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Capital Adequacy in Insurance and Reinsurance

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I. Introduction

Increased cross-sector and cross-border competition among financial institutions has led to considerable discussion of possible revisions in traditional insurance/reinsurance solvency regulation, including possibly greater regulatory centralization and harmonization within the United States (U.S.) and the European Union (E.U.). Important issues include a possible extension of the Basle approach to bank capital regulation to insurance, possible expansion of direct regulatory supervision and capital requirements for international reinsurers, possible development of mutual recognition systems across national borders, and possible expansion of consolidated or more centralized regulatory oversight.

This paper deals with capital adequacy and capital regulation of insurers and reinsurers. I first review the main risks, degree of market discipline, and scope of solvency regulation in insurance and reinsurance markets, with an emphasis on the U.S. Given that background, I next consider key principles of efficient capital regulation, focusing on the relation between optimal capital requirement stringency and market discipline. I then briefly describe and evaluate in relation to those principles capital requirements and related supervision of U.S. and E.U. insurers and reinsurers. I compare the U.S. and E.U. systems, consider the implications of possible federal insurance/reinsurance regulation in the U.S., and discuss whether regulation of reinsurers should be expanded abroad. I also briefly discuss pressure for consolidated regulation of financial conglomerates that include insurance and for greater centralization of regulatory authority over financial firms.

My main conclusions are:

1. Capital standards (and, more generally, regulatory solvency supervision) should be less stringent for sectors characterized by greater market discipline and less systemic risk.

2. Market discipline is greater and systemic risk is lower for insurance than in banking. Capital requirements therefore should be less stringent for insurers than for banks.

3. Market discipline is generally greater in reinsurance (wholesale) markets than in direct insurance (retail) markets. Capital requirements and related regulation need not be as stringent for reinsurers as for direct insurers.

4. Current capital requirements and related solvency regulation for U.S. and E.U. insurers and reinsurers are largely consistent with significant market discipline in the insurance and reinsurance sectors.

5. Any federal regulation of U.S. insurers/reinsurers, harmonized regulation of E.U. reinsurers, consolidated oversight of financial conglomerates, and increased centralization of regulatory authority to supervise insurance and other financial activities should be designed with full recognition of the limited systemic risk and strong market discipline in insurance/reinsurance and avoid undermining that discipline.

II. Risk, Market Discipline, and Solvency Regulation in Insurance and Reinsurance

Insurance Risk

Non-life (property-casualty) insurers face a variety of risks including underwriting risk, which encompasses premium and reserve (technical provisions) risks, credit risk, asset (market) risk, and interest rate risk. Asset risk is generally modest, reflecting heavy investments in government or highly rated bonds. Although many U.S. non-life insurers have greater asset than liability durations, interest rate risk is relatively modest, in part because payments to policyholders are not highly correlated with interest rate increases. Credit (counterparty) risk is largely related to reinsurance transactions, which are widely employed to manage underwriting and reserve risks.

Underwriting risk is paramount for non-life insurers. Premium and reserve risks both reflect the possibility of large errors in predicting ultimate claim costs. When insurers write coverage, there is always some risk that claim costs will exceed those predicted. Similarly, once claims have occurred, the provisions for unpaid claim liabilities may prove deficient. Premium risk and reserve risk differ in timing. Premium risk involves possible divergence between ultimate costs

and conditional forecasts of costs at the time policies are priced. Reserve risk involves possible divergence between ultimate costs and conditional forecasts of costs after claims have occurred (or are assumed to have occurred in provisions for incurred but not reported claims).

In either case, ultimate claim costs may substantially exceed those predicted when policies are priced and written. Natural or man-made catastrophes (e.g., Hurricane Andrew and the World Trade Center bombings in the U.S) can create large, sudden increases in costs for property and related covers. More benign changes in whether and unexpected changes in property repair costs also create risk. For long-tail covers, such as general liability, ultimate claims may not be known for many years after policies are priced and written, giving rise in some cases to enormous reserve risk long after policies have been sold (as has been vividly documented in the asbestos and environmental arenas). Both forms of underwriting risk are aggravated by relentless price competition in many non-life insurance markets, which may encourage prices to become arguably too low during "soft market" episodes of the insurance cycle (see Danzon and Harrington, 1994). Subsequent negative shocks to capital have occasionally led to very hard markets characterized by scarce capital, large rate increases, and less favorable coverage terms, often with material effects on real (non-financial) activity.[1]

Non-life insurers hold relatively large amounts of capital compared with their life insurer brethren and commercial banks.[2] Holding that capital involves material tax and agency costs.[3] Depending on the jurisdiction, double taxation of returns from investing capital to support the sale of policies significantly increases the cost of capital and the prices needed to offer coverage, especially for low probability events with large potential severities (see Harrington and Niehaus,

[1] Effects on real activity were widely reported during the mid 1980s U.S. liability insurance crisis and more recently in the U.S. medical care sector. Odell and Weidenmier (2002) document real and monetary linkage following the San Francisco earthquake and associated insurance payments during 1906-1907.

