Working Paper Series

06/2007

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CAMBRIDGE
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This paper is also available from the Centre for Economic Policy and Research, DP 5036, www.cepr.org/pubs/dps/DP5036.asp. It is also under third review at the *Journal of Financial Intermediation* (http://www.olin.wustl.edu/jfi/).

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Regulating Financial Conglomerates*

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May 2006

*We are grateful to Hyun Shin for a number of stimulating discussions at an early stage in this project. We thank Anjan Thakor (the editor), Kern Alexander, Elena Carletti, Zsusanna Fluck, Stewart Myers, Rolf Weber and seminar participants at the National Bank of Belgium, the Saïd Business School, the 2005 CFS Conference on Risk Transfer, ESSFM (Gerzensee, 2005), the 2005 Moscow EFA meetings, the European Central Bank and the April 2006 "Changing Nature of the Financial System and Systemic Risk" Conference at the University of Cambridge for helpful comments. Generous financial support was provided by the Cambridge Endowment for Financial Research (CERF).

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Regulating Financial Conglomerates

Abstract

We analyse the risk-taking and risk-shifting incentives of financial conglomerates that combine a bank and a non-bank financial institution. The conglomerate's risk-taking incentives depend upon the level of market discipline it faces, which in turn is determined by the conglomerate's liability strucure. We examine optimal capital requirements for standalone institutions, for integrated financial conglomerates, and for financial conglomerates that are structured as holding companies. For a given risk profile, because of diversification, integrated conglomerates have a lower probability of failure than either their standalone or decentralised equivalents. However, when risk profiles are endogenously selected, conglomeration may extend the reach of the deposit insurance safety net and hence provide incentives for increased risk-taking. As a result, integrated conglomerates may need higher capital requirements. In contrast, decentralised conglomerates are able to hold assets in the institution whose failure has the lowest social cost. Their optimal capital requirements encourage this. Hence the practice of "regulatory arbitrage", or of transfering assets from one balance sheet to another, is welfare-increasing. We discuss the policy implications of our finding in the context not only of the present debate on the regulation of financial conglomerates, but also in the light of existing US bank holding company regulation.

KEY WORDS: Financial conglomerate, capital regulation, regulatory arbitrage.
JEL Classification: G21, G22, G28.

1. Introduction

The emergence of financial conglomerates is one of the major financial developments of recent years.[1] Financial conglomerates are institutions that provide under a single corporate umbrella banking, insurance and other financial products. Conglomeration has been motivated by cost advantages from economies of scale and scope in insurance sales and securities underwriting, and by the perceived advantages of risk diversification.[2] The recognition of the importance of conglomeration for the financial sector has led the Group of Ten to study its potential implications for public policy. Their study is inconclusive regarding risk taking and risk assumption.[3] This paper is concerned with risk-taking and risk-shifting in financial conglomerates, and their implications for optimal capital regulation.

We analyse the extent to which risk-taking incentives in financial conglomerates and their optimal capital regulation are affected by organizational form. Dierick (2004) and Shull and White (1998) discuss the different legal structures available to conglomerates. Although the choice of legal structure may be restricted by regulation,[4] it is essentially a choice between structuring the conglomerate as an integrated entity subject to a unique liability constraint, or structuring it as a holding company and allowing its various divisions to fail independently. For example, universal banks are structured as integrated entities and are engaged in the same activities as bank holding companies. The conglomerate's capital regulation is constrained by its organizational form. Integrated entities face a single capital requirement, while the regulator can set separate capital requirements for each division of a decentralized conglomerate.

Integrated conglomerates achieve inter-divisional diversification (see Malkönen, 2004, and Allen and Jagtiani, 2000). Practitioners have argued that conglomerate diversification will reduce bankruptcy risk and therefore that it should be rewarded with reduced capital requirements (see Oliver, Wyman & Co., 2001).

The process of transferring assets between conglomerate divisions in order to avoid high capital charges is popularly referred to as *regulatory*, or *capital*, *arbitrage*. Regulators usually regard capital arbitrage as a *risk* of conglomeration: see for example Dierick (2004). The Joint Forum (2001) provide an extensive discussion of regulatory arbitrage and are ambivalent as to its effects, concluding that it must be accompanied by evidence of adequate risk management practices.[5]

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[1] The November 1999 Gramm-Leach-Bliley Act dismantled legal barriers to the integration of financial services firms which had been erected by the 1933 passage of the Glass-Stegall Act. Its passage made conglomeration legal in the United States. The Gramm-Leach-Bliley Act was a response to market forces which had already resulted in the Federal Reserve Board's approval in 1998 of the merger of Citicorp and Travelers. Conglomeration in Europe, which was subject to fewer regulatory hurdles, followed the same trend: between 1985 and 1999 the value of merger and acquisition deals involving a commercial bank and an insurance company was \$89.6 billion, or 11.6% of all acquisitions by European financial institutions. See Lown, Osler, Strahan and Sufi (2000) for detailed discussion about, and statistics concerning, the development of the European bancassurance market. A detailed discussion of conglomeration experience in the Benelux countries is provided by the National Bank of Belgium (2002).

[2] For a detailed discussion for the rationale behind conglomeration, see Berger, DeYoung, Genay and Udell (2000), Milbourn, Boot and Thakor (1999) and Dierick (2004). Santos (1998) discusses mergers between banks and insurance firms. A substantial literature considers conglomeration in non-financial firms. This literature examines rationales such as improved asset allocation and managerial perquisit consumption, but does not consider the effects which we discuss in this paper. See for example Inderst and Müller (2003) and Scharfstein and Stein (2000).

[3] "The potential effects of financial consolidation on the risk of individual institutions are mixed, the net result is impossible to generalise, and thus a case-by-case assessment is required. The one area where consolidation seems most likely to reduce firm risk is the potential for (especially geographic) diversification gains. Even here, risk reduction is not assured, as the realisation of potential gains is always dependent upon the actual portfolio held." (Group of Ten, 2001, p. 3)

[4] Within Europe, it is illegal to combine insurance with banking, securities or any other commercial business in the same legal entity (Dierick, 2004, p. 17: see Article 6(1)(b) of the Life Asssurance Directive and Article 81(b) of the Non-Life Assurance Directive).

[5] Loss transfer from a sound conglomerate division to a divison close to financial distress is a distinct issue which regulators can

In this paper we argue that these commonly-held views may be mistaken. First, diversification within integrated conglomerates increases risk-taking incentives. As a result, it may even *lower* welfare relative to the standalone institution case. Second, capital arbitrage within holding company conglomerates can *raise* welfare by increasing market discipline. This effect is further strengthened to the extent that the non-bank divisions in conglomerates have a lower social cost of failure than banks.

The intuition for our results is as follows. Bank depositors have privileged access to deposit insurance. Regulators are constrained by law to use hard and verifiable data, and hence cannot contract precisely upon bank risk levels. As a result, deposit insurance prices are insufficiently risk-sensitive and market discipline is weakened. This biases bank shareholders towards excessive risk-taking. Regulators use capital requirements to force financial institutions to internalise costs which they would otherwise ignore.[6] Capital requirements are therefore higher in banks than in financial institutions which have no access to the deposit insurance fund. Once again, however, regulators are unable to set perfectly risk-sensitive capital requirements.

Capital requirements are therefore an imperfect substitute for market discipline. Welfare is thus enhanced if regulations can be designed in such a way that assets are held by institutions that are subject to market discipline, and hence require lower capital requirements. This is possible in a financial conglomerate, where institutional barriers to asset transfers are low. The divisions of a holding-company conglomerate are separately-capitalised. As a result, high capital requirements for the bank encourage regulatory arbitrage, which transfers assets to other, non-bank, divisions. This replaces imprecise regulatory contracts with the precise disciplining of the marketplace, and so raises welfare.

In contrast, the bank in an integrated conglomerate shares a unique balance sheet with the other divisions. For a given investment portfolio, this generates diversification effects which reduce the costs of deposit insurance, and hence raises welfare relative to the standalone bank case. However, risk levels are selected endogenously and they will change in response to conglomerate formation. Because they have a common balance sheet, the divisions of the integrated conglomerate have common liabilities. Large-scale losses in non-bank divisions therefore harm bank depositors, and so result in a call upon the deposit insurance fund. This mechanism extends the reach of the deposit insurance fund, and hence reduces market discipline relative to the standalone case in non-bank divisions. Depending upon the benefits derived from diversification, this reduction in market discipline may even justify *higher* capital requirements for the conglomerate than for its stand alone constituents.

In contrast with commonly received opinion, regulatory arbitrage in our model has three unambiguously positive effects. First, the investment distortions induced by the deposit insurance fund will no longer occur. Second, marginal projects in which the standalone bank's shareholders would not invest will now attract funds, because of the lower capital requirement. Third, risky assets are transferred to an institution with lower social costs of failure. Regulatory arbitrage therefore reduces the extent of the safety net and, by allowing for a more efficient use of capital, results in a greater degree of bank credit extension.[7]

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deal with, subject to the passage of the necessary legislation.

[6]Other papers have stressed the role of capital adequacy requirements in protecting depositors and in providing incentives to banks: see for example Dewatripont and Tirole (1993) and Morrison and White (2005).

[7]In this paper we stress the importance of financial conglomerates in facilitating regulatory arbitrage. Standalone banks could also engage in regulatory arbitrage, however, through the market for asset securitization. We discuss this possibility in section 4.1. In our stripped-down model, securitization would generate the same welfare benefits as regulatory arbitrage within financial conglomerates. However, we argue that the informational and institutional frictions to asset transfer are likely to be lower between the divisions of a conglomerate than between standalone institutions.

We conclude from the above discussion that, contrary to the majority view, holding-company conglomerates allow for a more efficient allocation of resources than integrated ones. Our analysis is therefore supportive of existing legislative restrictions upon the integration of banking and insurance activities (see footnote 4), *provided capital arbitrage is permitted*.

Although we derive our results in a simple framework in which each institution effectively manages a single scaleable project, we believe that our intuition is robust to alternative set-ups. For example, a reasonable alternative framework would be one in which risk-averse banks selected their investment portfolios according to the Capital Asset Pricing Model (see Hart and Jaffee, 1974).

Our work demonstrates that the diversification benefits of financial conglomeration may be overturned simply by allowing for the endogeneity of risk levels in financial institutions. A similar point is made by Boot and Schmeits (2000), in a model of conglomeration without deposit insurance. In their paper, market discipline is reduced because diversification reduces the sensitivity of aggregate cash flows to divisional investment decisions. Unlike us, Boot and Schmeits are not concerned with capital regulation.

More closely related to our paper is the work of Dewatripont and Mitchell (2005), who also examine the regulation of financial conglomerates in which one division has access to a deposit insurance safety net. Like us, they find that the conglomerate may take excessive risks in order to extend the reach of the deposit insurance safety net. Unlike us, they assume that project return is either exogenous or has a given relationship to riskiness, and they allow for endogenous selection of project correlations. Dewatripont and Mitchell use their model to consider conglomerate formation incentives, rather than capital regulation. When every divisional manager has a veto over conglomerate formation and each division has to share its marginal product, they find that conglomerates will form ex ante only when they will ex post elect to diversify and to reduce risk.

In section 2 we present a model of standalone financial intermediaries and derive optimal capital requirements. Section 3 extends our analysis to holding-company and integrated conglomerates. Section 4 discusses the robustness of our results. Section 5 discusses some additional policy implications of our results. Section 6 discusses the empirical implications of our work. Section 7 concludes.

2. Standalone Financial Intermediaries

In this section we analyze a one-period interaction between a regulator, a financial intermediary, and the investors in the intermediary. All of the players in our model are risk-neutral and we normalise the risk-free interest rate to zero.

The financial intermediary has a choice between a safe and a risky project, both of which require an initial investment of \$1 and have an expected return of R. R is drawn from $[R_l, R_h]$ according to the uniform distribution. We write $\Delta \equiv R_h - R_l$, and we assume that $R_l < 1 < R_h$. Safe projects return R for sure, while risky projects return $R + \bar{B}$ or $R - \bar{B}$, each with probability $\frac{1}{2}$. We indicate the riskiness of the project with the choice variable B, where $B = 0$ for safe projects and $B = \bar{B}$ for risky projects. Hence, every project returns $R \pm B$ with equal probabilities.

All financial intermediaries raise an amount $\$C$ of equity capital from shareholders, and an amount $\$(1-C)$ from debt-holders. Debt-holders have priority in the event of project failure, and we assume that there are no bankruptcy costs. Both the intermediary's shareholders and debt-holders are able perfectly to observe the expected return R and the riskiness B of its investment.[8] Every financial intermediary aims to maximise its shareholder wealth.

We assume that it is costly to raise equity capital. This is in line with statements made by practitioners, and can be justified with respect to high transactions costs and differential taxation levels for equity. Specifically, we assume that to invest \$$C$ of equity capital, it is necessary to raise \$$C(1+\kappa)$.

