusions regarding the impact of the regulation upon the shift in the disclosure threshold.

Risk Neutralized Return Distribution Analysis

By equating the means for the before and after risk neutralized return distribution to the average of the first moments over the combined period, we test for stochastic dominance from the implied single crossing condition as discussed in the methodology section. For the lognormal distribution this is equivalent to testing for the effect of whether

the FSA regulation was associated with an increase in investors' assessment of the disclosure precision for the sector when contrasting pre versus post November 30, 2001.

A. Graphs of Stochastic Dominance Effects Implied from FSA

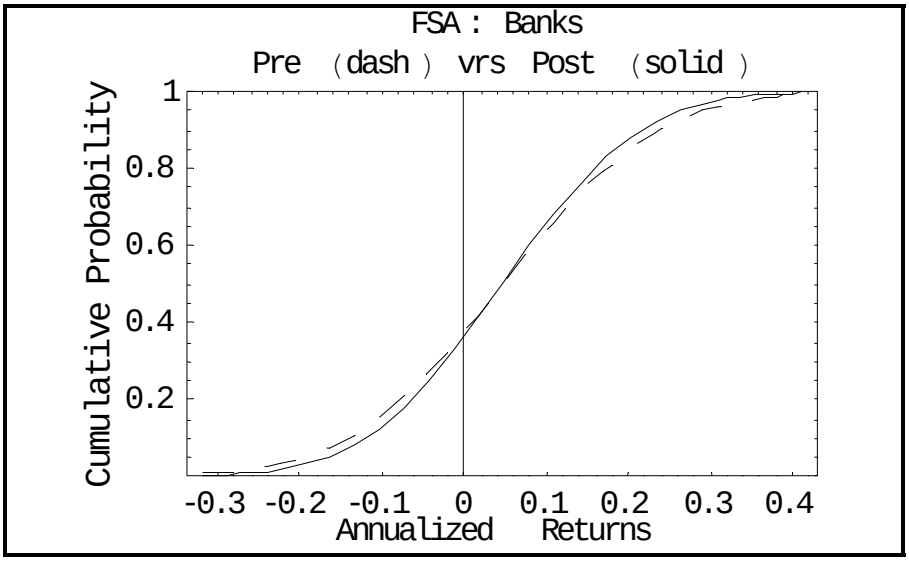
In the following results section we provide the dominance relationship below each graph. Two periods of time are considered: one year prior to November 30, 2001, and 1-year after are compared and correspond to T-1, T as labeled and depicted as dashed for pre and solid for post.. For comparison purposes each graph is provided with its domain scaled to equal the mean plus/minus two times the average volatility. Recall that for the four sectors affected two sectors, Banks and General Insurance were previously regulated by Governmental bodies and the other two sectors Investments and Life Insurance were self regulated sectors.

We provide tables of results in Appendix B. Below for each graph we indicate the dominance relationship as > implying the shift is to the right for the threshold (and therefore to the right in the region below the single crossing point and to the left above the single crossing point). The Chi-Square statistic is computed to test the Hypothesis of no shift in the distribution from T versus T-1[19].

Post FSA dominates pre FSA for Banking, Insurance and Investment sectors as we move from pre to post November 30, 2001 (as depicted in Figures 1 to 3). Pre FSA dominates post FSA for the Life sector.

[19] The Chi-Square test is applied as follows. First, 100 bins were defined relative to the pre-event distribution using the numerically estimated moments. This defined the expected frequencies under the null hypothesis. The observed frequencies (for the same set of bins) from the post event distribution defined the observed frequencies. A standard chi square statistic is then computed to test the null hypothesis of no difference pre versus post distributions.

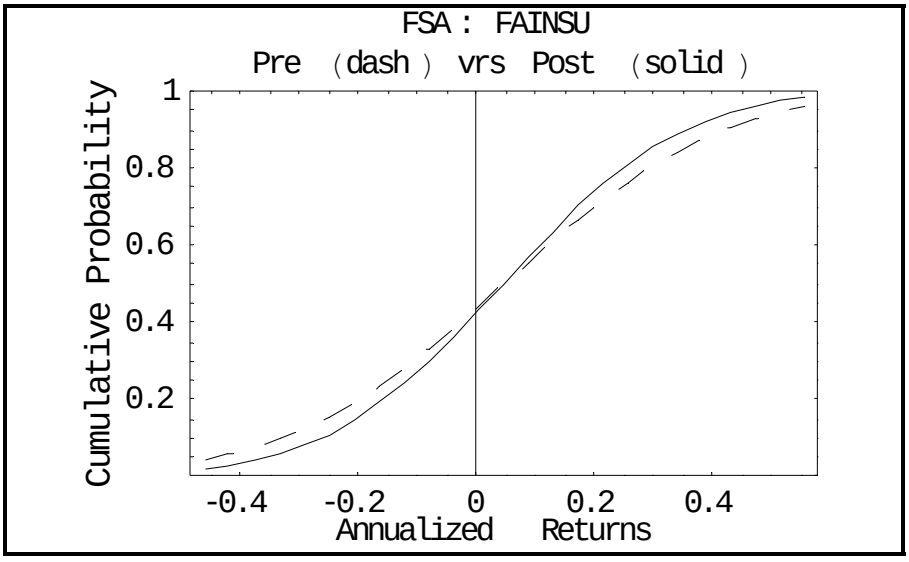
Figure 1: FSA Regulation - Pre versus post cumulative return distribution for FABANK



Dominance relationship: T-1 < T.

Chi-Square Statistics 2344.35 (T vrs T-1).

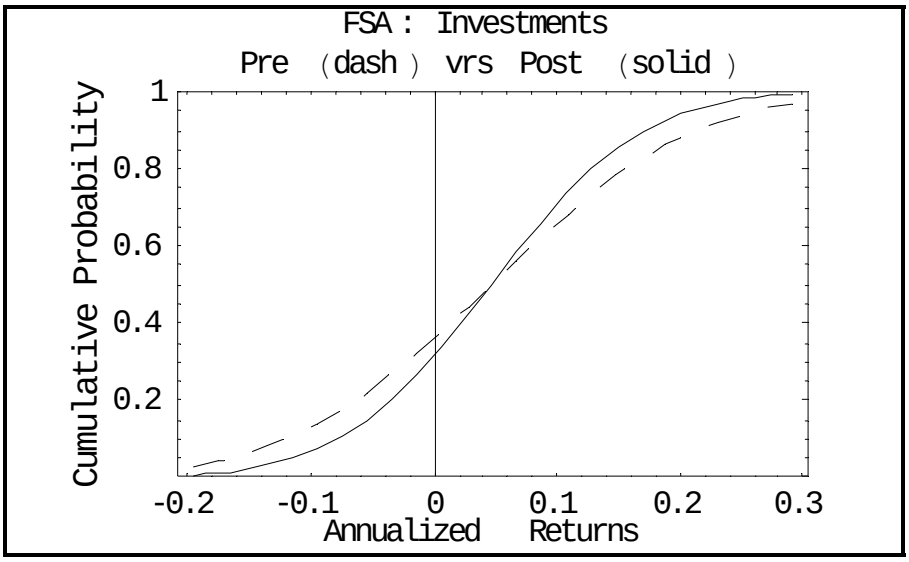
Figure 2: FSA Regulation - Pre versus post cumulative return distribution for FAINU



Dominance relationship: T-1 < T.