[2] Capital to asset ratios for U.S. non-life insurers in the late 1990s average about 40 percent, compared with 10-11 percent for life insurers and commercial banks.

[3] See Jaffee and Russell (1997) for discussion of tax and agency costs of capital and Harrington and Niehaus (2000 and 2001) for detailed analysis of tax costs of capital in the U.S.

2000). Non-life insurers manage their risk and thus economize on costly capital by diversifying underwriting risk across policies of a given type and region, across types of cover, and geographically. They also transfer significant amounts of risk to reinsurers, which achieves additional risk spreading, including across national borders, thus reducing both the amount of capital held by ceding insurers and the aggregate amount of capital held by insurers and reinsurers to support aggregate writings.

Life insurers' primary risks arise from the asset side of the balance sheet, as was clearly illustrated by asset quality problems in real estate and high yield bonds in the U.S. during the late 1980s and early 1990s and by large drops in the value of equity portfolios of E.U. life insurers during 1999-2001. Significant reductions in asset values and changes in interest rates can cause policyholders to withdraw funds and/or reduce sales, and conceivably force some assets to be sold at temporarily depressed prices. Although life insurers also face some mortality/morbidity risk, volatility on these dimensions is relatively modest and frequently managed effectively by transferring the risk to specialized reinsurers. U.S. life insurer capital levels in relation to assets are much smaller than those for non-life insurers and more comparable to those for banks (see note 2).

Private Incentives for Safety and Soundness

The U.S. and a number of E.U. countries guaranty certain obligations of insolvent insurers, thus protecting some policyholders from the full consequences of insurer default (see additional discussion below). Holding the specific arrangements and general solvency regulation aside for moment, it is useful to highlight first private incentives for safety and soundness in insurance markets. Those incentives ultimately determine the degree of safety and soundness, including

insurers' ability to withstand large shocks that reduce asset values or increase liabilities.[4] Three main influences encourage safety and soundness:

1. Many if not most policyholders prefer to deal with safe and sound insurers and, up to some point, are willing to pay the higher costs that greater safety requires. A variety of institutions, including the widespread use of insurance intermediaries (agents, brokers, advisors), a highly developed system of private ratings of insurers' claims paying abilities, and, for business covers, knowledgeable corporate staff who oversee risk management and insurance programs, help match policyholders with safe insurers.
2. Insurance production and distribution often involve the creation of sizable firm-specific assets, commonly known as franchise value, which could diminish or evaporate if the insurer experiences severe financial difficulty. Protection of those assets from loss due to financial difficulty therefore provides a significant incentive for adequate capitalization and other forms of risk management.[5] Firm-specific assets arise in two main ways. First, attracting and providing cover to a new customer typically requires relatively high upfront costs, which insurers expect to recover from higher margins on renewal business. Thus, renewal premiums often include quasi-rents as a return for the initial investment in creating the customer relationship. Those quasi-rents would be jeopardized in the event of financial difficulty. Second, insurers often make substantial investments in developing a brand name or reputation for quality service (especially non-life insurers). Those investments also produce quasi-rents, all or part of which would be lost in the event of insolvency. Both factors reduce the problem of time inconsistent incentives and associated excessive risk taking (e.g., asset substitution).

[4] As a recent, practical example, regulators' post-mortems of E.U. insurer insolvencies since 1996 conclude that underlying internal problems related to management and incentives appear to be the root cause of most insolvencies (see Sharma, 2002; also see McDonnell, 2002).

[5] The seminal theoretical treatment of this issue in the insurance literature is Finsinger and Pauly (1984). I have emphasized the role of franchise value in promoting market discipline in my work with Patricia Danzon (1994). Keeley and many others have considered the role of bank franchise value in bank capital decisions. See Santos (1999) for a review.

3. Many insurers in the U.S. and abroad issue debt, primarily at the holding company level. That debt is effectively subordinated to policyholder claims. It creates an additional category of stakeholders that press for efficient risk management, which in turn allows insurers to lower their cost of capital, including tax and agency costs.[6]

In view of these influences, efficient management of risk by insurers involves balancing the benefits of holding more capital and more effectively managing risk against (e.g., higher premiums, preservation of franchise value, lower debt funding costs) against the tax and agency costs of capital and frictional costs associated with other risk management methods. Given those costs, the optimal level of safety and soundness generally will achieve low default risk, but it is too costly to eliminate insolvency risk. The optimal insolvency rate for insurers is not zero.