We consider two types of financial intermediaries: *Deposit-Financed Intermediaries*, which we will also refer to as DFIs or as *banks*; and *Market-Financed Intermediaries*, or MFIs. The MFIs within financial conglomerates are either insurance or securities firms. The bank debt-holders are called *depositors*. They are protected by a deposit insurance fund, which will make good any losses which they experience. As a result their willingness to invest is independent of their bank's investment choices. The MFI debt-holders do not have deposit insurance, and so condition their willingness to invest upon the riskiness of their intermediary's investment choices. For convenience we will sometimes refer to MFI debt-holders as *bond-holders*.[9] We denote the face value of the MFI's debt by ρ.

Financial intermediaries are subject to regulation. The regulator has two roles. First, it manages the deposit insurance scheme for bank depositors. Second, it sets the capital requirement C so as to maximise the expected present value of investments, net of the social costs of failure. We assume that regulators are constrained to use only hard data which is verifiable in court. They are therefore unable to contract precisely upon the return R or the riskiness B of the intermediary's investment. This is consonant with observed regulation: if perfect contracting was possible, command-and-control regulation would be optimal. In particular, we assume that deposit insurance premia are zero, and that capital regulation is completely risk-insensitive. Any regulations based upon data coarser than those available to an informed investor would generate qualitatively the same results, at the cost of greater complexity.

We assume that the intermediary has a private cost $\zeta \geq 0$ of bankruptcy. We interpret ζ as representing the intermediary's charter value: it is clearly a function of policy choices such as competition levels, but in our model we leave it as an exogenous variable. Finally, we assume that intermediary failure has a social cost $\phi > 0$. When the intermediary is a bank, ϕ includes such exogenous factors as the impact of the bank's failure upon the payment system, and the costs of destroying informational assets which have a value in the relationship with the bank's clients.[10] We assume that the social failure cost ϕ includes any social effects which the intermediary cares about. Hence we include ϕ in our welfare calculations, but not ζ.[11]

Table 1 summarizes the symbols used in this section. We summarise the game that we study in figure 1.

At time 0 the regulator selects the capital requirement C. At time 1 nature presents the intermediary with safe and risky projects, each of which returns R in expectation. At time 2 the intermediary decides whether

[8] Our results would be unaffected if the dispersed depositors in a bank were unaware of its investments, since these agents are protected in our model by a deposit insurance scheme.

[9] We therefore model the asset side of bank and insurance company balance sheets in the same way, and we distinguish the liability side only in terms of the protection provided to depositors through the deposit insurance fund. While regulators appear to regard the differences between the insurers and banks as more extensive, our approach allows us to make our points in the most parsimonious fashion. Moreover, it accords with casual remarks made in conversation by insurance practitioners, who regard their liability-side provisions as bond-like, and who argue that their assets are frequently securitised bank loans. To the extent that capital arbitrage is an important issue, this seems likely to be true.

[10] See James (1991) for an estimation of the cost of bank failure, and Slovin, Sushka and Polonchek (1993) for the estimation of the cost of Continental Illinois bankruptcy to its clients.

[11] To the extent that they represent future profits, charter values will of course be incorporated into future welfare calculations in a repeated version of our game.

Symbol	Meaning	Symbol	Meaning
R	Return from investment	C_D	Capital level for DFI
$[R_l, R_h]$	Support of R distribution	ρ	Face level of MFI debt
ΔR	$R_h - R_l$	κ	Cost of equity capital
B	Risk level: 0 or $\bar{B} > 0$	ζ	Charter value
C_M	Capital level for MFI	ϕ	Social cost of failure

Table 1: Symbols used for modelling standalone financial intermediaries

to invest, and if so, whether to make a safe or a risky investment. If investment occurs the funds are raised at time 3. The project's returns realize at time 4 and are distributed to the investors.

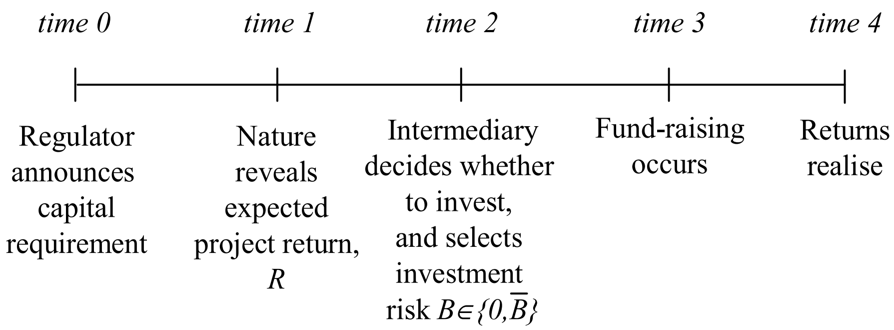

Figure 1: Time line for the operation of the standalone intermediary.

We define a *fragile* intermediary to be one that will fail with non-zero probability and we say that such an intermediary is assuming *systemic risk*. A *sound* intermediary is one that will never fail. The decision to run a fragile intermediary is endogenous and non-observable.

We now compute the respective optimal capital requirements C_M^* and C_D^* for market- and deposit- financed intermediaries.

2.1. Market-Financed Intermediaries

To determine the optimal time 0 capital requirement C_M^* for an MFI, we solve our model by backward induction, starting with the MFI's time 2 investment decision.

First, we characterize the MFI's debt contract. Suppose that the regulator has set a capital requirement C. The intermediary will be fragile precisely when condition (1) is satisfied, so that it will fail in the event that the project returns $R - B$:

$$R - B < \rho. \tag{1}$$

Recall that $B \in \{0, \bar{B}\}$ is a choice variable and hence that fragility is an endogenous intermediary characteristic.

At time 3, the bond-holders are able perfectly to observe both R and B. Since they are risk-neutral it follows that the MFI's promised payment ρ must satisfy

$$\rho = \rho_S \equiv 1 - C$$

when the intermediary is sound, and $\frac{1}{2}\rho + \frac{1}{2}(R - \bar{B}) = 1 - C$, or

$$\rho = \rho_F \equiv 2(1 - C) - R + \bar{B}$$

when the intermediary is fragile.

We now examine the MFI shareholder payoffs. Their expected profit in a sound MFI is

$$\pi_S(C,R) \equiv \frac{1}{2}(R + B - \rho_S) + \frac{1}{2}(R - B - \rho_S) - C(1+\kappa) = R - (1 + C\kappa), \tag{2}$$

which yields the following individual rationality constraint for sound MFIs:

$$R \geq R_S(C) \equiv 1 + C\kappa. \tag{SIR}$$

The expected shareholder profit in a fragile MFI is

$$\begin{aligned} \pi_{M,F}(C,R) &\equiv \frac{1}{2}(R + B - \rho_F) + \frac{1}{2}\zeta - C(1+\kappa) \\ &= R - (1 + C\kappa) - \frac{1}{2}\zeta. \end{aligned}$$

Notice that $\pi_{M,F} < \pi_{M,S}$. The strict inequality obtains because the intermediary faces a private cost of bankruptcy. It therefore follows that the MFI will never choose to be fragile. This observation follows immediately from the second Modigliani-Miller proposition (1958): provided perfectly-informed debt holders are able precisely to price the debt, the effect of additional risk taking is completely reflected in the additional cost of debt. Consequently, additional risk-taking cannot transfer wealth from debt to equity holders.

The MFI will therefore select any investment whose return exceeds $R_S(C)$. Figure 2 illustrates the standalone MFI's investment choices as a function of C and R: for a given C, the MFI will accept any investment with expected return in excess of $1 + C\kappa$, and will select B so as to ensure that the intermediary is sound, as indicated on the figure by the script $\mathscr{S}$.

Proposition 1, whose proof is immediate from figure 2, states that market discipline will induce market-financed intermediaries to adopt a first-best investment strategy in the absence of capital regulation.

PROPOSITION 1 *When capital is set in accordance with equation (3) the intermediary accepts all projects for which $R \geq 1$ and is always sound.*

$$C_M^* = 0. \tag{3}$$

2.2. Deposit-Financed Intermediaries

In this section we examine the optimal capital regulation of a deposit-financed intermediary. As discussed above, the risk measurements that the regulator can use in setting capital requirements are coarser than those which the bond-holders in a MFI use when establishing a fair price for their investments. We incorporate this requirement into our model by assuming that capital requirements can distinguish only between investment

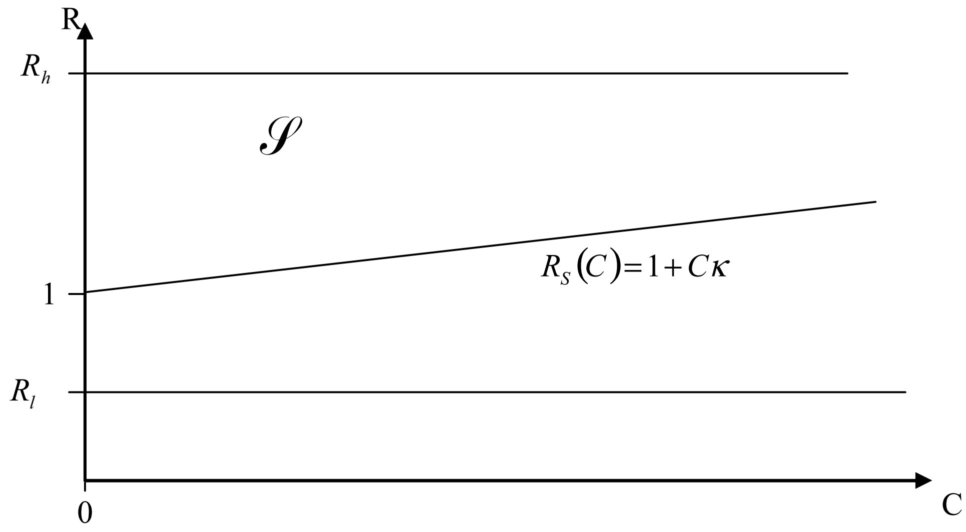

Figure 2: Investment choices for a standalone market-financed intermediary.

and non-investment. In the latter case the depositors' funds are entirely cash-collateralised and it is clearly optimal to set the capital requirement equal to zero.

Note that, because the DFI's depositors are protected by deposit insurance, the DFI need only promise to repay $1 - C$. A bank is therefore fragile precisely when

$$R - B < 1 - C, \tag{4}$$

and is otherwise sound.

Shareholders are fully aware of the DFI's investment decision and they react optimally to the regulator's choice C of capital requirement. The expected return to a sound bank is again given by $\pi_S(C)$, and the sound banking IR constraint is therefore $R \geq R_S(C)$, as in equations (2) and (SIR).

Shareholders' expected profit from running a fragile bank is

$$\pi_F(C,R) \equiv \frac{1}{2}\left(R + \bar{B} - (1 - C)\right) - \frac{1}{2}\zeta - C(1 + \kappa) = \frac{1}{2}\left(R + \bar{B} - \zeta - 1 - C(1 + 2\kappa)\right), \tag{5}$$

which yields the following individual rationality constraint for fragile banking:

$$R \geq R_F(C) \equiv 1 + \zeta - \bar{B} + C(1 + 2\kappa). \tag{FIR}$$

The shareholders will prefer fragile to sound banking precisely when $\pi_F - \pi_S > 0$: equivalently, when

$$R < \bar{B} + 1 - C - \zeta. \tag{6}$$

Note that equation (6) implies equation (4) and hence it is both a necessary and a sufficient condition for the shareholders to run a fragile bank. In other words, shareholders' individual rationality contraint for investment is satisfied whenever they prefer risky projects to safe ones.