Chi-Square Statistics 5502.29 (T vrs T-1).

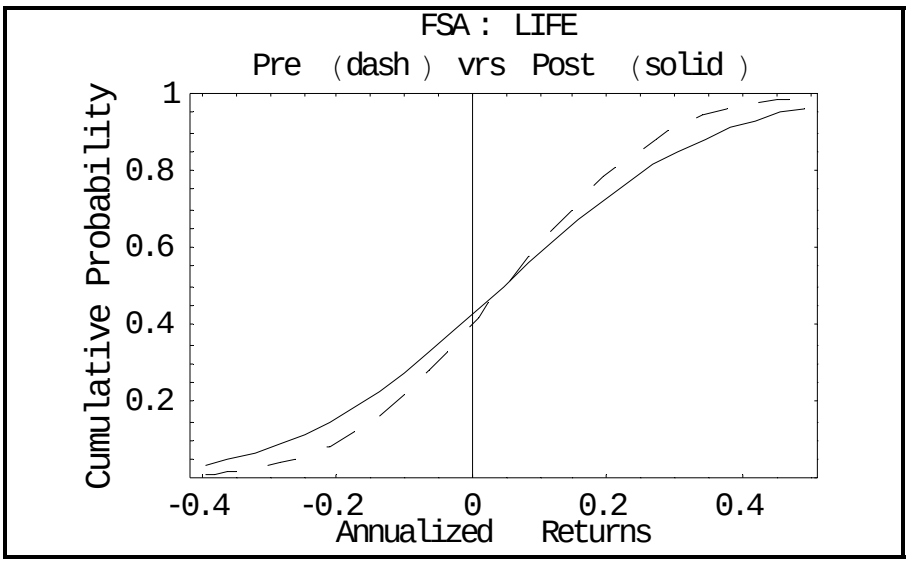
Figure 3: FSA Regulation - Pre versus post cumulative return distribution of FAINVC



Dominance relationship: T-1 < T.

Chi-Square Statistics 11235.79 (T vrs T-1).

Figure 4: FSA Regulation - Pre versus post cumulative return distribution for FALIFE



Dominance relationship: T-1 > T.

Chi-Square Statistics 23174.98 (T vrs T-1).

To better understand the nature of the dominance relationships, we first consider the impact that externalities among firms can have on the above results.

Role of Externalities: Sector Risk Implications

Our test of the Hypothesis II is designed to ascertain whether return behavior is consistent with the presence of externalities and the FSA regulation having a desirable re-distributive impact upon the financial sector relative to its stated objectives. In addition, when viewed in conjunction with the results from Hypothesis I a stronger argument can be made in support of meeting regulatory objectives if the overall evidence is consistent with a shift of the threshold to the right *even in the presence of externalities*.

To test Hypothesis II we conduct a factor analysis of the major companies in each sector to isolate the impact of firm specific drivers upon the post regulation sector level behavior. We analyze the firm specific return variance, adjusted for both general market and general sector movements, to isolate the effects of reaction function interdependencies that may drive observed shifts in the threshold for the sector as a whole. Finally, we note that the investment sector consists of a large number of small firms and so is potentially different from the other sectors from an industrial organization perspective. As a result, we analyze only those Investment firms that are 2% and higher to detect any interdependencies that may exist.

Pre FSA Factor Analysis of Hypothesis 2

We perform both principal component and rotated factor analysis on the pre and post daily return data adjusted for general market and general sector movements[20]. Rotated factors when compared to principal components permit the sectors to be more sharply focused upon because we do expect correlations to exist among the sub-sectors of the general financial sector. We report both un-rotated and rotated factors loadings to observe these effects.

In the analysis of the pre FSA returns, five principal components were identified with eigenvalues greater than 1 and cumulative variance explanation equaled 83.19% (see Appendix C). The relative proportions of this cumulative percentage are provided in Appendix C for both un-rotated and rotated factors. Essentially the rotation permits factors 2 to 5 to explain relative more variance by reducing the percentage of explained variance for factor 1 from 51.96% (un-rotated) to 41.32% (rotated). This also permits the factor loadings to be sharpened across factors which in turn sharpen factor descriptions.

It is interesting that the first factor has all firms from Banks, Insurance Life, Insurance General loading highly but with all investment firms not loading (regardless of whether we consider un-rotated or rotated factors). The factor analysis has immediately sharply discriminated between Banks and Insurance versus Investments pre the FSA. (see Appendix D 'Factor Loading Tables'). In the principal component analysis the investment sector loaded on factor 2. This is consistent with the substantially different industrial organization that characterizes this subset of the general financial sector. In addition, all

[20] We consider only factors with eigenvalues above 1 and we use the Varimax technique was used for the rotation method.

factor loadings are positive on these two factors with the exception of the 3iGroup within the Investment sector. Within the Investor sector there appear to be two sub-sectors - the 3iGroup versus the rest. It is interesting to note that fundamentals support this because the 3iGroup deals primarily as a venture capitalist whereas the other firms primarily manage portfolios of securities trading on the secondary exchanges.

In addition across the remaining five factors from the pre FSA period, factor loadings for each factor identify precisely a subset of firms coinciding with each sector. For the rotated factor results, Factor 2 consists of General Insurance, Factor 3 consists of the Investment firms, factor 4 Life Insurance and factor 5 a sub relationship within the investment sector. That is, the investment sector really consists of two sub sectors. It is interesting to note that these relationships occur after adjusting for both general market and sector effects. The correlations exist from firm specific drivers, which we interpret as firm specific reaction functions relevant to the disclosure game. Next, we identify what re-distributive effects happened pre versus post the FSA regulation in the presence of these interdependencies.

Pre versus Post FSA Regulation

The results of the post FSA factor analysis provide a striking contrast to the analysis of pre FSA. Overall, there was a large reduction in the extent of within sector correlations. First, applying the same cutoff criteria the number of factors increased from five to 10. Total explained variance reduced from 83.19% to 38.94% for the first five factors and to 62.83% for the ten factors (see Appendix E). No individual factor explained more than 11% of the variance which is consistent with the overall conclusion that post FSA within

sector correlations were reduced. This is consistent with Hypothesis 2. In addition, when combined with the results from testing Hypothesis 1, it is consistent with the regulation having an overall positive impact even though it is likely to have resulted in re-distributive effects at the individual firm level.