Market Imperfections and Efficiency Rationales for Regulation

The traditional rationale for economic regulation is to protect the public interest by efficiently mitigating market failures. The test for whether government intervention into market activity will likely be efficient is two pronged (Breyer, 1982). First, there should be a demonstrable market failure compared to the standard of a reasonably competitive market characterized by: (1) large numbers of sellers with relatively low market shares and low cost entry by new firms; (2) low cost information to firms concerning the cost of production and to consumers concerning prices and quality; and (3) an absence of material spillovers (i.e., all costs are internalized to sellers or buyers). Second, there should be substantial evidence that regulation can efficiently address any market failure, that is, that regulation's benefits will exceed its direct and indirect costs. Regulatory tools are necessarily imperfect. Regulation always involves direct and indirect costs, and it risks unintended consequences. If both tests are met, efficient intervention then requires matching appropriate regulatory tools to specific market failures.

[6] Swiss Re (2000) and Hancock, et al. (2001) emphasize the tradeoff between capital (safety and soundness) and capital costs.

Market structure and ease of entry are highly conducive to competition in most insurance markets. Modern insurance markets that are relatively free from regulatory constraints on prices and risk classification exhibit pervasive evidence of competitive conduct and performance. The principal imperfections that plausibly justify some degree of government regulation take the form of costly and imperfect information and spillovers. The primary rationale for insurance regulation is to improve efficiency by promoting safety and soundness and healthy competition in view of those problems.

Costly/imperfect information and potential spillovers. Some form of solvency regulation is efficient because of costly/imperfection information and potential spillovers. As noted above, for example, non-life insurers bear enormous risk of loss from natural catastrophes and unexpected events. Liability insurers have paid hundreds of billions of dollars for claims brought many years after policies were sold, when legal liability standards and legal interpretations of policy provisions had changed substantially. The risk of many non-life losses is very difficult to evaluate and price accurately. Insurers must hold large amounts of capital to maintain reasonably low probabilities of insolvency. Competition creates relentless pressure for low premiums, which in some cases may contribute to inadequate rates and increase insolvency risk, especially for difficult to price coverages subject to large, but slow developing losses.

With solvency regulation, policyholders that would find assessing and monitoring insurer insolvency risk very difficult (or who might have little incentive to do so on their own or using brokers or advisors) in effect delegate significant responsibility for monitoring to regulators. This rationale for solvency regulation is considerably stronger for direct (retail) insurance for personal lines than for larger commercial policyholders and reinsurance (wholesale) transactions.[7] Regulatory monitoring might detect insurer financial problems early enough to prevent insolvency. In other cases, monitoring can help regulators intervene before the deficit between an insolvent

[7] See Santos (1999) for general discussion of the wholesale/resale distinction in the rationale for financial services regulation.

insurer's assets and liabilities gets any larger. Some degree of regulatory restrictions on insurer risk-taking (e.g., investment limitations and capital requirements) also is plausibly efficient.

Protecting risk averse policyholders from loss. Limited, government-mandated protection of policyholders' claims against insolvent insurers is likely to be efficient, at least arguably, in view of costly/imperfect information and possible spillovers on other parties (such as those with legally valid workers' compensation or liability claims against policyholders of insolvent insurers). The insurance industry also has a collective interest in bonding its promises to pay claims. Given costly and imperfect information, in the absence of any guarantees insolvencies might damage the reputations of many insurers, including perhaps some financially strong ones, therefore motivating many or most insurers to participate in a joint guaranty system. Joint guarantees help maintain collective pressure for efficient solvency regulation by giving member insurers a direct stake in the outcomes of such regulation. Government mandated systems reduce free rider problems and obviate antitrust concerns that might otherwise arise with privately initiated and managed joint guarantees.

Systemic risk. It generally is agreed that systemic risk is relatively low in insurance markets compared with banking, especially for non-life insurance.[8] Low probability events with large losses can simultaneously damage many non-life insurers, and the impact is spread broadly through product line and geographic diversification and especially through reinsurance, which creates material contractual interdependence among insurers. As noted earlier, large shocks can temporarily disrupt non-life insurance markets with attendant adverse effects on real activity. However, there is little likelihood and no evidence of "pure" contagion associated with major events, as opposed to rational, information-based flights to quality. Systemic risk is plausibly larger for life insurers (e.g., due to a collapse in major real estate markets), especially when some policyholders may seek to withdraw funds following large negative shocks, thus causing some

[8] Systemic risk is lower for all non-bank financial institutions (Santos, 1999). Nebel (2001) provides a useful discussion of why systemic risk is low for insurance.

insurers to unload assets at temporarily depressed prices. But such shocks do not threaten the payment system, as might be true for commercial banks, and pure contagion is less problematic than with banking.[9]

Main Features of Insurance Solvency Regulation

While the details vary significantly and frequently change across jurisdictions, insurance/reinsurance solvency regulation in the U.S., the E.U., and other developed countries generally has most or all of the following features:

1. Regulatory establishment and monitoring of compliance with asset/liability rules;
2. Regulatory rules that restrict certain types of risk-taking (such as restrictions on permissible investments);
3. Regulatory capital requirements;
4. Solvency monitoring (early warning) systems to identify troubled companies;
5. Monitoring of primary insurers' reinsurance ceded, rules for allowing primary insurers to receive balance sheet credit for such reinsurance, and/or direct supervision of reinsurers;
6. Guaranty systems to pay a portion of claims against insolvent insurers, usually funded by post-insolvency assessments on solvent insurers; and
7. Procedures for receivership, rehabilitation, and liquidation of troubled companies.