The bank shareholders' equilibrium choice is summarized in figure 3, which shows for different combinations of the expected project return R and the regulator's choice of C how bank shareholders will resolve

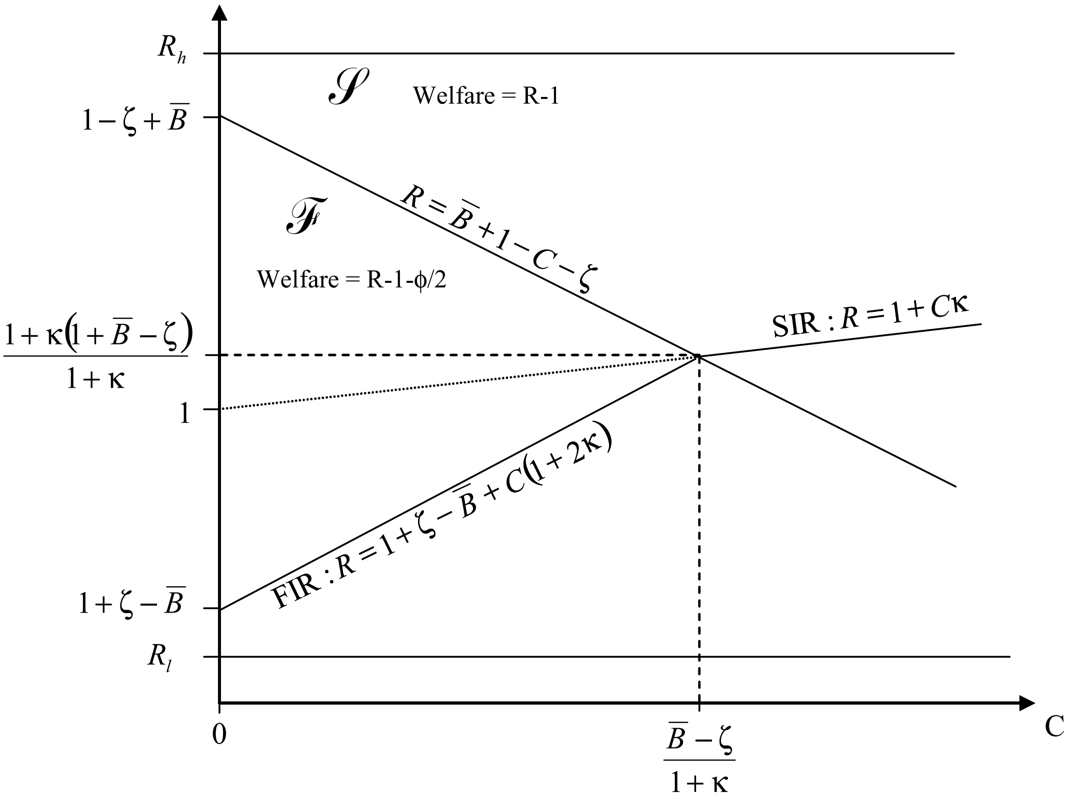

Figure 3: Stand alone banks: IR constraints and welfare.

their moral hazard problem. For (C,R) pairs below the lines labelled FIR and SIR, shareholders will choose not to invest. Above these lines, investment will occur. In region $\mathscr{F}$ shareholders make a risky investment and the bank is fragile. The bank is sound in region $\mathscr{S}$.[12]

The intuition behind this figure is straightforward. Since risk-taking is not reflected in the cost of funds, shareholders in highly-leveraged banks have a strong incentive to incur more risk. Nevertheless, if the bank is sufficiently fortunate to possess a project with a high expected return R, selecting the risky project ($B=\bar{B}$) jeopardizes the return. Hence, for sufficiently high R, shareholders will select the safe project ($B=0$). The critical level of return above which safe projects are preferred is increasing in the bank's leverage (see equation (6)).

As the bank receives an implicit subsidy from the deposit insurance fund, shareholders have an incentive to invest even when confronted with a project whose present value, net of the total cost $1+C\kappa$ of investment, is negative. Since the subsidy is decreasing in the bank's capital exposure C, there will be a point at which the subsidy is insufficient to compensate for the risk of capital loss: this is the point ($C=\frac{\bar{B}-\zeta}{1+\kappa}$) in figure 3 at which SIR and FIR cross. For C to the right of this point, investment occurs only in safe projects whose return exceeds the total cost of funds, $1+C\kappa$.

The regulator correctly anticipates the shareholder response to a capital requirement C, and hence can determine the optimal capital requirement.

[12]Note that for high values of R playing safe is not a necessary condition for soundness.

PROPOSITION 2 *When regulating a standalone bank the optimal capital requirement C^* is given by*

$$C^* = \begin{cases} C_F^*, & \phi < \bar{\phi}; \\ C_S^*, & \phi \geq \bar{\phi}, \end{cases}$$

where C_F^*, C_S^* and $\bar{\phi}$ are given by equations (7), (8) and (9) respectively.

$$C_F^* \equiv \frac{\bar{B}-\zeta}{1+2\kappa} + \phi \frac{1+\kappa}{(1+2\kappa)^2}; \tag{7}$$

$$C_S^* \equiv \frac{\bar{B}-\zeta}{1+\kappa}; \tag{8}$$

$$\bar{\phi} \equiv \frac{\kappa(1+2\kappa)}{(1+\kappa)^2}(\bar{B}-\zeta). \tag{9}$$

In the case where $C^* = C_F^*$ the regulator chooses optimally to introduce financial fragility; in the case where $C^* = C_S^*$ the regulator sets capital at precisely the minimum level to wipe out systemic risk.

Proof. See the appendix. □

The optimality of financial fragility is somewhat surprising. Raising capital requirements reduces investment for two reasons: first, it reduces the risk-shifting incentive generated by risk-insensitive deposit insurance premia; second, because capital is costly, it induces under-investment in safe projects. When capital is lowered from the level C_S^* at which the bank is safe the second of these effects outweighs the first and hence, when the social cost ϕ of bank failure is low enough, welfare is raised. In fact, we demonstrate in the appendix (equation (10)) that when $\phi = 0$, the welfare W_F with fragile banks is equal to the socially first best level. In this case, the capital requirement is optimally set so as to ensure that over- and under-investment incentives cancel out and $R_F(C) = 1$. For higher values of ϕ, the marginal cost in terms of lost revenue from small increases of the capital requirement are outweighed by the social benefit in terms of reduced bankruptcy probability and so the (constrained) optimal hurdle rate exceeds 1.

Finally, note that equations (7) and (8) imply that capital adequacy requirements and charter value ζ are substitutes. This observation is in line with earlier work (e.g., Keeley, 1990, and Repullo, 2004): we discuss its relevance for competition policy in section 5, which is devoted to policy implications.

2.3. Numerical Example of Standalone Financial Intermediaries

We now provide a simple numerical example that illustrates the results of this section. Consider a simplified version of the model in which R is non-stochastic, with $R = 1.1$, $\bar{B} = 0.8$, $\kappa = 0.2$ and $\zeta = 0.07$.[13] We firstly analyze a standalone deposit-financed intermediary with this parameterization, and then compare it to a market-financed intermediary.

If the regulator wishes to induce risk-taking in a DFI the optimal capital requirement is $C_F^* = 0$; it is easy to demonstrate that the optimal capital requirement that results in safe investment is $C_S^* = \bar{B} - R + 1 - \zeta = 0.63$. In our model, setting the capital requirement equal to C_S^* results in underinvestment. Proposition 2

[13]In restricting R to a single value we sacrifice the continuity of our main results. In our model, any increase in the capital requirement C raises the investment hurdle rates $R_F(C)$ and $R_S(C)$: when R has continuous support, this reduces the expected level of investment and hence has a social effect. In contrast, changing C has an effect upon investment decisions in this example only when the sole available investment is marginal. In line with our more detailed model, we nevertheless assume that the regulator will adopt the lowest possible capital requirement that is consonant with its target risk-taking behaviour.

ϕ	$C = C_F^*$ (fragile)		$C = C_S^*$ (safe)	
	Shareholder wealth	Social welfare	Shareholder wealth	Social welfare
0.18	0.415	0.010	−0.026	0
0.21	0.415	−0.005	−0.026	0

Table 2: **Standalone Deposit-Financed Intermediary: numerical example.** When $R = 1.1$, $\bar{B} = 0.8$, $\kappa = 0.2$ and $\zeta = 0.07$, the expected shareholder wealth and social welfare are shown for $C = C_S^*$ and $C = C_F^*$. The first line corresponds to the case in proposition 2 where $\phi < \bar{\phi}$; the second corresponds to the case where $\phi \geq \bar{\phi}$.

demonstrates that, when the social cost of failure ϕ is low enough, the regulator will accept some financial fragility in order to avoid this deadweight cost. The first line of table 2, where $\phi = 0.18$, illustrates this effect. When the capital requirement is set equal to C_S^* the high cost of capital renders investment unattractive to DFI shareholders: it therefore does not occur and social welfare is zero. The regulator can induce investment in this case by setting the capital requirement equal to C_F^*: although this results in a fragile intermediary, social welfare remains positive. This result corresponds to the case in proposition 2 with a low social cost of failure, $\phi < \bar{\phi}$.

In the second line of table 2, $\phi = 0.21$: this corresponds to the case in proposition 2 with a high social cost of failure, $\phi > \bar{\phi}$. In this case setting a capital requirement of C_F^* results in an expected social loss. The regulator therefore prefers to set the capital requirement equal to C_S^*, even though this suppresses DFI investment.

We now consider a standalone market-financed intermediary for which $\phi = 0.21$. When the capital requirement is $C_M^* = 0$ the payoff to bond holders in the bad state of the world will be $1.1 - 0.8 = 0.3$, and in return for their investment of 1 they will therefore demand a return of 1.7 in the good state. The shareholders experience a loss of $\zeta = 0.07$ in the bad state, and receive an income of $1.1 + 0.8 - 1.7 = 0.2$ in the good state: the corresponding expected return of 0.065 is less than the expected return of 0.1 that they would receive from playing safe. Hence there is no need for the regulator to set a positive capital requirement in this case. Indeed, were it to require a capitalization of C_S^*, the shareholders would lose 0.026 from playing safe, and hence would not participate.

3. Financial Conglomerates

We now analyze the optimal capital regulation of a financial conglomerate, which we define to be an intermediary that combines an MFI with a DFI. We consider two types of conglomerate: *holding-company* conglomerates, and *integrated* conglomerates. Holding-company conglomerates consist of a DFI and an MFI with separate balance sheets, both owned by an umbrella corporation. Integrated conglomerates consist of a DFI and an MFI with a single balance sheet.

We continue to assume that each division of the financial conglomerate has a safe and a risky investment opportunity with a common expected return. The expected returns R_D and R_M in the DFI and the MFI are independent draws from the uniform distribution on $[R_l, R_h]$, where again, $R_l < 1 < R_h$. Each project

Symbol	Meaning	Symbol	Meaning
R_D, R_M	Investment returns in DFI, MFI	C_{HM}	Holding-company MFI capital
$[R_l, R_h]$	Support of R_D and R_M distributions	C	Integrated conglomerate capital
ΔR	$R_h - R_l$	κ	Cost of equity capital
B	Risk level: 0 or $\bar{B} > 0$	ζ	Charter value for DFI
C_{HD}	Holding-company DFI capital	ϕ	Social cost of failure per division

Table 3: Symbols used for modelling standalone financial intermediaries

requires an investment of \$1 and the conglomerate makes a separate investment decision for each division. As in section 2, conglomerates aim to maximise the returns to their shareholders.

After making an investment decision, conglomerates raise funds for investment. Integrated conglomerates have a single balance sheet, and the regulator therefore assigns a single capital requirement for the entire conglomerate of C per dollar invested. For a given capital requirement in our model, integrated conglomerates would clearly prefer to take maximum advantage of the deposit insurance fund. However, in order to isolate the effect of liability structure upon conglomerate capital regulation, we assume that integrated conglomerates raise debt in equal proportions from bond-holders and depositors.[14] Hence, even when an integrated conglomerate invests only in its MFI's project, half of its debt will be provided by insured depositors.

The divisions of a holding-company conglomerate have separate balance sheets and hence the regulator can set separate capital requirements C_{HM} and C_{HD} for the MFI and the DFI, respectively. The debt-holders in the DFI are protected by deposit insurance; all of the debt-holders for MFI investments are uninsured bond-holders.

The two divisions of a holding-company conglomerate could in principle trade projects with one another. In moving an asset from one balance sheet to another, the holding-company conglomerate would change the capital requirement for that asset. This type of trade therefore takes advantage of differences in the respective capital regimes of the MFI and the DFI: we refer to it as "regulatory arbitrage."

We assume that the conglomerate's charter value is again ζ[15] and that the systemic cost of failure is ϕ per division. Note that this implies that the total systemic cost of conglomerate failure is 2ϕ.

Table 3 summarises the variables used in this section. The game that we study in this section is illustrated in 4.

At time 0 the regulator announces the conglomerate capital requirement. At time 1 nature presents the DFI and the MFI with safe and risky projects whose expected returns are R_D and R_M respectively. At time 2 the conglomerate decides whether or not to invest, and whether to make safe or risky investments. All of the funds which the conglomerate requires for investment are raised at time 3. Any regulatory arbitrage within holding-company conglomerates also occurs at time 3. Returns are realized and distributed at time 4.

We argue in this section that the most important difference between MFIs and DFIs is in the level of diversification which they can achieve. A holding-company conglomerate can allow its divisions to fail

[14] This is a reasonable practical assumption: conglomerates continue to perform non-banking activities, and hence will continue to raise debt funds from non-depositors.

[15] This reflects an assumption that charter value is mostly derived from banking licence rents. Assigning a charter value ζ to the non-bank division as well would not change our qualitative results.

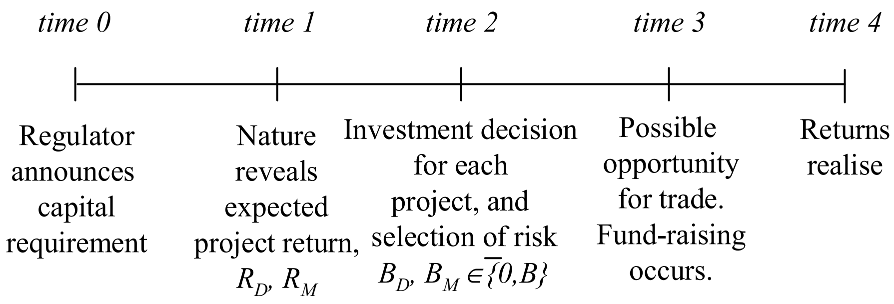

Figure 4: Time line for conglomerates

independently of one another: failure in one will never be offset by success in another. It follows that a holding-company conglomerate experiences no benefits from portfolio effects. However, we will argue that, when capital requirements are set appropriately, capital arbitrage within holding-company conglomerates can nevertheless achieve the social first best.