A closer examination of the post FSA factors, and especially the larger first five factors reveals the following interesting patterns. Factor 1 captures sharply the General Insurance sector (Appendix F). Rotated, this factor reveals that Royal Sun has a large negative factor loading while the other firms in this sector have large positive loadings (Appendix G). Relative size information is provided for each sector in Appendix H and the largest firm in the sector has a negative loading (or at least an opposite loading). Similarly, factor two identifies the Life Insurance sector reveals the same pattern. The largest firm has a negative loading and the next two largest firms have large positive loadings (no other firms load on this factor from any sector). Factor 3 identifies the 3iGroup with a large negative loading and the other three large positive loadings are also from the Investment sector. We note, however, that this pattern is unchanged from pre to post FSA regulation unlike the factors relevant to the other sectors. Finally, factor 4 identifies the largest bank with a negative loading plus one of the smaller banks. Other banks loaded positively but lacked large loadings.

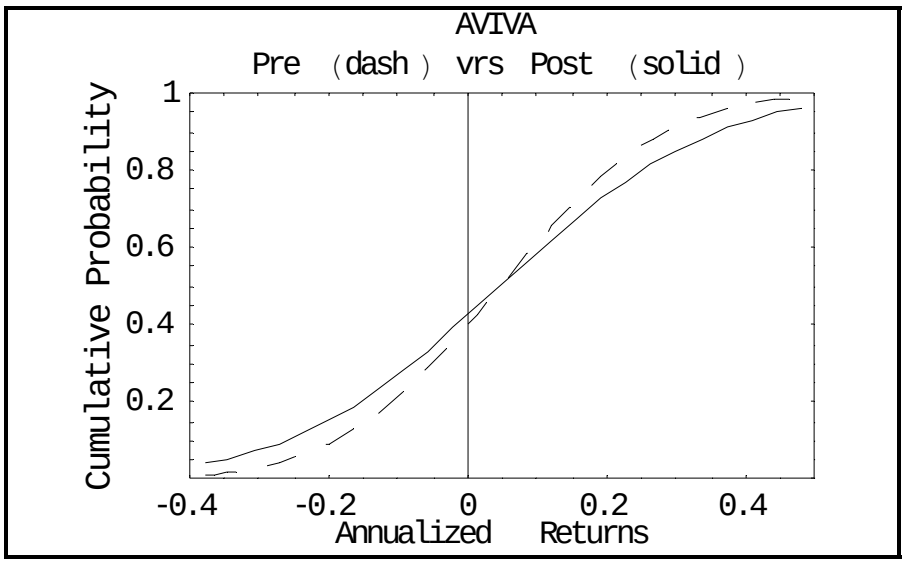
The above results have identified that with the exception of the Investment sector that different behavior appears to be exhibited by the largest firm in each sector relative to other firms. In order to explore this further we conduct a test of Hypothesis III, by providing an analysis of the shift in the thresholds for individual firms (adjusted for both general market and sector movements). For each sector, with the exception of Investments,

a highly significant *left shift* in the voluntary disclosure threshold was observed for the largest firm. This is consistent with Hypothesis 3 that if the disclosure game has a Stackelberg leader then the regulation will have the predicted effect of making the leader worse off and the followers better off. In the following sections we analyze the behavior of each sector from this perspective in more detail.

Interpretation of the Disclosure Games: Life Insurance

The Life Insurance sector is dominated by a large firm AVIVA (33.7%) and from pre FSA to post FSA AVIVA's threshold moved sharply to the left as depicted below.

Figure 5 FSA Regulation - Pre versus post cumulative return distribution for AVIVA

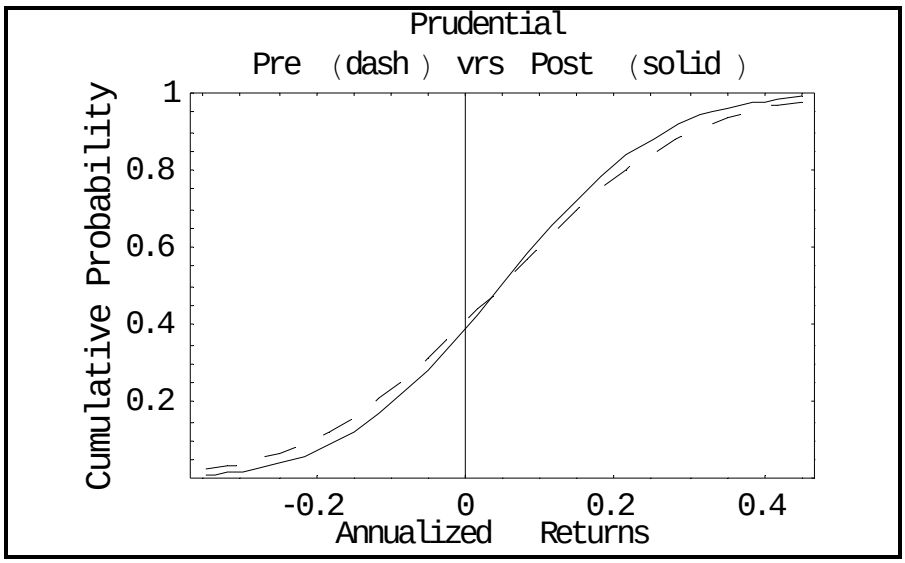


Dominance relationship: T-1 > T.
Chi-Square Statistics 56251.50 (T vrs T-1).

From the factor analysis results in Appendix C, pre FSA factor loadings for AVIVA on both the general factor (component 1) and the Life Insurance factor (component 4) are similar to the other Life Companies. However, post FSA AVIVA's weights are quite

different. In particular, on rotated factor 2 post FSA (appendix D) it is only the three Life Companies that have the large loading and AVIVA has a large negative loading (-0.920). On this same factor the remaining large loads are the other Life companies which have positive loadings (Legal and General 0.54, Prudential 0.75). These three firms make up the majority of the Life Insurance sector and AVIVA, Prudential and Legal and General account for 33.7%, 25.7% and 19.6% respectively (cumulative equals 79%). From the individual analysis at an individual firm level the voluntary disclosure threshold for both Prudential and Legal & General, moved sharply to the right post the FSA regulation.

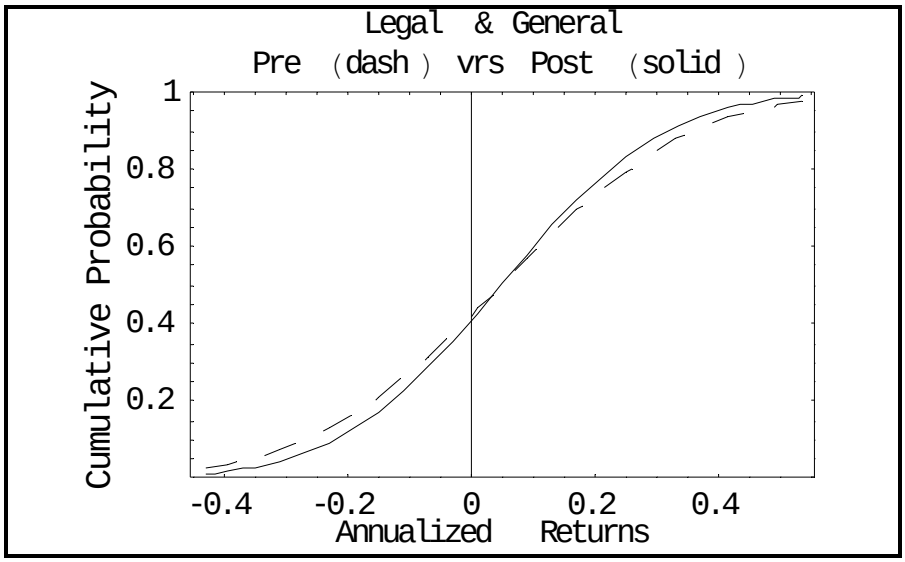
Figure 6: FSA Regulation - Pre versus post cumulative return distribution for Prudential



Dominance relationship: T-1 < T.