In contrast, an integrated financial conglomerate with two risky investments benefits from diversification effects: the returns on a failing project may be cancelled out by those on a successful one. Thus *ceteris paribus*, diversification effects in integrated conglomerates may serve to diminish the likelihood of failure and hence of the associated systemic costs. However, as we have already noted, insured depositors always provide some of the debt for integrated conglomerates. As a result, integration extends the coverage of the deposit insurance safety net. We will show that in some circumstances, this raises risk-taking incentives within the MFI to such an extent that diversification benefits are lost, and optimal capital requirements *exceed* those of standalone institutions.

3.1. Holding-Company Conglomerates

In this section we determine the optimal capital requirements C^*_{HD} and C^*_{HM} for holding-company conglomerate divisions. As in section 2.2, the regulator is constrained to condition capital requirements only upon verifiable data, so that the optimal capital requirement will be 0 for a completely cash-collateralized division, and will otherwise be risk-insensitive.

Without inter-division trade the conclusions of this section would be identical to those of sections 2.1 and 2.2. Our results are therefore driven by the effects of regulatory arbitrage. We assume that within the conglomerate there is perfect information and hence that inter-division trade is neither impaired by informational asymmetry, nor driven by profit/loss transfers across divisions.

Suppose now that a DFI is presented with an expected return which is too low for it to retain, but which would be profitable for an MFI. When regulatory arbitrage is possible, the DFI is able to sell the project to the MFI for \$1.[16] After the sale, the DFI's deposit liabilities will be entirely cash-collateralised and hence would attract a capital requirement of zero. Hence the DFI finances the project entirely through deposit-taking, and then sells it to the MFI. The MFI will finance its purchase of the project using capital C_{HM} and bonds to the value $1 - C_{HM}$.

[16] This is a statement about the division of surplus. It simplifies the algebra but is not necessary for our conclusions.

Regulatory arbitrage will increase welfare if it serves to discourage financial fragility. Since only DFIs will ever choose to be fragile, the optimal capital regime will make it more attractive to select safe projects and then to sell them to the MFI than to select risky ones and to retain them. With respective capital requirements C_{HM} and C_{HD} for the MFI and the DFI, this will be the case precisely when $\pi_F(C_{HD}) < \pi_S(C_{HM})$, or

$$C_{HD} \geq \frac{1}{1+2\kappa}\left\{\bar{B} - \zeta + 1 - R_l + 2C_{HM}\kappa\right\}.$$

When this condition is satisfied, the DFI will accept exactly those projects which are safe and whose expected return exceeds $R_S(C_{HM})$. It will sell these projects to the MFI.

Since the MFI will always be sound and will invest in any project whose return exceeds $1 + C_{HM}\kappa$, the following result is immediate:

PROPOSITION 3 *The respective optimal capital requirements for the market- and deposit- financed divisions of a holding-company financial conglomerate are as follows:*

$$\begin{aligned} C^*_{HM} &= 0; \\ C^*_{HD} &= \frac{1}{1+2\kappa}\left\{\bar{B} - \zeta + 1 - R_l\right\}. \end{aligned}$$

This will achieve the first-best outcome: both divisions will invest in any project for which $R \geq 1$ and both will be sound. The MFI will retain all of its projects; the DFI will sell its projects to the MFI.

Recall that with a non-zero social cost ϕ of failure, the best the regulator can do is deliberately to introduce some underinvestment, and when $\phi < \bar{\phi}$ also some fragility, into a standalone DFI. Proposition 3 therefore demonstrates that, because it achieves the first best, capital arbitrage in a decentralized conglomerate is welfare-improving. The intuition for our result follows from a proper understanding of the purpose of capital regulation: it is intended to force financial intermediaries to internalize the costs of actions which they would otherwise ignore. When these costs are already internalized, as they are in the case of an MFI, further capital regulation serves only to impede the intermediary's efficient operation. Hence a regime which encourages a holding-company conglomerate to hold its investments in the division which suffers from the lowest systemic externalities will raise welfare.

This goes against the grain of many of the assumptions (implicit and explicit) in regulatory discussions. These tend to focus on concerns that conglomerates will use regulatory arbitrage to shift poor investments into DFIs and so transfer their expected losses to the deposit insurance fund. We have shown that this is only worth doing under a poorly-designed capital adequacy regime. When capital requirements are set optimally, this type of regulatory arbitrage will cost more than it is worth. Capital requirements for holding-company DFIs are therefore set significantly above those for standalone DFIs precisely in order to *encourage* regulatory arbitrage.

Finally, we note that the prediction in proposition 3 that a DFI sells *all* of its loan assets is in reality rather extreme. Banks are sometimes prohibited by the terms of their customer agreements from selling their loans and hence would in practice retain some assets. Incorporating this requirement into our model might serve to reduce somewhat the optimal capital requirement C^*_{HD}, but it would not materially affect our results.

3.2. Numerical Example of a Holding-Company Financial Conglomerate

We now extend the numerical example of section 2.3 to demonstrate that holding company conglomerates can achieve first best even when standalone intermediaries could not. Suppose again that $R = 1.1$, $\bar{B} = 0.8$, $\zeta = 0.07$ and $\kappa = 0.2$. Table 2 illustrates regulatory choices when the social cost of failure ϕ is 0.18 and 0.21. In both cases, setting the capital requirement equal to C_S^* suppresses DFI investment. When $\phi = 0.18$ the regulator prefers to set a zero capital requirement so as to induce investment at the cost of financial fragility; when $\phi = 0.21$ she prefers to set $C = C_S^*$. In contrast, a market-financed intermediary with a zero capital requirement will always make the first best investment decision.

Now consider a holding-company conglomerate in our example. If the MFI has a zero capital requirement it will accept every safe positive NPV project. We know from the previous paragraph that if the conglomerate's DFI has capital requirement C_S^*, it will never retain the investment. However, because it is able to transfer it to the conglomerate's MFI, it will accept it, and pass it on, without increasing its riskiness. Hence in this example, as in proposition 3, a holding-company conglomerate for which the MFI has zero capital requirement and the DFI has capital requirement C_S^* will achieve first best.

3.3. Integrated Conglomerates

Integrated conglomerates can make two, one, or no investments. We start by analyzing conglomerates with two investments, and total expected return of $R = R_M + R_D$. When neither of the projects is risky, we say that the integrated conglomerate is *safe*. When only one of these projects is risky, we say that the conglomerate is *undiversified*. Undiversified conglomerates can return in a high $(R + \bar{B})$ or a low $(R - \bar{B})$ state, each with probability $\frac{1}{2}$. When both projects are risky, we say that the conglomerate is *diversified*. Diversified conglomerates can return high $(R + 2\bar{B})$, middle (R) or low $(R - 2\bar{B})$ payouts with respective probabilities $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{1}{4}$.

We summarize the equilibrium strategy of integrated conglomerates in proposition 4:

PROPOSITION 4 *Integrated conglomerates with two investments are either diversified and fragile or safe.*

Proof. See the appendix. □

Proposition 4 is illustrated in figure 5, which shows the IR constraints for investment, and the sound and fragile regions. The choice between diversified and undiversified conglomerates is driven by a trade-off between the loss of charter value if the conglomerate defaults on its bond debt, and deposit insurance safety net payments. Diversified institutions may generate higher expected deposit insurance payouts than undiversified conglomerates. This is because low state returns for diversified conglomerates $(R - 2\bar{B})$ are lower than those of undiversified conglomerates $(R - \bar{B})$, and this raises the threshold R value below which the deposit insurance fund pays out with positive probability. Even when R is sufficiently low for the deposit insurance fund to pay out for both diversified and undiversified conglomerates, the diversified conglomerate will be preferred provided it does not fail in the middle state (return equal to R). This follows because its shareholders experience a loss of charter value with probability $\frac{1}{4}$, as opposed to the $\frac{1}{2}$ probability with which undiversified shareholders experience the same loss. Only when shareholders in diversified conglomerates experience a loss of charter value in the middle state will undiversified conglomerates dominate. We

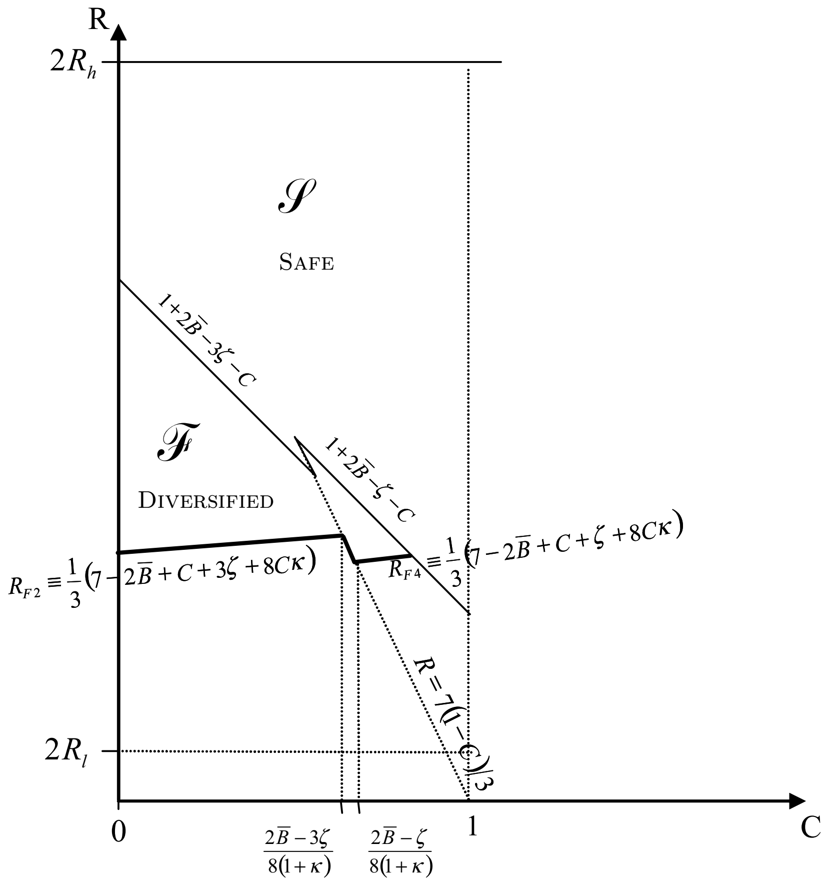

Figure 5: **Integrated conglomerate investment strategies.** The manager's participation constraint is indicated by the bold line. The conglomerate is fragile in the diversified region: below the line $R = 7(1-C)/3$ it fails when it returns R or $R-2\bar{B}$; above this line it fails when it returns $R-2\bar{B}$. The conglomerate is sound in the safe region.

demonstrate in the appendix that in this case, the expected return from investment is too low to satisfy the shareholder's participation constraint.

Along the line $R = 7(1-C)/3$, figure 5 illustrates a discontinuity in the boundary between the fragile and sound regions. Below this line diversified conglomerates default on bonds in the middle and low states, while above it they default only in the low state. This affects the expected loss of charter value and explains the discontinuity.

The conglomerate selects safe investments when the expected deposit insurance payout from risky investments does not cover the expected loss of charter value.

Proposition 3 shows that first best levels of investment can be achieved without systemic risk in the holding company and so we have:

COROLLARY 1 *From a welfare perspective, the holding company conglomerate structure weakly dominates the integrated structure.*

In other words, once capital requirements are properly set, holding companies are a better way to structure conglomerates. This result clearly has important policy implications.

We now turn to a second, related question: should integrated financial conglomerates receive a lower regulatory capital allocation than standalone DFIs by virtue of their risk diversification? To answer this question we must consider both the diversification effect and also the possibility that integration might increase systemic risk by inducing additional risk-taking by the MFI.

It is not *a priori* clear whether the diversification or the risk-shifting effects of integration dominate, although corollary 1 indicates that the best way to deal with the problem is to impose a holding-company structure upon financial conglomerates. The optimal capital requirement calculation for integrated financial conglomerates proves in our model to be intractable. However, we now demonstrate that the risk-shifting effect can bite.

Suppose that $\phi \geq \bar{\phi}$ so that (proposition 2) the optimal standalone capital requirement for a DFI would be C_S^* and hence the DFI would always be sound. Note (proposition 1) that the MFI would hold optimal capital of 0 and that it would always be sound. Consider the investment choices of an integrated conglomerate whose total capital requirement is $0 + C_S^* = C_S^*$. This reflects current legislation: the consensus amongst practitioners is that the diversified integrated conglomerate should attract a lower capital requirement. Note that in our formula the total capital requirement for the integrated conglomerate is $2C$ and hence that in our example, $C = \frac{1}{2}C_S^*$.