Chi-Square Statistics 3805.91 (T vrs T-1).

Figure 7: FSA Regulation - Pre versus post cumulative return distribution for Legal & General



Dominance relationship: T-1 < T.
Chi-Square Statistics 3453.73 (T vrs T-1).

This is consistent with the hypothesized interpretation of the disclosure game played out among these three firms. In addition, it is clear that AVIVA experienced the relatively stronger shift than Prudential and Legal and General combined. From table 3, Appendix I AVIVA's volatility increased by 30% whereas both Prudential and Legal & General declined by 14% and 14.5% respectively[21]. Post the FSA regulation we are detecting a shift in investor expectations that is consistent with the precision of investor priors decreasing for AVIVA. At the same time investor expectations are consistent with the precision of investors' priors increasing for both Prudential and Legal & General. Overall, for the sector as whole the left shift from AVIVA dominates the right shifts from Prudential and Legal & General, resulting in an overall left shift observed for this sector when testing Hypothesis I.

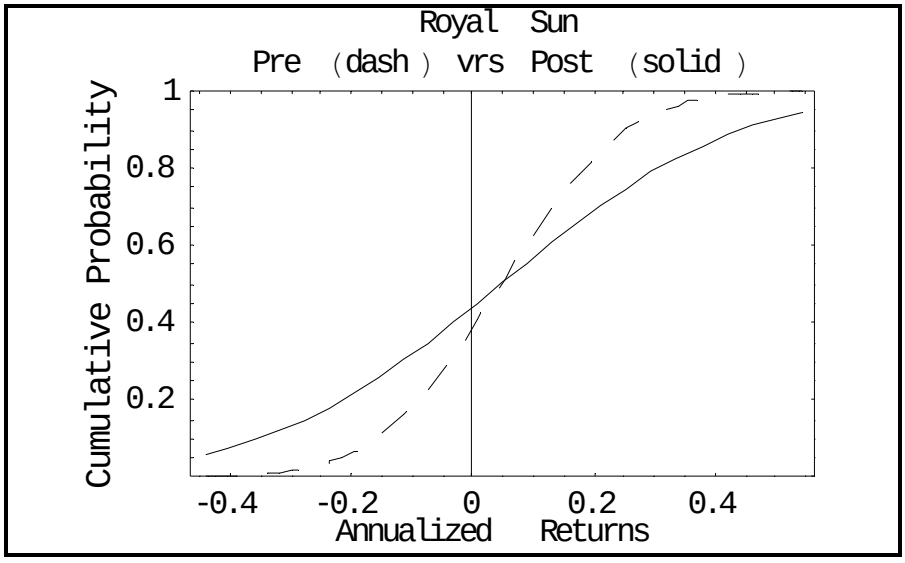
[21] Volatility under CAPM is not a driver of cost of equity capital but as a result of the "beta debate" in CAPM which questions the association between beta and expected return, and therefore beta and cost of capital, empirically volatility is considered to be a driver. This is reinforced if equity is considered to be an option defined on the total assets of the firm.

All the remaining sectors resulted in a positive shift and these sectors are analyzed next.

Interpretation of the Disclosure Games: General Insurance

This sector was consistent with Hypothesis I. Appendix H reveals that this sector is dominated by a large firm Royal Sun (29.9%), followed by Jardine, Britins, Amlin, Wellington and Hiscox (14.1%, 12.1%, 8.0%, 7.6% and 7.1% respectively). From the individual analysis in Appendix I Table 2 we observe that dramatic shifts of the threshold were realized at the individual firm level for this sector. Again the largest firm, Royal Sun, shifted sharply to the left as did Britins.

Figure 8: FSA Regulation - Pre versus post cumulative return distribution for Royal Sun



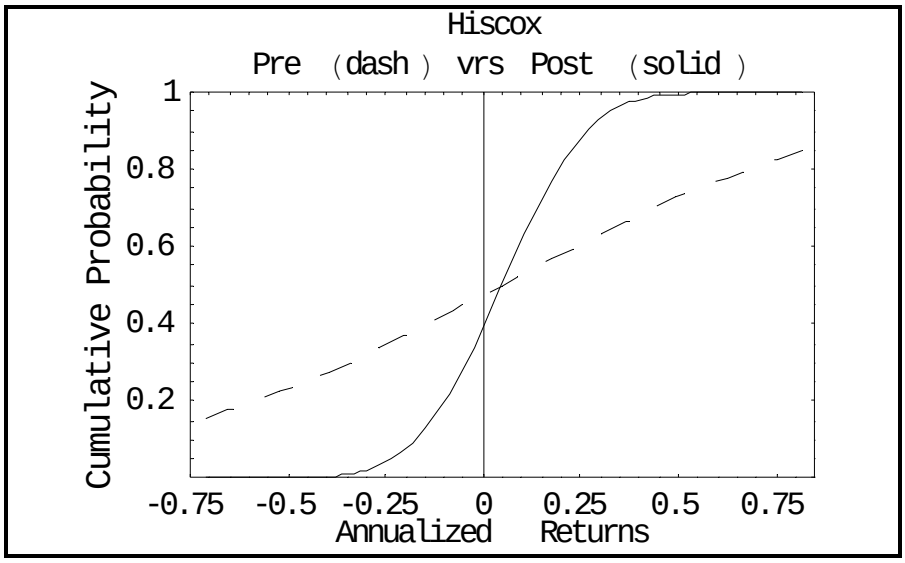
Dominance relationship: T-1 > T.
Chi-Square Statistics 228,867 (T vrs T-1).

For this sector the offsetting right shifts were realized from the subset of relatively smaller firms, Amlin, Wellington and Hiscox, see Table 2, Appendix I. Post the FSA

regulation for Amlin, Wellington and Hiscox the evidence is consistent with investors' expecting more voluntary disclose (so the precision of investor priors increase) and less voluntary disclosure from Royal Sun and Britins. For the case of Jardine a weak shift to the right was observed so it was basically left unaffected. Jardine's factor loading behavior post the FSA regulation is also consistent with this interpretation.