LEMMA 1 *If $\phi \geq \bar{\phi}$ then precisely when $\bar{B} > \frac{2}{3} + \zeta$, there is a non-empty range of R values for which a two project integrated conglomerate with capital requirement $\frac{1}{2}C_S^*$ will be diversified and fragile.*

Proof. See the appendix. □

For $\phi \geq \bar{\phi}$, separately capitalized conglomerate divisions would be sound; the MFI is always charged for its risk-bearing, and we proved in section 2 that with capital requirement C_S^* the DFI will be unable to assume a sufficiently large risk to draw upon the deposit insurance fund. When the two institutions are integrated and diversified, the conglomerate's bond-holders will continue to charge for the risk which they assume. However, for large enough $\bar{B}$, failure is sufficient to trigger a claim on the deposit insurance fund, for which the conglomerate will make no marginal payment. When the expected value of the claim is sufficiently large to compensate for the expected loss of charter value the integrated conglomerate will choose to be fragile.

This result illustrates our point: holding capital requirements constant as integrated conglomerates form can result in an *increased* probability of failure. Hence, contrary to received opinion in the market, when the systemic cost ϕ of failure is sufficiently large capital requirements for integrated conglomerates should *exceed* the sum of their component stand-alone requirements.

Proposition 4 and lemma 1 discuss the properties of two-project conglomerates, provided they exist. Lemma 2 guarantees that they do.

LEMMA 2 *Integrated conglomerates accept all positive NPV projects. They also accept some negative NPV projects.*

Proof. See the appendix. □

Lemma 2 proves that the fragile region of figure 5 is non-empty. Within this region integrated conglomerates take risks with two projects in order to generate an expected deposit insurance payout. If the conglomerate has a single project whose return falls within this region, it is worth accepting a small loss on a second, risky, project in exchange for the deposit insurance subsidy that it generates.

Note that the IR constraints are increasing in the charter value ζ and decreasing in project riskiness $\bar{B}$, while these parameters have the opposite effect upon the upper bound of the diversified region in figure 5. Hence:

LEMMA 3 *For a given capital requirement, the probability that an integrated conglomerate will fail is increasing in the maximum investment riskiness $\bar{B}$ and decreasing in the charter value ζ.*

As in previous sections it follows that ζ, which may be interpreted as charter value, substitutes for financial capital.

3.4. Numerical Example of an Integrated Financial Conglomerate

Lemmas 1 and 2 show that when capital requirements are optimally set sufficiently high to guarantee that standalone DFIs are safe, integrated financial conglomerates will nevertheless accept negative NPV projects and play risky when the project riskiness $\bar{B}$ is high enough. In this section we provide a numerical example that illustrates this result.

Suppose that $R_D = 1.1$, $\phi = 0.18$, $\zeta = 0.07$ and $\kappa = 0.06$.[17] Lemmas 1 and 2 show that the integrated conglomerate's propensity to accept risky negative NPV projects is increasing in project riskiness, $\bar{B}$. We therefore employ two different values for $\bar{B}$ to capture this effect. First we set $\bar{B} = 0.7$ so that $C_S^* = 0.53$, and second we increase $\bar{B}$ to 0.8 so that $C_S^* = 0.63$. In both cases it is easy to demonstrate that a standalone DFI with capital requirement C_S^* will invest, and first best will be achieved. Hence with the optimal capital requirement for standalone DFIs with either parametrization is C_S^*.

$\bar{B}$	One investment			Two investments		
	Conglom. riskiness	S/holder wealth	Social welfare	Conglom. riskiness	S/holder wealth	Social welfare
0.7	Safe	0.0841	0.1	Safe	0.0582	0.090
0.8	Safe	0.0811	0.1	Fragile	0.08345	0.045

Table 4: **Integrated Financial Conglomerate: Numerical Example.** This table illustrates figures for $\bar{B} \in \{0.7, 0.8\}$, $R_D = 1.1$, $R_M = 0.99$, $\phi = 0.18$, $\zeta = 0.07$, $\kappa = 0.06$ and the conglomerate capital requirement equal to C_S^* for a standalone DFI. The riskiness of the conglomerate conditional upon accepting one or both projects is shown, with the expected shareholder wealth and social welfare for each case. The first line of the table corresponds to the case in lemma 1 where $B \leq \frac{2}{3} + \zeta$; the second line to the case where $B > \frac{2}{3} + \zeta$.

Consider in this example an integrated financial conglomerate. In this case, because there is a common balance sheet, regulatory arbitrage of the type illustrated in section 3.2 is impossible. We examine the risk-taking of a conglomerate whose total capital requirement is equal to the sum of the optimal standalone

[17]This parameterisation is similar to the one employed in section 2.3, except that we use a lower value for κ. We do this so as to ensure that investment occurs even when capital requirements are set equal to C_S^*. We note in footnote 13 that when R has a single-element support, as in this example, investment is an all-or-nothing affair. Since in section 2.3 investment does not occur when C_S^* it is necessary in this section to adjust the parameterization to ensure that it does.

capital requirements for its constituent financial intermediaries. Hence, with our parameterizations, when $\bar{B} = 0.7$ the total capital requirement for an integrated conglomerate is 0.53, and when $\bar{B} = 0.8$ the total capital requirement is 0.63. Recall from proposition 4 that the integrated conglomerate will either play risky with both projects, or with neither of them.

We now introduce a negative NPV investment, which in exchange for an investment of 1 yields an expected payout of $R_M = 0.99$. Table 4 illustrates the conglomerate's investment decisions when it is faced with this investment in addition to the original positive NPV investment. In the first line of the table, the maximum project riskiness $\bar{B}$ is 0.7. Whether the conglomerate invested in one or both projects, it would choose to play safe. However, shareholders maximize their wealth by taking only the positive NPV project and so first best is achieved.

Lemmas 1 and 2 show that higher $\bar{B}$ values increase the integrated conglomerate's incentive to accept risky negative NPV investments in order to profit from the deposit insurance fund. The second line of table 4 therefore illustrates the case where $\bar{B}$ is increased to 0.8. Conditional upon accepting only the positive NPV project, the conglomerate will play safe and generate shareholder wealth 0.0811. However, it can generate shareholder wealth 0.08345 by accepting both projects and playing risky. Hence in this case, setting the capital requirement for the integrated conglomerate equal to the sum of its optimal standalone capital requirements results in suboptimal investment and financial fragility that would not arise with standalone institutions.

4. Extensions

In this section we explore the robustness of our model by considering a number of possible extensions that result from relaxing some of our simplifying assumptions.

4.1. Informational Problems and Securitization

This paper is concerned with asset transfer within holding-company conglomerates. This allows us to compare the welfare properties of holding-company and integrated conglomerates, and hence to address issues which are of current concern to regulators. Our set-up can be extended to address related issues regarding market discipline under other institutional and contractual arrangements. Of particular interest is securitization, which raises a natural question: could a standalone bank achieve first best in the same way as a holding-company conglomerate, by securitizing its assets and selling them to full-informed investors, who would exercise market discipline? Nothing in our model prevents this type of trade. Thus, one reading of our model is that a bank could reduce its capital requirement to zero through securitization. While it is clearly possible to reduce capital requirements using securitization, this literal reading of our model yields a simplistic view of the securitization process. Although we believe our assumption of fully-informed investors to be a justifiable simplification in the context of our analysis of financial conglomerates, it would be at odds with the basic facts of the securitization process, which is in practice impeded by informational frictions.

Throughout our model we assume that uninsured bond-holders are able perfectly to observe the expected return and the riskiness of a financial intermediary's assets. In practice, this is unlikely to be the case. Bank assets are generally untraded, and frequently relate to small unlisted corporations. Information concerning a bank's portfolio is therefore costly, and at the time of securitization, it is unlikely to be widely disseminated. Hence potential purchasers of the assets face an adverse selection problem, which will make it harder to sell them.

A standard response to adverse selection problems in debt asset transfer is "tranching" asset sales by risk class. Uninformed investors are then attracted to the safest tranches (see for example DeMarzo, 2005), while sophisticated investors are attracted to the riskiest tranches, where they can earn the highest return on their information-gathering skills (see for example Boot and Thakor, 1993).[18]

This suggests that price-discovery for bank asset sales involves two problems. First, a significant adverse selection problem has to be overcome when the initial sale occurs. This involves negotiation between sophisticated investors and the selling party, and generally results in asset sales below their true value. Second, prices are refined and updated in secondary market trading. This occurs as investors gather valuable information and trade upon it.

Holding companies will internalise the wealth effects of asset transfers. Hence the first, adverse selection, problem is somewhat lessened for regulatory arbitrage within holding-company conglomerates. Moreover, recent empirical work by Massa and Rehman (2005) suggests that information flows are better within the divisions of a financial conglomerate than they are between the conglomerate and other market players. On the other hand, the share price sensitivity to information about the assets is low in conglomerates, and hence the secondary market incentives for information production are weaker.

In contrast, wealth effects are not internalised when asset securitizations occur. As a result, adverse selection problems will be greater than they are for asset transfers within holding-company conglomerates. On the other hand, the value of a pool of securitized assets is relatively more sensitive to information about the pool. As Boot and Thakor (1993) note, this provides enhanced incentives for information-gathering, and hence results in more accurate pricing.

The secondary market effect may provide the regulator with valuable information which could be used to refine regulatory contracts. However, for the regulatory arbitrage effects that we analyse, the initial sale effect is more important than the secondary market effect, since it has a direct impact upon investment incentives within the bank. Hence we argue that the benefits which we identify are more likely in practice to be realised via regulatory arbitrage in a holding-company conglomerate than via arm's length securitization by a standalone bank.

In practice, more sophisticated regulation may induce information revelation by informed bankers. This is the goal of the internal models approach of the second Basle Accord (2004). To the extent that this is successful, it reduces the adverse selection problem in the primary market for bank assets, and so lowers the benefits of a holding company structure with regulatory arbitrage relative to an arm's length securitization.

4.2. Costly Asset Transfers

We assume in our model that transferring assets between divisions is costless. In practice, there may be costs: in particular, suppose that banks are endowed with monitoring skills that are absent in market-financed insti-

[18] A related literature examines the adverse selection problem in equity initial public offerings (IPOs). In this market, expert investors are compensated via underpricing for gathering and revealing information about the issue: see Benveniste and Spindt (1989) and Sherman and Titman (2002).

tutions (Diamond and Rajan, 2001). This introduces two costs, which must be weighed against the benefits of improved market discipline and potentially lower social costs of failure. Firstly, assets which *are* transferred will be less effectively monitored. Secondly, setting capital requirements sufficiently high to induce regulatory arbitrage will raise the hurdle rate for informationally opaque projects which it is not profitable to transfer. Both of these effects will serve to diminish the optimal capital requirement for depository institutions. The development of securitization techniques which allow for risk but not monitoring responsibility to be transferred will attenuate the effects examined in this paragraph.

4.3. Social Costs of Failure

Our analysis is predicated upon the assumption that the social cost ϕ of institutional failure is the same for deposit- and market-financed intermediaries. However, a number of authors have argued that the systemic costs of bank failure are significantly higher than those of insurance or security company failure: bank failure may give rise to contagion; bank failure affects the payments system; and bank failure may cause the loss of valuable informational assets. These effects serve to strengthen our conclusions. We have based our argument entirely upon the endogeneity of bank risk-taking and the risk-insensitivity of bank finance. However, our conclusion that a holding company structure is optimal when allowing for regulatory arbitrage could equally be derived in the absence of these effects, provided the social cost of bank failure exceeds that of market-financed institutions. With this assumption, as capital requirements force the internalisation of systemic externalities, they will optimally be higher for banks than for market-financed intermediaries. As a result, the bank's hurdle rate will exceed the market-financed intermediary's. Thus, regulatory arbitrage will again lower the effective cost of bank investment and hence will raise welfare.

5. Policy Implications

5.1. Bank Conglomerates

We can use our approach to analyse related questions regarding conglomerate regulation. In the United States, statutory responsibility for the regulation of bank holding companies was handed to the Board of Governors of the Federal Reserve by the 1956 Bank Holding Companies Act. The Board is required to approve every application to acquire control of a bank: section 3(c) of the Act requires it to do so with regard to the managerial resources and the future prospects of the acquiring company. The Board has attempted to use this rule to force bank holding companies to act as a "source of strength" for troubled bank subsidiaries: that is, to assist troubled banks and, if necessary, to draw upon both its bank and its nonbank resources.[19]

The Board began in the 1970s aggressively to apply the source of strength doctrine when considering holding company applications to acquire or to merge with a bank, and these applications were upheld by the courts. However, attempts to use the doctrine to force holding companies to support bank subsidiaries absent such a merger have met with mixed success, and the legal status of the doctrine in these cases is still unclear. However, the 1989 adoption of the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) forces each bank in a multi-bank holding company to guarantee the FDIC's claims on its

[19]See Alexander (2004), Keeton (1993), and Weinstein and Albert (1998) for details of the source of strength doctrine and of the case law surrounding the analysis in this section. We are grateful to Kern Alexander for enlightening discussions about this material.

sister banks. Hence, while it may be difficult for the Federal Reserve to force a holding company to use a non-bank subsidiary to support a banking subsidiaries, it is certainly able to enforce cross-bank guarantees within a single holding company. Any bank holding company that is unwilling or unable to bear the costs is deemed “unsafe and unsound” and therefore the Federal Reserve Board forces its closure.