Offsetting this, however, were equally and larger shifts to the right by Amlin, Wellington and Hiscox. For the case of Hiscox volatility declined by 87% and the shift was as follows:

Figure 9: FSA Regulation - Pre versus post cumulative return distribution for Hiscox



Dominance relationship: T-1 < T.
Chi-Square Statistics 213,954 (T vrs T-1).

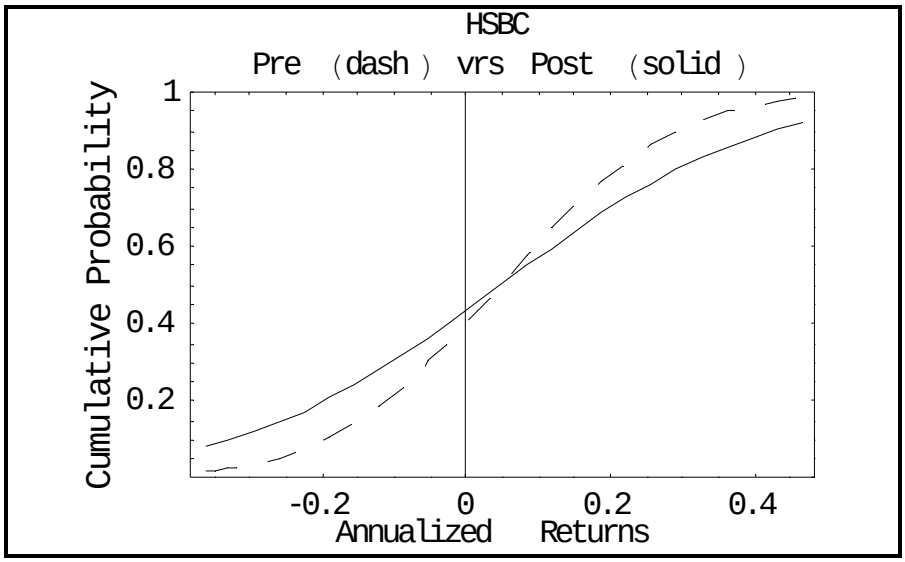
In summary this sector breaks down into two subsets of firms (relative large) which behave in a manner that is consistent with Hypothesis 3 and the relatively smaller which also behave in a manner consistent with Hypothesis 3. The overall positive impact upon the

sectors is consistent with the relatively smaller sector's positive shifts dominating the negative impact from the relatively larger set of firms.

Interpretation of the Disclosure Games: Banks

Overall this sector was consistent with Hypothesis I. This sector is dominated by HSBC (32.7%), followed by RBOS, HBOS, Barclays, Lloyds, and Standard Charter (21.3%, 12.7%, 12.5%, 10.5% and 3.7% respectively). Significant shifts were observed at the individual firm level. Again the largest bank shifted significantly to the left and the second largest RBOS exhibited a sharp offsetting shift to the right. In addition, at the relatively smaller bank level, shifts were all to the right. As a result, Banks behaved similarly with the largest firm exhibiting a strong left shift and the rest of the sector counteracting with right shifts (see Table 1, Appendix I).

Figure 10: FSA Regulation - Pre versus post cumulative return distribution for HSBC



Dominance relationship: T-1 > T.

Chi-Square Statistics 69,543 (T vrs T-1).

Some Conclusions from the Banks, General Insurance and Life Insurance

The above analysis supports the following immediate conclusions. The disclosure game is consistent with Hypothesis III, which argues that the disclosure game empirically appears to be characterized by a Stackelberg leader exploiting the externalities to reduce their own cost of capital. The FSA regulation serves to break up the leader's power which alters the reactions of the Cournot followers in this game to disclose more. Investors' expectations are consistent with the implication that the relative largest entity in each of these sectors is expected to disclose less voluntarily after the FSA regulation and their cost of capital increases. This in turn triggers re-distributive effects among the other entities in the sector in the presence of externalities.

At the aggregate sector level to be consistent with stated regulatory objectives the left shift exhibited by the leader should be more than offset by the aggregate movements of the remaining firms. This was indeed the case for both Banks and General Insurance but not the case for Life Insurance companies. For the latter the offsetting reactions from the remaining firms in the sector and especially Prudential and Legal & General were not sufficient to counteract the left shift experienced by AVIVA.

Interpretation of the Disclosure Games: Investments

This sector is different from the other three sectors. The results from the factor analysis immediately identified this difference because pre FSA regulation the other three sectors all loaded strongly on the first factor and no firm from this sector loaded on this factor. The industrial organization of this sector is very different because it consists of a very large number of smaller firms. Therefore, considering the disclosure game in terms of a Stackelberg leader is less reasonable than is the case for the other three sectors.

In addition, the factor analysis suggests that there are really two sub-sectors in this sector because consistently the largest firm, 3iGroup (13% of the sector) loaded in a different way from the others both pre and post. From the fundamentals a case can be made for this representation identified by the factor analysis. This is because 3iGroup is in the business of Venture Capital whereas the remaining firms manage investment portfolios. For the remaining firms we examine all firms that are at least 2% of the combined Investments sector (see Appendix H).

First, for the largest 3iGroup the threshold shift was pronounced, and to the right, post the FSA regulation. That is, 3iGroup is strictly better off.

For the remaining firms in the investment segment the pattern that emerged is as follows. The largest firm is Foreign Colonial, followed by Alliance Trust, Witan and Scottish Mortgage. Again the largest, Foreign Colonial shifted to the left and Alliance Trust shifted in the offsetting direction to the right. But thereafter, shifts appeared to be approximately alternating for the remaining set. Therefore, the significant positive impact upon the Investment sector is likely to have been driven more by the venture capital sector as opposed to any pronounced impact either way for the remaining firms in the Investment sector (see Table 4, Appendix I).

Section VII: Conclusions

Overall the FSA regulation appears to have had an expected positive impact relative to stated regulatory objectives because in three out of four sectors the overall shift in the disclosure threshold was to the right. The transition from a regulatory system of "a subtle

blend of self regulation and statute" Miles (1992) to one of integrated regulation has been successful in meeting the FSA's stated objectives. The exception was Life Insurance. A right shift is consistent with a reduction in sector risk and cost of equity capital for the sector. Such a right shift in the disclosure threshold is the predicted result of an increase in investors' prior precision and therefore, a reduction in the information risk component of the cost of capital (e.g., Easley and O'Hara (2004)).

At a micro level, however, the introduction of the regulation has re-distributive effects among the major firms in each sector. Here the main hypothesis tested was motivated from empirical insights from the US in relation to the passing of the 1933/1934 Securities Acts (e.g. Simon (1989)) and the introduction of Regulation FD/Sarbanes-Oxley almost 70-years later. The hypothesis was that the disclosure game in the US appeared to be consistent with the assumption that larger firms exploit their access advantage to channels of voluntary communication. We analyzed predictions for a disclosure game in the UK where we hypothesized that large firms exploit communication channels and externalities for self interest, by playing the role of a Stackelberg leader. Regulators on the other hand attempt to exploit the disclosure externalities for social welfare interests. As a result, post regulation under this hypothesis the re-distributive effects are predicted to render larger firms worse off and smaller firms better off. This is because the regulation serves to counteract the strength of the Stackelberg leader. In this paper, we obtain support for this hypothesis for the three sub sectors (Banks, General Insurance and Life Insurance) whose industrial organization lends itself to this type of game theoretic analysis. The difference between Banks and General Insurance versus Life Insurance was that for the latter, AVIVA, (the leader) the disclosure threshold shifted to the left by a greater amount than the remaining firms' shifted

to the right. As a result, sector level risk (i.e., systematic risk) increased for Life Insurance. For Banks and General Insurance, even though the largest firm's disclosure threshold shifted to the left this shift was compensated by greater offsetting shifts to the right for the other major entities resulting in a reduction in sector level risk. Overall, the evidence from these sectors was consistent with the hypothesis of the largest firm in each sector being a "Stackelberg leader" in each voluntary disclosure game.

Evidence from this paper suggests that the expected positive impact from the FSA regulation arises from the redistributive effects that resulted in a general increase in the competitiveness of the financial sector due to reduced information risk. The driver of this benefit appears to arise from the regulation serving to "level the playing field" between large versus small firm conflicts of interest in the voluntary disclosure game. This is also consistent with existing evidence from the 1933/1934 regulation in the US, which resulted in the growth of the Over-the-Counter market post the 1933 Act (Simon 1989).

Appendix A: FSA Act and the Financial Sectors

	Lognormal Estimate			
FSA-Banks	Mean	Std Dev	Chi-Square	Probability
1-Year Pre FSA	10305.40	1534.45	145.3	0.3851
1-Year Post FSA	8389.53	1106.44	152.4	0.2414
FSA-Investments	Mean	Std Dev		
1-Year Pre FSA	4040.11	526.18	128.2	0.773
1-Year Post FSA	3127.61	304.76	175.6	0.7153
FSA-LIFE	Mean	Std Dev		
1-Year Pre FSA	6832.37	1302.34	142.3	0.4524
1-Year Post FSA	4116.31	1037.77	143.3	0.431
FSA-FAINSU	Mean	Std Dev		
1-Year Pre FSA	2140.16	636.75	141.6	0.471
1-Year Post FSA	1278.64	311.75	112.8	0.9614

Null Hypothesis = Estimated Terminal Value Distribution is Lognormal

Appendix B: Sector Volatility of Returns and Chi-Squared Test of pre versus post FSA sector distribution shift

	Annualized Volatility of Returns	
FSA-Banks All Share	Volatility	Chi-Square
T-1	0.148	2344.35
T	0.131	
FSA-INV All Share		
T-1	0.130	11235.79
T	0.097	
FSA-LIFE All Share		
T-1	0.189	23174.98
T	0.248	
FSA-FAINSU All Share		
T-1	0.291	5502.29
T	0.240	

Appendix C: Factor Analysis of Pre FSA Returns - Principal Component Analysis: Explained Variance

Table 1: Variance Analysis

Extraction Loadings			Rotation Loadings		
Total	% Variance	Cum %	Total	% Variance	Cum %
12.989	51.955	51.955	10.330	41.320	41.320
3.280	13.122	65.077	4.210	16.839	58.160
2.297	9.189	74.266	2.949	11.797	69.956
1.205	4.818	79.084	2.194	8.777	78.734
1.025	4.102	83.186	1.113	4.452	83.186

Table 2: Eigenvalue Analysis

Components	Initial Eigenvalues		
	Total	% Var	Cum %
1	12.989	51.955	51.955
2	3.280	13.122	65.077
3	2.297	9.189	74.266
4	1.205	4.818	79.084
5	1.025	4.102	83.186
6	0.801	3.205	86.391
7	0.757	3.026	89.417
8	0.721	2.882	92.300
9	0.611	2.443	94.742
10	0.549	2.196	96.939
11	0.472	1.890	98.829
12	0.293	1.171	100.000
13	0.000	0.000	100.000
14	0.000	0.000	100.000
15	0.000	0.000	100.000
16	0.000	0.000	100.000
17	0.000	0.000	100.000
18	0.000	0.000	100.000
19	0.000	0.000	100.000
20	0.000	0.000	100.000
21	0.000	0.000	100.000
22	0.000	0.000	100.000
23	0.000	0.000	100.000
24	0.000	0.000	100.000
25	0.000	0.000	100.000

Appendix D: Factor Loading: Pre FSA Principal Component and Rotated Factor Analysis

In the following table the higher factor loadings (0.4 and above) are in bold. This makes the sector differences transparent. Five factors were identified explaining a cumulative of 83.2% of the variance.

Table 1: Unrotated factor loadings

Component Matrix					
Factors	1	2	3	4	5
Barclays	**0.91**	-0.20	0.21	-0.23	-0.12
HBOS	**0.93**	-0.20	0.20	-0.20	-0.09
HSBC	**0.94**	-0.20	0.20	-0.19	-0.07
Lloyds	**0.93**	-0.20	0.20	-0.20	-0.09
Royal	**0.88**	-0.20	0.21	-0.24	-0.14
StanChar	**0.94**	-0.19	0.19	-0.15	-0.04
Amlin	**0.53**	**0.53**	**-0.64**	-0.07	-0.12
Britins	**0.77**	0.39	**-0.49**	-0.08	-0.08
Hiscox	**0.66**	**0.47**	**-0.57**	-0.07	-0.10
Jardine	**0.96**	0.00	-0.04	-0.08	0.01
Royal Sun	**0.77**	0.39	**-0.48**	-0.08	-0.08
Wellington	**0.94**	-0.14	0.13	0.01	0.07
AVIVA	**0.88**	0.01	0.00	0.39	0.17
Britannic	**0.96**	-0.08	0.08	0.18	0.12
L & G	**0.89**	0.00	0.00	0.39	0.17
Old Mut	**0.96**	-0.09	0.08	0.17	0.12
Pru	**0.87**	0.01	-0.01	**0.41**	0.18
3iGroup	-0.09	**-0.58**	-0.34	0.17	0.20
AllianceTrust	0.01	**0.53**	0.18	-0.16	0.15
EdinburghInv	0.05	**0.54**	0.32	-0.12	-0.09
ForeignColonial	0.03	**0.63**	0.38	0.02	0.10
RITCapital	-0.01	0.34	0.12	**-0.42**	**0.68**
SCOTINV	0.04	**0.41**	0.37	0.33	**-0.43**
SCOTMORT	0.01	**0.49**	**0.45**	0.15	-0.15
WITAN	0.07	**0.61**	0.23	0.14	0.22