The FIRREA regulation was originally intended to discourage *ex post* loss concentration in distressed divisions in order to maximise the value of the deposit insurance option (see footnote 5). It has been challenged in the courts, but they have consistently upheld it: Ashcraft (2004, footnote 6) cites two significant challenges to the FIRREA provision, in one of which the provision caused a failing bank (Bank of New England) to drag a sister institution (Maine National Bank) under.

The 1989 Act prevents one bank division from walking away from the other in the event of its failure. Hence it forces integration in bank conglomerates. We have demonstrated that such forced integration would be socially sub-optimal in conglomerates containing a non-bank division, as it would prevent risk concentration in the division subject to the most market discipline and the lowest social failure cost. However, these effects are constant across the divisions of a bank conglomerate and hence the above argument does not apply. On the contrary, the legislation ensures that banks internalise as much as possible of the risk that they take. Notwithstanding this observation, a similar argument to that underlying proposition 4 implies that an integrated bank conglomerate may take more risk than any of its constituents would have done on a stand alone basis. The reason is that, when each division is able to bail out the others, a greater degree of risk is required to profit from the deposit insurance put option. If the Act simply incentivises the holding company to take more risks then it generates no efficiency gains.

If instead liability were limited by the requirement that the failure of one division could not trigger the failure of the other, access to the deposit insurance net would be diminished, and with it risk-shifting incentives. This would clearly be desirable: to the extent that the FIRREA is contestable legislation, it may already be the case. Even with this alteration, though, the Act fails to account for the substitutability of capital regulation and market discipline (i.e., of pillars one and three of the new Basle Accord). We have argued that capital requirements should optimally counter the increased risk-shifting incentives engendered by deposit insurance. As a consequence, when these incentives are ameliorated, capital requirements should be reduced. Since a successful cross-bank guarantee policy would reduce the value to a bank holding company of the deposit insurance put option, it would increase market discipline and hence reduce risk-shifting incentives. Hence, for the FIRREA to increase efficiency it should be accompanied by correspondingly looser capital requirements.[20]

In summary, our framework indicates the potential for efficiency gains from source of strength-type regulations, but also demonstrates that these gains are currently not fully realised for two reasons. First, one division may take larger risks so that its failure triggers the failure of the other and hence maintains its access to the deposit insurance put option. Second, to the extent that these regulations succeed in increasing market discipline, they should be accompanied by a downward adjustment in capital requirements.

[20] A similar effect obtains in branch-organised multinational banks: see Lóránth and Morrison (2003).

5.2. Level Playing Fields in Capital Regulation

Since capital is costly, an essential precursor to fair competition in the financial sector is that no institution should be placed at a relative disadvantage by capital regulation. This is the basis of the Basle Accord's emphasis upon a "level playing field" (see Basle Committee on Banking Supervision, 1997). A commonly deployed argument in favour of integrated conglomerates is that they reduce systemic risk by diversifying risks across banks and insurance companies. This observation has been used to argue that a level playing field will allocate lower capital requirements to an integrated conglomerate than to either a holding-company conglomerate, or the corresponding standalone institutions.

Provided asset riskiness is exogenous, this argument is perfectly correct. Our model highlights an additional effect that has received less attention: namely, that by extending the reach of the deposit insurance net to the conglomerate's MFI, integration may actually introduce additional risk-taking incentives and hence increase systemic risk. Lemma 1 demonstrates that for certain parameter values, the second of these effects dominates the first. When this happens, level playing fields actually require integrated conglomerate capital requirements to *exceed* those of the corresponding standalone institutions.

It has been acknowledged for some years that charter value forces banks to internalise their costs of failure and hence discourages excessive risk-taking.[21] As a result of this effect, charter value and capital are substitutes (in our model, see propositions 2 and 3). Lemma 1 establishes a new effect: it demonstrates that optimal integrated conglomerate capital requirements exceed standalone requirements for sufficiently low charter value. In other words, diversification alone is not enough to reduce capital requirements.

5.3. Pro-Cyclicality Effects in Capital Regulation

A frequently voiced criticism of the new Basle Accord on capital regulation is that it may serve to amplify the economic cycle. As far as we are aware, pro-cyclicality has not featured in discussions of financial conglomeration. In this section we suggest that it may be a concern in integrated conglomerates.

The most important MFIs in financial conglomerates are insurance companies, whose assets are market securities. As such, their investments have the same expected return as the market. In contrast, DFIs hold customer loans which have distinct return characteristics.[22]

In the light of the observations in the previous paragraph, we consider a variation of our model in which MFI returns are equal to those on the market and the DFI makes its investment decisions with a knowledge of the expected market return R_M. When the sum of R_M and the expected DFI return lies in region $\mathscr{F}$ of figure 5 the integrated conglomerate will be fragile. For a given DFI return distribution, the probability that this occurs is clearly decreasing in R_M.

During an economic slowdown, the maximum investment riskiness $\bar{B}$ increases, bank charter value ζ decreases and the expected market return R_M to MFI portfolios drops. Lemma 3 shows that the first two effects will cause an increase in the size of region $\mathscr{F}$ in figure 5. This translates into an increased probability that the integrated conglomerate is fragile.

In summary, poor expected market returns increase the conglomerate's incentive to play risky and hence

[21] The initial paper on this topic was Keeley (1990).

[22] Although loan portfolio returns are correlated with the market, there is some evidence that bank loans have less systematic risk than securities and insurance company portfolios: see Allen and Jagtiani (2000).

exacerbate systemic pressures already in the economy. The endogeneity of risk selection therefore reverses the standard assumption that diversification has a stabilizing effect in economic downturns. Conversely, the size of the fragile region is smaller for high expected market returns and the probability that the total conglomerate return lies within it is also reduced.

6. Empirical Implications

In this section we highlight some empirical predictions of our work.

6.1. Diversification Discounts

A substantial literature examines the valuation of non-financial conglomerate firms. Theoretical work suggests that investment decisions in conglomerate firms may be distorted by inter-divisional agency problems (e.g. Scharfstein and Stein, 2000), and early empirical work appeared to support these theories. For example, Lang and Stulz (1994) and Berger and Ofek (1995) both demonstrate that conglomerate firms have a lower Tobin's q than corresponding specialised firms would have. However, more recent work points out that these results may reflect an endogeneity problem. Maksimovic and Phillips (2002) find evidence that firms that are less productive tend to diversify and hence that the diversification discount reflects the characteristics of firms that choose to diversify, rather than the effects of diversification *per se*. Graham, Lemmon and Wolf (2002) argue that conglomerate firms tend to acquire discounted firms, and that the Berger and Ofek methodology makes the combined institution appear discounted.

Our paper suggests an explanation for a diversification discount that is specific to financial firms. In our formal model we analyse integrated conglomerates formed from two unrelated divisions, but it would be possible to extend our analysis to consider correlated projects. In this case, the probability that both divisions failed simultaneously would increase and hence so would the value of the deposit insurance safety net. In other words, our model suggests that, because they have less access to the deposit insurance fund, diversified financial conglomerates should trade at a discount relative to more specialized institutions. Furthermore, since this discount arises in our model because of deposit insurance, it should be greater in countries where the deposit insurance scheme is more generous.

Recent empirical work by Laeven and Levine (2005) examines diversification effects in financial firms and supports our prediction. Laeven and Levine control for the endogeneity problems and merger and acquisition activity that may have affected the findings of the literature on non-financial conglomerate discounts. They find that financial conglomerates trade at a discount, and that the magnitude of the discount is reduced in less-diversified firms.

6.2. Conglomerate Activities

We argue in the preceding subsection that diversification in integrated financial conglomerates lowers the value of the deposit insurance safety net. Since the selection of activities within a financial conglomerate is endogenous, it follows that, *ceteris paribus*, financial firms that diversify into new business lines should not at the same time diversify their risks. Hence our work implies that legislation that, like the Gramm-Leach-Bliley Act, broadens the permissible scope of banking activities should not result in a reduction in earnings volatility within the affected institutions. In fact, lemma 1 suggests that, by increasing the scope for claims on the deposit insurance fund, such legislation may in some cases result in *increased* risk levels.

Some recent work examines the effect upon the riskiness of bank portfolios of recent moves to increase the proportion of earnings derived from fee-based, as opposed to interest-based, income. DeYoung and Roland (2001) examine U.S. commercial bank data between 1988 and 1995 and find that increased fee-based business results in greater earnings volatility. Moreover, they find that earnings volatility is positively related to the degree of leverage, which indicates a greater degree of access to the deposit insurance safety net. Similarly, Stiroh (2004) finds in a study of individual and aggregate U.S. bank data from the late 1970s to 2001 that the move into non-interest businesses is associated with higher bank risks. While the authors of these studies argue that their results show that fee-based income does not generate diversification benefits, our results suggest that banks may deliberately choose to expand into correlated business lines so as to retain the benefits of deposit insurance.

6.3. Competition and Conglomeration

The intuitions in this papers are developed using a model in which the expected return R from investing is drawn from a uniform distribution with support $[R_l, R_h]$. Consider an extension of our model in which R is drawn from an alternative distribution which is first order dominated by the uniform one: in this case it is immediate from figure 5 that the prior likelihood of integrated conglomerate fragility is increased. Moreover, for a given risk level the expected value of the deposit insurance subsidy, and hence the attraction of financial conglomeration, is greater in a fragile integrated conglomerate when R is lower. Similarly, lemma 3 shows that a reduction in the charter value ζ will increase the probability of conglomerate fragility.

These observations suggest that integrated financial conglomerate behaviour may be affected by banking sector competition levels. When competition is heightened in response either to technological or regulatory factors the distribution of R shifts to the left and bank charter value ζ drops.[23] The argument of the previous paragraph suggests that these factors will serve first to make conglomeration more attractive, and second to increase the fragility of financial conglomerates.

7. Conclusion

In this paper we present a model of financial intermediation in which capital requirements serve to force shareholders to internalize failure and deposit insurance costs which they would otherwise ignore. Our basic intuition is that risk-taking incentives are endogenous and depend upon the extent to which a financial institution is subject to market discipline. When market discipline is weak, as in a depository institution whose depositors are protected by deposit insurance, the institution will tend to take socially excessive risks. In this case, regulatory capital requirements serve as a costly substitute for market discipline: optimal regulation trades off their costs against their disciplining effects. Hence, our results suggest that pillars one and three of the new Basle Accord are (partial) substitutes.

Integrated conglomerates are diversified and hence may better internalise the risks which they assume. However, they are partially financed by risk-insensitive deposits and this undermines the market discipline

[23] Barros, Berglöf, Fulghieri, Gual, Mayer and Vives (2005) and Degryse and Ongena (2006) both survey the literature concerning competition and integration in the banking sector.

of their non-bank division, which may as a result assume larger risks. When the second effect outweighs the first, they will be relatively less efficient than the sum of their standalone parts, and they should be subject to a *higher* aggregate capital adequacy requirement.

In contrast, we find that the ability to set separate capital requirements for each of the divisions of a holding-company conglomerate allows the regulator to induce first-best investment behaviour by the conglomerate. This is because the regulator can set capital requirements to reflect the riskiness of each division and hence can encourage the conglomerate to hold assets in the most efficient location. Hence, our results rest upon the existence of regulatory arbitrage, which in our set-up is unambiguously welfare-increasing.

Although our formal analysis examines a conglomerate containing a bank and a non-bank institution, our framework allows us to comment upon the Federal Reserve's "source of strength" doctrine. This forces the holding company or another division within the holding company to bear any costs incurred by the deposit insurance company in the wake of divisional failure. In line with our results on integrated conglomerates, we argue that this regulation may actually serve to increase bank risk-taking incentives. Moreover, to the extent that it succeeds in enhancing market discipline, it should be accompanied by reduced capital requirements.

We also consider the effect of the economic downturns upon integrated conglomerate investment. We find that the incentive for excessive risk-taking in an integrated conglomerate is greatest when the total expected returns of its divisions is lowest. Hence, in bank and insurance conglomerates, to the extent that the insurance company portfolio tracks the market, the probability of risk-shifting is greatest in economic downturns. Hence, integrated conglomerates may invest so as to amplify the economic cycle.

Finally, we identify three empirical implications of our work. First, diversification diminishes access to the deposit insurance fund and our work therefore suggests that financial conglomerates should exhibit a diversification discount. Second, we argue that conglomerates will attempt to attenuate the erosion of their deposit insurance subsidy by focussing their activities so as to maintain earnings volatility. Finally, because heightened banking sector competition erodes lowers bank charter value we suggest that it is likely to result in more conglomeration, and to increase the fragility of integrated financial conglomerates.