Table 2: Rotated Factor Loadings

Component Matrix					
Factors	1	2	3	4	5
Barclays	**0.97**	0.15	0.00	0.01	-0.03
HBOS	**0.98**	0.15	0.00	0.05	-0.02
HSBC	**0.98**	0.16	-0.01	0.08	-0.01
Lloyds	**0.98**	0.15	0.00	0.05	-0.02
Royal	**0.96**	0.14	0.00	-0.02	-0.04
StanChar	**0.97**	0.16	-0.01	0.12	0.01
Amlin	0.12	**0.98**	0.10	0.08	0.01
Britins	**0.42**	**0.89**	0.08	0.15	0.03
Hiscox	0.28	**0.95**	0.09	0.12	0.02
Jardine	**0.83**	**0.42**	0.01	0.22	0.04
Royal Sun	**0.43**	**0.88**	0.08	0.15	0.03
Wellington	**0.89**	0.20	-0.01	0.31	0.03
AVIVA	**0.65**	0.29	0.03	**0.67**	-0.05
Britannic	**0.83**	0.25	0.00	**0.49**	-0.01
L & G	**0.66**	0.29	0.02	**0.67**	-0.05
Old Mut	**0.83**	0.25	0.00	**0.48**	0.00
Pru	**0.64**	0.29	0.03	**0.68**	-0.06
3iGroup	-0.09	-0.11	**-0.69**	0.19	0.02
AllianceTrust	-0.05	0.13	**0.52**	-0.03	0.28
EdinburghInv	0.04	0.07	**0.63**	-0.10	0.05
ForeignColonial	-0.03	0.02	**0.72**	0.09	0.16
RITCapital	-0.01	0.01	0.27	-0.01	**0.83**
SCOTINV	0.00	-0.03	**0.60**	0.09	**-0.49**
SCOTMORT	0.00	-0.09	**0.67**	0.07	-0.15
WITAN	-0.08	0.10	**0.61**	0.26	0.20

Appendix E: Factor Analysis of Post FSA Returns - Principal Component Analysis: Explained Variance

Table 1: Variance Analysis

Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	% Variance	% Cum	Total	% Variance	% Cum
2.630	10.522	10.522	2.281	9.124	9.124
2.204	8.816	19.338	1.993	7.970	17.094
1.785	7.141	26.479	1.663	6.652	23.746
1.577	6.310	32.788	1.558	6.232	29.979
1.537	6.148	38.936	1.528	6.113	36.092
1.401	5.604	44.540	1.403	5.612	41.704
1.301	5.202	49.742	1.352	5.406	47.110
1.170	4.680	54.422	1.349	5.394	52.504
1.072	4.289	58.711	1.306	5.223	57.727
1.029	4.116	62.827	1.275	5.100	62.827

Table 2: Eigenvalue Analysis

	Initial Eigenvalues		
Component	Total	% Variance	% Cumulative
1	2.630	10.522	10.522
2	2.204	8.816	19.338
3	1.785	7.141	26.479
4	1.577	6.310	32.788
5	1.537	6.148	38.936
6	1.401	5.604	44.540
7	1.301	5.202	49.742
8	1.170	4.680	54.422
9	1.072	4.289	58.711
10	1.029	4.116	62.827
11	0.972	3.889	66.716
12	0.897	3.588	70.303
13	0.875	3.498	73.802
14	0.808	3.231	77.032
15	0.769	3.077	80.109
16	0.712	2.848	82.957
17	0.688	2.753	85.710
18	0.644	2.576	88.287
19	0.610	2.440	90.727
20	0.567	2.267	92.994
21	0.516	2.064	95.058
22	0.484	1.937	96.995
23	0.376	1.506	98.501
24	0.330	1.321	99.822
25	0.045	0.178	100.000

Appendix F: Post FSA Factor Loadings: Principal Component Analysis

In the following table the higher loadings per factor are in bold. This makes the sector differences transparent.

Component	1	2	3	4	5	6	7	8	9	10
Barclays	-0.20	-0.12	0.27	-0.11	0.19	0.31	0.26	**0.40**	0.04	0.22
HBOS	0.22	0.15	-0.27	-0.09	0.07	**-0.68**	0.03	-0.01	0.04	0.34
HSBC	0.35	-0.08	0.15	-0.34	-0.09	0.15	**-0.47**	-0.11	-0.20	-0.29
Lloyds	-0.35	0.26	-0.05	-0.34	0.17	0.08	**0.46**	-0.04	0.13	0.03
Royal	-0.09	-0.06	-0.04	**0.73**	-0.25	0.03	-0.27	0.08	0.05	-0.08
StanChar	0.27	-0.19	0.26	**-0.42**	0.08	-0.01	-0.10	-0.20	-0.27	0.04
Amlin	**0.48**	0.08	-0.17	0.03	-0.07	0.21	0.12	**0.41**	0.34	-0.08
Britins	**0.54**	0.24	-0.19	0.05	-0.31	0.17	0.27	0.10	0.03	0.08
Hiscox	**0.61**	-0.09	-0.11	-0.04	0.02	0.09	0.25	0.03	0.16	0.02
Jardine	0.25	0.01	0.17	0.15	**0.49**	0.26	0.03	-0.22	-0.18	0.19
Royal Sun	**-0.74**	-0.15	0.05	-0.04	0.01	-0.23	-0.08	0.20	0.10	0.09
Wellington	**0.56**	0.06	0.00	0.08	-0.19	-0.15	0.17	-0.21	0.01	0.02
AVIVA	-0.13	**0.83**	-0.36	-0.13	0.05	-0.04	-0.16	0.01	-0.08	-0.09
Britannic	**0.45**	-0.01	0.06	0.08	**0.42**	-0.14	-0.28	0.14	0.15	0.09
L & G	0.04	**-0.59**	0.08	0.36	-0.09	-0.28	0.10	0.13	-0.11	0.01
Old Mut	-0.03	-0.04	0.01	**0.46**	**0.41**	**0.41**	0.08	-0.24	-0.08	0.18
Pru	0.04	**-0.55**	**0.42**	-0.33	-0.30	0.04	0.14	-0.01	0.20	-0.04
3iGroup	-0.33	-0.35	**-0.66**	-0.14	-0.04	0.26	0.02	-0.03	-0.08	0.06
AllianceTrust	-0.01	0.04	0.27	0.04	**0.44**	-0.23	-0.07	-0.20	**0.59**	-0.21
EdinburghInv	0.14	0.16	0.30	-0.11	0.15	-0.10	-0.25	**0.54**	-0.20	0.36
ForeignColonial	0.02	0.19	0.27	0.19	0.05	-0.30	**0.50**	0.01	**-0.46**	-0.13
RITCapital	-0.09	0.33	0.31	0.07	0.15	0.08	0.11	0.29	-0.09	**-0.56**
SCOTINV	-0.08	0.37	0.29	-0.01	-0.32	0.31	-0.22	-0.01	0.10	0.33
SCOTMORT	0.00	0.21	0.30	0.18	-0.37	-0.02	-0.01	0.02	-0.03	0.03
WITAN	-0.22	0.36	0.44	0.07	-0.27	-0.02	0.09	-0.36	0.19	0.22