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Appendix

Proof of Proposition 2

Recall that welfare is defined to be the total surplus generated by the bank, net of any social costs. Hence, a sound bank generates welfare $R-1$ and a fragile one generates welfare $R-1-\frac{\phi}{2}$. The regulator's job is to select C so as to maximize expected welfare:

$$C^* \in \arg\max_C W(C),$$

where for a given C, $W(C)$ is the expected welfare:

$$W(C) \equiv \int_{R_l}^{R_h} \frac{1}{\Delta}\omega(C,R)\,dR,$$

and the project welfare function $\omega(C,R)$ is as indicated in figure 3:

$$\omega(C,R) \equiv \begin{cases} R-1, & R > \max(\bar{B}+1-C-\zeta, R_S); \\ R-1-\frac{\phi}{2}, & R_F < R \leq \bar{B}+1-C-\zeta; \\ 0, & R \leq \min(R_S, R_F). \end{cases}$$

Straightforward calculations yield

$$W(C) = \begin{cases} \frac{1}{2\Delta}\left\{(R_h-1)^2 - (\zeta-\bar{B}+C(1+2\kappa))^2\right\} - \frac{\phi}{\Delta}(\bar{B}-\zeta-C(1+\kappa)), & C < C_S^*; \\ \frac{1}{2\Delta}\left\{(R_h-1)^2-(C\kappa)^2\right\}, & C \geq C_S^*, \end{cases}$$

where C_S^* is defined in equation (8).

To find C^*, note firstly that

$$\lim_{C\uparrow C_S^*} W(C) = \lim_{C\downarrow C_S^*} W(C) = \frac{1}{2\Delta}\left\{(R_h-1)^2-(C\kappa)^2\right\},$$

so $W(.)$ is a continuous function on $\Re_{\geq 0}$. Moreover, $W(.)$ is trivially decreasing for $C > C_S^*$. This is intuitively as well as mathematically obvious: since banks are always sound when $C > \frac{\bar{B}-\zeta}{1+\kappa}$, increasing C beyond C_S^* serves simply to increase underinvestment.

For $C < C_S^*$ increasing C has two effects. Firstly, the fragile region $\mathscr{F}$ within which the bank assumes systemic risk shrinks. This serves unambiguously to raise welfare. Secondly, the capital costs $C\kappa$ of investing and hence the hurdle rate FIR increase. This increases welfare provided $FIR < 1$ so that risk shifting is causing overinvestment; conversely, it decreases welfare if $FIR > 1$, in which case high capital costs are already causing underinvestment.

When $C < C_S^*$, $W'(C) = 0$ when $C = C_F^*$, defined in equation (7). Note that $C_F^* > 0$ and that $C_F^* < C_S^*$ whenever $\phi < \bar{\phi}$, defined in equation (9): when this is the case, it follows because $W(C)$ is concave, continuous at C_S^* and decreasing for $C > C_S^*$ that the regulator will set $C = C_F^*$. Expected welfare is then given by

$$W_F \equiv W(C_F^*) = \frac{1}{2\Delta}(R_h - 1)^2 - \frac{\phi}{2\Delta(1+2\kappa)^2}\left\{2(\bar{B} - \zeta)\kappa(1+2\kappa) - \phi(1+\kappa)^2\right\}. \tag{10}$$

If $\phi > \bar{\phi}$ then $C_F^* > C_S^*$: $W(C)$ is then strictly increasing for $C < C_S^*$ and strictly decreasing for $C > C_S^*$. The regulator will therefore set $C = C_S^*$.

Proof of Proposition 4

The proof proceeds as follows. Firstly, we derive the expected profits of diversified and undiversified conglomerates as functions of (C, R). Secondly, we identify (C, R) values for which diversified conglomerates outperform undiversified conglomerates, and then we identify (C, R) values for which safe investment dominates both diversified and undiversified risky investment. Finally, we compare the shareholder's IR constraint for each region with its upper bound and so derive a feasible investment region.

Diversified Conglomerates. It is convenient to define the regions $\mathscr{F}_1$, $\mathscr{F}_2$, $\mathscr{F}_3$, $\mathscr{F}_4$, and $\mathscr{F}_5$ as follows:

$$\begin{aligned}
\mathscr{F}_1 &= \{(C,R) : R < 1 - C\} \\
\mathscr{F}_2 &= \{(C,R) : 1 - C \leq R < \min(2\bar{B} + 1 - C, 1 - C + \rho)\} \\
\mathscr{F}_3 &= \{(C,R) : 2\bar{B} + 1 - C \leq R < 1 - C + \rho\} \\
\mathscr{F}_4 &= \{(C,R) : 1 - C + \rho \leq R < \min(2\bar{B} + (1 - C), 1 - C + \rho + 2\bar{B})\} \\
\mathscr{F}_5 &= \{(C,R) : \max(1 - C + \rho, 2\bar{B} + (1 - C)) \leq R < 1 - C + \rho + 2\bar{B}\}
\end{aligned}$$

The regions are illustrated in figure 6. They divide the plane according to the expected deposit insurance payouts and the expected costs of charter value loss.

When $(C, R) \in \mathscr{F}_1$ the conglomerate fails in the middle and low states and in neither of these states will the bond-holders receive a payment.

When $(C, R) \in \mathscr{F}_2$ or $(C, R) \in \mathscr{F}_4$, the conglomerate fails in the low state and the bond-holders will in this case receive nothing so that the conglomerate receives a deposit insurance fund subsidy. The conglomerate fails in the middle state only when $(C, R) \in \mathscr{F}_2$, but in this case the bond-holders are partially repaid and so there is no deposit insurance payout. Hence regions $\mathscr{F}_2$ and $\mathscr{F}_4$ are distinguished only by the additional expected loss of charter value in region $\mathscr{F}_2$.

When $(C, R) \in \mathscr{F}_3$ or $(C, R) \in \mathscr{F}_5$, no default is so large that the bond holders receive no payment and hence the conglomerate never draws upon the deposit insurance fund. In both regions default occurs in the bottom state; in the middle state it occurs only in region $\mathscr{F}_3$. One again therefore the two regions are distinguished only by their respective expected charter values.

The expected profit of the conglomerate in region $\mathscr{F}_1$ is

$$\pi_{F1} \equiv \{R - 2(1 + C\kappa)\} - \frac{3}{4}\zeta + \left\{\frac{1}{2}(1 - C - R) + \frac{1}{4}(1 - C - R + 2\bar{B})\right\}.$$

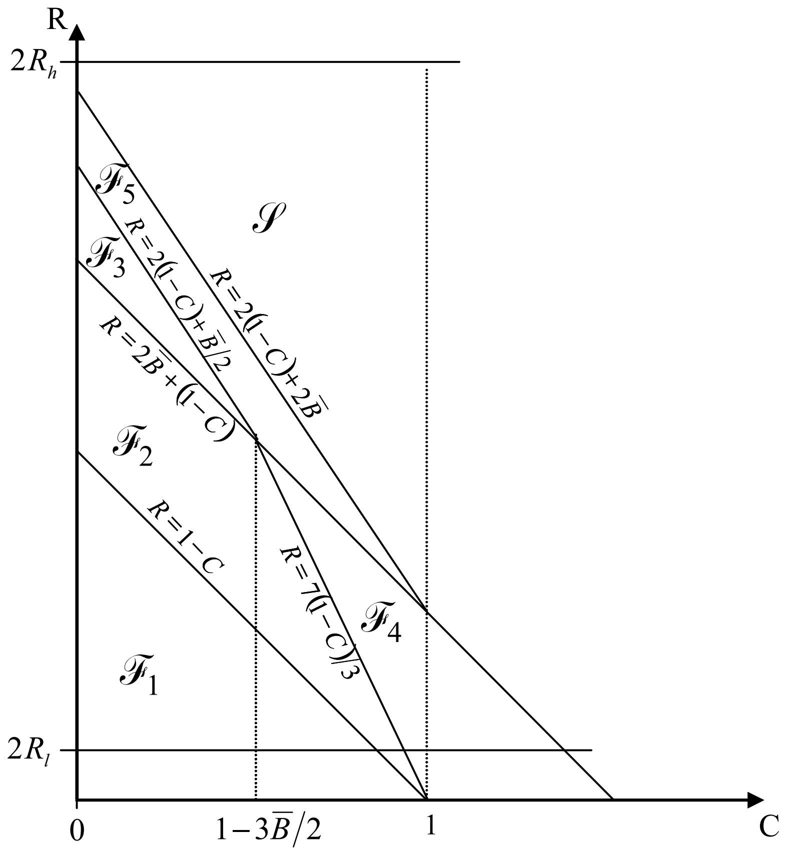

Figure 6: Fragile and sound regions in integrated diversified conglomerates. Note that region $\mathscr{F}_3$ vanishes when $\bar{B} \geq \frac{2}{3}$.

The first curly-bracketed expression is the expected conglomerate profit in a world with perfect information and no externalities. The second term is the expected loss of charter value. The third is the expected value of the deposit insurance subsidy.

Similarly, the expected profits of the conglomerate in regions $\mathscr{F}_2$, $\mathscr{F}_3$, $\mathscr{F}_4$ and $\mathscr{F}_5$ are given by the following expressions:

$$\begin{aligned}
\pi_{F2} &\equiv R - 2(1 + C\kappa) - \frac{3}{4}\zeta + \frac{1}{4}(1 - C - R + 2\bar{B});\\
\pi_{F3} &\equiv R - 2(1 + C\kappa) - \frac{3}{4}\zeta;\\
\pi_{F4} &\equiv -2(1 + C\kappa) - \frac{1}{4}\zeta + \frac{1}{4}(1 - C - R + 2\bar{B});\\
\pi_{F5} &\equiv R - 2(1 + C\kappa) - \frac{1}{4}\zeta.
\end{aligned}$$

Undiversified Conglomerates. Analogously with the diversified case, we define regions $\hat{\mathscr{F}}_1$ and $\hat{\mathscr{F}}_2$ as follows:

$$\hat{\mathscr{F}}_1 \equiv \{(C,R) : R < \bar{B} + 1 - C\}$$
$$\hat{\mathscr{F}}_2 \equiv \{(C,R) : \bar{B} + 1 - C \leq R < \bar{B} + 1 - C + \rho\}$$

Regions $\hat{\mathscr{F}}_1$ and $\hat{\mathscr{F}}_2$ are illustrated in figure 7.

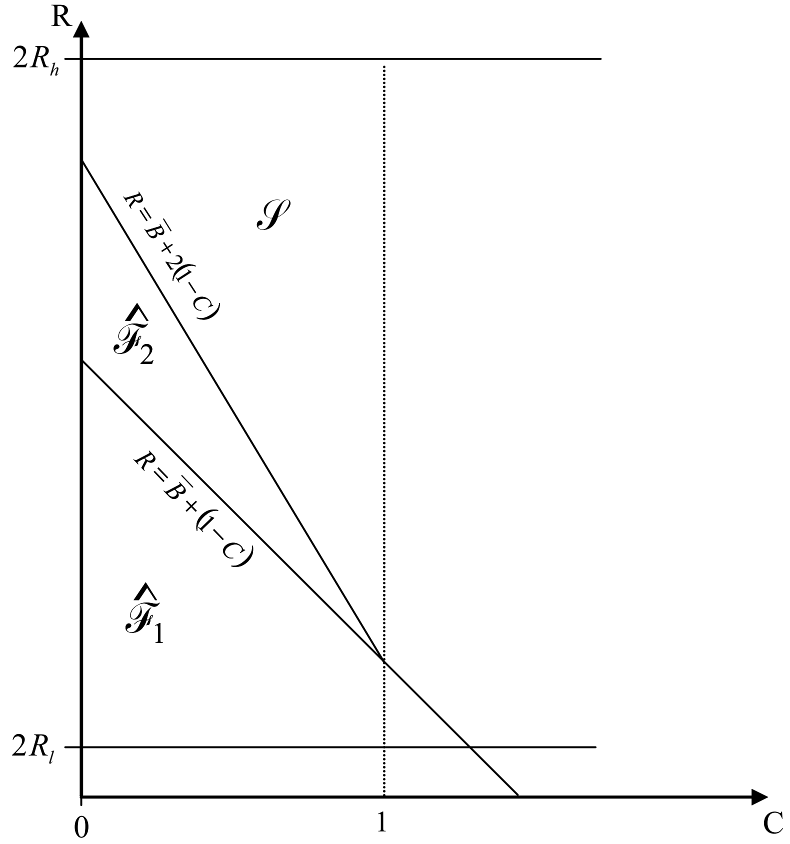

Figure 7: Fragile and sound regions in undiversified integrated conglomerates.

For $(C,R) \in \hat{\mathscr{F}}_1$ the bond-holders receive nothing if the conglomerate fails and hence the conglomerate receives a deposit insurance fund payout, while for $(C,R) \in \hat{\mathscr{F}}_2$ the bond-holders receive a payment in the event of conglomerate failure and there is therefore no deposit insurance payment.