Appendix G: Post FSA Factor Loadings: Rotated Factor Analysis

	1	2	3	4	5	6	7	8	9	10
Barclays	-0.07	0.29	0.02	0.22	0.34	0.16	-0.09	-0.04	0.30	**0.41**
HBOS	0.10	-0.18	-0.13	0.09	0.04	-0.21	0.14	0.15	**-0.74**	0.15
HSBC	0.09	-0.04	-0.03	**-0.75**	-0.16	-0.09	0.01	-0.15	0.17	0.02
Lloyds	-0.11	-0.13	0.03	0.24	**0.68**	-0.02	0.00	0.07	0.08	-0.11
Royal	-0.06	-0.01	0.14	0.33	**-0.73**	0.06	-0.03	-0.04	0.13	-0.09
StanChar	0.01	0.20	-0.03	**-0.62**	0.18	0.08	-0.02	0.07	-0.12	0.09
Amlin	**0.66**	-0.02	-0.11	0.18	-0.03	-0.15	0.09	-0.19	0.20	0.20
Britins	**0.72**	-0.11	0.12	0.06	0.00	-0.05	-0.21	0.03	-0.04	0.01
Hiscox	**0.65**	0.15	-0.15	-0.05	0.06	0.07	0.08	-0.02	-0.08	0.01
Jardine	0.10	-0.01	-0.04	-0.16	0.05	**0.69**	0.11	0.08	-0.01	0.11
Royal Sun	**-0.69**	0.12	-0.01	0.34	0.08	-0.25	-0.01	-0.08	0.00	0.09
Wellington	**0.52**	0.05	0.11	-0.15	-0.11	0.00	0.06	0.19	-0.26	-0.14
AVIVA	-0.01	**-0.92**	0.10	0.05	0.15	-0.15	-0.03	0.01	-0.01	0.01
Britannic	0.21	-0.06	-0.21	-0.14	-0.19	0.19	**0.43**	-0.10	-0.16	0.37
L & G	-0.07	**0.54**	-0.23	0.15	-0.40	-0.02	-0.05	0.22	-0.14	0.02
Old Mut	-0.03	-0.01	-0.01	0.18	-0.09	**0.77**	0.00	-0.03	0.11	-0.08
Pru	0.02	**0.75**	0.12	-0.23	0.16	-0.25	0.03	-0.09	0.11	-0.06
3iGroup	-0.18	0.00	**-0.43**	0.17	0.11	0.01	**-0.50**	**-0.42**	-0.04	-0.28
AllianceTrust	-0.09	0.04	0.00	0.07	0.09	0.06	0.85	-0.06	0.02	-0.10
EdinburghInv	-0.04	-0.06	0.09	-0.11	-0.03	-0.02	-0.01	0.07	-0.05	**0.82**
ForeignColonial	0.01	0.01	0.04	0.07	0.07	0.07	-0.08	**0.83**	0.00	0.01
RITCapital	-0.03	-0.22	-0.01	0.01	0.03	-0.11	0.22	**0.40**	**0.62**	0.10
SCOTINV	0.01	-0.13	**0.68**	-0.03	0.00	0.03	-0.12	-0.24	0.09	0.19
SCOTMORT	0.06	0.02	**0.47**	0.03	-0.19	-0.13	-0.06	0.17	0.08	0.04
WITAN	-0.13	0.00	**0.75**	0.08	0.13	0.04	0.14	0.10	-0.08	-0.16

Appendix H: Description of sector and major companies analysed within sector

Description of sector and major companies analysed within sector	Company weighting (%)
FTSE Banks Index – FABANK (11 members) is a capitalization weighted index designed to measure the performance of banking companies within the FTSE All Share	
Barclays	12.5
HBOS	12.7
HSBC	32.7
Lloyds	10.5
RBOS	21.3
StanChar	3.7
Cumulative	93.4
FTSE Insurance Index – FAINSU (15 members) is a capitalization weighted index designed to measure the performance of insurance companies within the FTSE All Share	
Amlin	8.0
BritIns	12.1
Hiscox	7.1
Jardine	14.1
RoyalSun	29.9
Wellington	7.6
Cumulative	78.8
FTSE Investment Companies – FAINVC (115 members) is a capitalization weighted index designed to measure the performance of investment companies within the FTSE All Share	
3iGroup	13.0
AllianceTrust	4.5
EdinburghInv	2.4
ForeignColonial	5.9
RITCapital	2.4
ScotInv	2.0
ScotMort	2.9
Witan	3.6
Cumulative	36.7
FTSE Life Assurance Index – FALIFE (7 members) is a capitalization weighted index designed to measure the performance of life assurance companies within the FTSE All Share	
Aviva	33.7
Britannic	1.7
Legal&General	19.6
OldMutual	11.7
Prudential	25.7
Cumulative	92.4

Appendix I: Sector Volatility of Returns and Chi-Squared Test of pre versus post FSA firm specific distribution shift

Table 1: Banks

	Annualized Volatility of Returns	
FSA-Banks		
Barclays	Volatility	Chi Square
T-1	0.169	0.00
T	0.169	
HBOS		
T-1	0.253	3837.76
T	0.216	
HSBC		
T-1	0.191	69542.52
T	0.290	
Lloyds		
T-1	0.211	2220.33
T	0.188	
Royal Bank of Scotland		
T-1	0.225	13657.88
T	0.163	
Standard Charter		
T-1	0.312	3159.04
T	0.271	

Table 2: General Insurance

	Annualized Volatility of Returns	
FSA-FAINSU	Volatility	Chi-Square
Wellington		
T-1	0.640	170818.16
T	0.170	
RoyalSun		
T-1	0.160	228867.36
T	0.310	
Jardine		
T-1	0.217	170.94
T	0.210	
Hiscox		
T-1	0.746	213954.13
T	0.170	
Brit Ins		
T-1	0.308	18651.55
T	0.395	
Amlin		
T-1	0.424	35446.27
T	0.242	

Table 3: Life Insurance

	Annualized Volatility of Returns	
FSA-LIFE	Volatility	Chi-Square
AVIVA		
T-1	0.186	21364.37
T	0.242	
Legal&General		
T-1	0.244	3453.73
T	0.210	
OldMutual		
T-1	0.267	5490.50
T	0.310	
Prudential		
T-1	0.199	3805.91
T	0.170	
Brittanic		
T-1	0.187	311628.29
T	0.395	

Table 4: Investment Firms

	Annualized Volatility of Returns	
FSA-INV	Volatility	Chi-Square
3i Group		
T-1	0.277	4405.98
T	0.234	
Alliance		
T-1	0.086	3943.73
T	0.073	
Edinburgh		
T-1	0.088	17412.19
T	0.112	
ForeignCol		
T-1	0.110	291041.93
T	0.227	
RIT Capital		
T-1	0.119	214.33
T	0.115	
SCOTINV		
T-1	0.090	40151.23
T	0.127	
SCOTMORTG		
T-1	0.127	1758.92
T	0.114	
WITAN		
T-1	0.113	1393.59
T	0.122	

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