The expected profits from running an undiversified conglomerate in regions $\hat{\mathscr{F}}_1$ and $\hat{\mathscr{F}}_2$ are as follows:

$$\hat{\pi}_{F1} \equiv R - 2(1 + C\kappa) - \frac{1}{2}\zeta + \frac{1}{2}(1 - C - R + \bar{B});$$
$$\hat{\pi}_{F2} \equiv R - 2(1 + C\kappa) - \frac{1}{2}\zeta.$$

The first two terms in these expressions are again the expected profits in a world without agency effects; the term involving ζ is the expected charter value loss and the last term in the expression for $\hat{\pi}_{F1}$ is the expected deposit insurance fund payout.

LEMMA 4 (CHOOSING BETWEEN DIVERSIFIED AND UNDIVERSIFIED CONGLOMERATES) *The condition for an integrated conglomerate to prefer diversified risky investment to undiversified risky investment depends upon the value of* (C,R) *as follows:*

1. *In* $\mathscr{F}_1 \cap \hat{\mathscr{F}}_1 = \{(C,R) : R \leq 1-C\}$,
$$\frac{1}{4}(1-C-R) \geq \frac{1}{4}\zeta;$$
2. *In* $\mathscr{F}_2 \cap \hat{\mathscr{F}}_1 = \left\{(C,R) : 1-C < R \leq \min\left(1-C+\bar{B}, \frac{7}{3}(1-C)\right)\right\}$,
$$\frac{1}{4}\zeta \leq \frac{1}{4}(R-(1-C));$$
3. *In* $\mathscr{F}_2 \cap \hat{\mathscr{F}}_2 = \left\{(C,R) : 1-C < R \leq \min\left(2\bar{B}+(1-C), \frac{7}{3}(1-C)\right)\right\}$,
$$-\frac{1}{4}\zeta \leq \frac{1}{4}(1-C-R+2\bar{B}),$$
which is always true;
4. *In* $\mathscr{F}_3 \cap \hat{\mathscr{F}}_2 = \{(C,R) : 1-C+\bar{B} < R \leq \bar{B}+2(1-C)\}$, $-\frac{3}{4}\zeta \geq -\frac{1}{2}\zeta$, *which is impossible;*
5. *In* $\mathscr{F}_4 \cap \hat{\mathscr{F}}_1 = \left\{(C,R) : \frac{7}{3}(1-C) < R \leq \bar{B}+(1-C)\right\}$, $\frac{1}{4}\zeta \geq \frac{1}{4}(1-C-R)$, *which is always true;*
6. *In* $\mathscr{F}_4 \cap \hat{\mathscr{F}}_2 = \{(C,R) : \bar{B}+(1-C) \leq R < 2\bar{B}+(1-C)\}$, $\frac{1}{4}(1-C-R+2\bar{B}) - \frac{1}{4}\zeta \geq -\frac{1}{2}\zeta$, *which is always true;*
7. *In* $\mathscr{F}_5 \cap \hat{\mathscr{F}}_2 = \{(C,R) : \bar{B}+(1-C) \leq R < 2\bar{B}+(1-C)\}$, $-\frac{\zeta}{4} > -\frac{1}{2}\zeta$, *which is always true.*

Proof. Trivial by manipulation of the expressions for π_F and $\hat{\pi}_F$. □

The intuition for this result is simple. When $(C,R) \in \mathscr{F}_1$, a diversified investment strategy increases the deposit insurance payout relative to an undiversified strategy at the expense of greater expected charter value loss. This is desirable only for sufficiently low ζ.

When $(C,R) \in \mathscr{F}_1 \cap \hat{\mathscr{F}}_1$, diversified conglomerates receive a large deposit insurance payout with probability $\frac{1}{4}$. Undiversified conglomerates receive a smaller deposit insurance payout with probability $\frac{1}{2}$. The latter option is preferable for the former for sufficiently low R; for R higher the latter option yields a better return in exchange for the expected drop in charter value. If instead $(C,R) \in \hat{\mathscr{F}}_2$, undiversified conglomerates never receive a payout from the deposit insurance fund. In this case shareholders will clearly prefer a diversified conglomerate.

When $(C,R) \in \mathscr{F}_3 \cap \hat{\mathscr{F}}_2$, neither diversified nor undiversified conglomerates will receive a deposit insurance fund payment. Shareholders therefore prefer undiversified conglomerates, since these have the lowest expected charter value losses.

When $(C,R) \in \mathscr{F}_4 \cap \hat{\mathscr{F}}_1$, the expected reduction in charter value is unambiguously lower for diversified than for undiversified conglomerates. Moreover, the deposit insurance subsidy is larger in diversified conglomerates.

When $(C,R) \in \hat{\mathscr{F}}_2$ there is no deposit insurance subsidy; the expected charter value losses in $\mathscr{F}_2$ and $\mathscr{F}_5$ are lower for diversified than for undiversified conglomerates and shareholders will therefore prefer diversified conglomerates in $\left(\mathscr{F}_4 \cap \hat{\mathscr{F}}_2\right) \cup \left(\mathscr{F}_5 \cap \hat{\mathscr{F}}_2\right)$.

LEMMA 5 (THE DECISION TO TAKE RISKS) *Running a sound conglomerate dominates running either a diversified or an undiversified conglomerate precisely when condition (11) is satisfied:*

$$\left.\begin{array}{c}(R<7(1-C)/3)\ \textit{and}\ (R>1-C+2\bar{B}-3\zeta);\\ \textit{OR}\\ (R>7(1-C)/3)\ \textit{and}\ (R>1-C+2\bar{B}-\zeta).\end{array}\right\} \tag{11}$$

Proof. Note that there is no value to risk-taking when the consequential deposit insurance payout will be zero. This is the case for undiversified conglomerates when $(C,R) \in \hat{\mathscr{F}}_2$, and for diversified conglomerates when $(C,R) \in \mathscr{F}_3 \cup \mathscr{F}_5$. Hence if $(C,R) \in \left(\hat{\mathscr{F}}_2 \cap \mathscr{F}_3\right) \cup \left(\hat{\mathscr{F}}_2 \cap \mathscr{F}_5\right)$, running a sound conglomerate dominates either form of fragile conglomerate.

It remains to check when sound conglomerates are preferred in regions $\mathscr{F}_1$, $\mathscr{F}_2$ and $\mathscr{F}_4$. In $\mathscr{F}_1$ it is easy to show that a sufficient condition for fragile conglomerates always to dominate sound ones is

$$1-C-R+\bar{B}>\zeta.$$

We expect ζ to be small relative to the total losses $\bar{B}$ from failure and we therefore assume that this is the case. Finally, condition (11) follows from straightforward comparison of the expressions for π_{F2}, π_{F4} to the expected profits $R-2(1+C\kappa)$ from running a sound conglomerate. □

LEMMA 6 *Consider an integrated conglomerate with capital requirement C. If condition (11) of lemma 5 is satisfied then shareholders will select a safe investment portfolio; if condition (12) is satisfied then they will select an undiversified risky portfolio; otherwise they will select a diversified risky portfolio.*

$$(1-C-\zeta<R<1-C+\zeta)\ \textit{and}\ (R<7(1-C)/3). \tag{12}$$

Proof. The lemma follows immediately from lemmas 4 and 5 □

Lemma 6 partitions the (C,R) space into five regions as illustrated in figure 8, according to whether an integrated conglomerate with two projects returns the highest expected return when diversified, undiversified, or safe. We now investigate the shareholder's individual rationality constraints in each of these regions.

LEMMA 7 (MANAGER'S PARTICIPATION CONSTRAINTS) *In an integrated conglomerate with two projects,*

1. *The shareholder's IR constraint is violated whenever (C,R) lies in region I or II;*
2. *The shareholder's IR constraint can be satisfied in region III if and only if*

$$\bar{B}>\frac{1}{2}(1+C+3\zeta+2C\kappa); \tag{13}$$

3. *The shareholder's IR constraint can be satisfied in region IV if and only if*

$$\bar{B}>\frac{1}{2}(1+C+\zeta+2C\kappa). \tag{14}$$

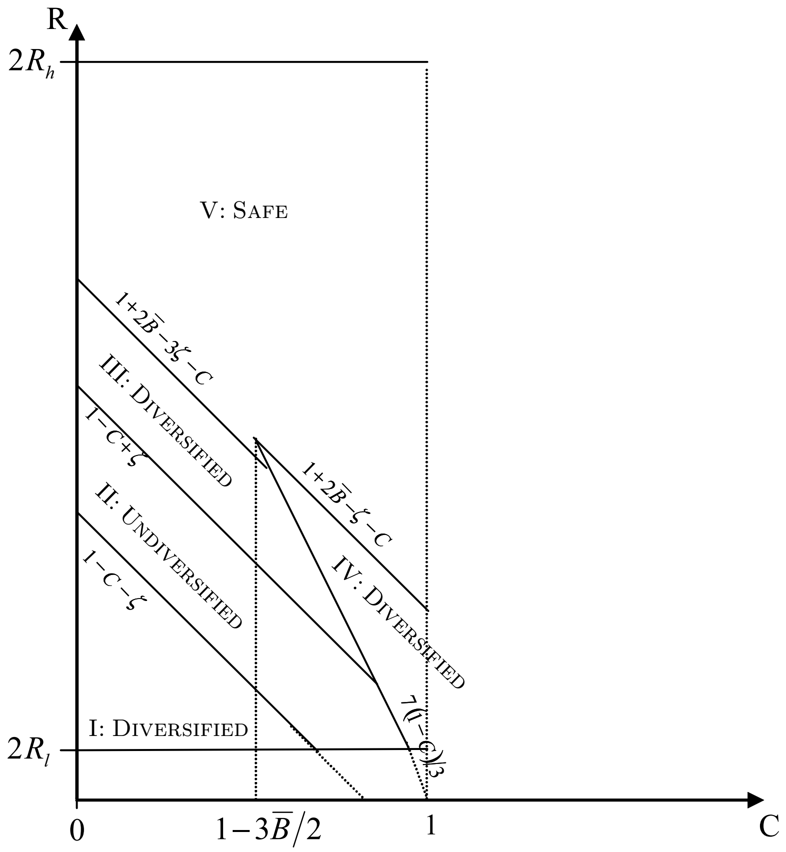

Figure 8: Preferred risk levels for a two-project integrated conglomerate.

Proof. Setting π_{F1} and $\hat{\pi}_{F1}$ greater than or equal to zero yields the respective IR constraints for regions I and II: $R \geq R_{F1} \equiv 5-2B+3C+3\zeta+8C\kappa$ and $R \geq R_{\hat{F}1} \equiv 3-B+C+\zeta+4C\kappa$. The shareholder's IR constraint can be satisfied in region I iff $R_{F1} \leq 1-C-\zeta$ iff $B > 2(1+C+\zeta+2C\kappa)$, which is impossible since $B < 1$. Similarly, the IR constraint is satisfiable in region II iff $R_{\hat{F}1} \leq 1-C+\zeta$ iff $B > 2(1+C)+4C\kappa$, which is again impossible. The IR constraint in region III is obtained by setting $\pi_{F2} \geq 0$: $R \geq R_{F2} \equiv \frac{1}{3}(7-2B+C+3\zeta+8C\kappa)$. It can be satisfied in region III iff $R_{F2} \leq 1+2\bar{B}-3\zeta-C$ from which condition (13) follows immediately. In region IV the IR constraint is obtained from π_4: $R \geq R_{F4} \equiv \frac{1}{3}(7-2B+C+\zeta+8C\zeta)$. It can be satisfied iff $R_{F4} \leq 1+2\bar{B}-\zeta-C$which yields condition (14). $\square$

This concludes the proof of proposition 4.

Proof of Lemma 1

Inserting $C = \frac{1}{2}C_S^*$ into equations (13) and (14) yields equations (15) and (16).

$$\bar{B} > \frac{2}{3}+\frac{5}{3}\zeta; \tag{15}$$

$$\bar{B} > \frac{2}{3}+\zeta. \tag{16}$$

The relevant IR constraint is R_{F2} precisely when $\frac{1}{2}C_S^* < \frac{2\bar{B}-3\zeta}{8(1+\kappa)}$, or $\bar{B} < \frac{\zeta}{2}(1-\kappa)$, which contradicts condition (15). The IR constraint is R_{F4} iff $\bar{B} > \frac{\zeta}{2}(3+2\kappa)$, which is implied by condition (16).

Proof of Lemma 2

The expected profit of a single project integrated conglomerate with return R is given by $\hat{\pi}_{F1}(C,R)$, $\hat{\pi}_{F2}(C,R)$ or π_S according to whether (C,R) lies in region $\mathscr{F}_1$, $\mathscr{F}_2$, or $\mathscr{S}$ of figure 7. It is easy to check that profit is monotonically increasing in R. Accepting a second positive NPV project without risk is equivalent to increasing the expected return on the first project: since taking risk is optional the second project will be accepted. Hence two-project integrated conglomerates exist, and by lemma 1 the fragile region of figure 5 is non-empty. If the conglomerate has a single project whose return falls within this region, it is worth accepting a small loss on a second, risky, project in exchange for the deposit insurance subsidy which it generates.