III. Market and Regulatory Discipline: Insurance, Reinsurance, and Banking

The design of efficient solvency regulation necessarily confronts difficult tradeoffs. Beyond some point, lowering insolvency risk through tighter regulatory constraints, such as higher capital requirements, inefficiently increases the total costs of insurance or banking services. Regulatory monitoring and controls to reduce insolvency risk involve direct costs, such as salaries paid to regulators and data collection, processing, and analysis costs. They also produce indirect costs,

[9] Brewer and Jackson (2002) analyze U.S. bank and life insurer stock price reactions to "financial distress' announcements and provide evidence that pure contagion is much lower than for banks than for life insurers. Also see Malkiel (1991) and Fenn and Cole (1994).

for example, by distorting the decisions of some financially sound institutions in ways that increase their costs (or seek to undermine regulatory requirements).

A tradeoff also exists between protecting customers against loss when banks or insurers fail and incentives for banks and insurers to be safe. Protection against loss reduces depositor and policyholder demand for lower insolvency risk and their incentives to seek safe institutions, thus in turn dulling those institutions' incentives to hold more capital and manage risk effectively. Even well designed government (or government-mandated) guarantees may increase insolvency risk. Accurate risk-based premiums for guaranty protection, which could mitigate the dulling effects of guarantees on incentives for safety and soundness, are infeasible in practice. Government guarantees therefore are very well known to involve moral hazard: depositors/policyholders have less incentive to deal with safe institutions and some institutions have less incentive to be safe.

In the U.S., a modest increase in insolvency risk and insolvencies following the breakdown of adherence to collective pricing systems, greater reliance on competition to determine rates in many states, and regulatory pressure toward rate inadequacy in others made limited guarantees of insolvent insurers' obligations more advantageous beginning in the late 1960s. State guarantees developed with substantial input from insurers (and in conjunction with proposed federal guarantees). The vast majority rely on ex post assessment funding mechanisms, which enhance incentives for financially strong insurers to press for effective solvency surveillance and efficient liquidation of insolvent insurers. Such incentives are generated because unexpected increases in the costs of assessments are likely to be borne in large part by insurers, as opposed to being fully shifted to customers or taxpayers.[10]

[10] See Lee, Mayers, and Smith (1997) and Downs and Sommer (1999) for further discussion. A poorly designed guaranty system that spread the cost of insurer insolvencies broadly among taxpayers could reduce pressure by insurers and policyholders for the government to commit resources and adopt internal controls that are necessary for efficient monitoring. Although the desire to avoid loss of premium tax revenue in states that allow offset of guaranty fund assessments against premium taxes might produce legislative pressure for controlling the cost of assessments, Brewer, Mondschean, and Strahan (1997) argue and provide evidence suggesting that that tax offsets of life guaranty association assessments reduce incentives for monitoring.

Because systemic risk is materially lower for insurance, especially non-life insurance, than for the banking system, the efficient level of guaranty fund protection is correspondingly lower. Contrary to some complaints that state guaranty fund protection is inadequate in the U.S., limited coverage is advantageous. Reinsurance is not covered. Coverage for large business policyholders is limited in part by maximums (e.g. U.S.$300,000) per occurrence of a covered claim. About a third of the states further reduce protection or exclude large business policyholders from coverage, which encourages them to trade with safe insurers and discourages them from buying coverage that they believe may be under-priced.[11] Those arrangements are very likely more efficient than state systems without such restrictions.[12] Several E.U. guaranty systems have even stronger limitations, and a few E.U. countries have no guarantees.[13]

Table 1 summarizes incentives for safety and soundness and the associated need (or lack thereof) for regulatory discipline for banks, non-life insurers, life insurers, and reinsurers. Although it reflects subjective assessments of the magnitude of each influence in each sector, the key point is that market discipline is stronger in insurance (and especially reinsurance) than in banking. In the U.S., this difference in large part reflects that insurance guarantees have much smaller effects on market discipline than federal deposit insurance, with its broad explicit protection and the history of

[11] Life guaranty funds exclude coverage for large amounts of unallocated annuities and generally include haircut provisions on policyholder accounts.

[12] The recent insolvency of Reliance Insurance Group, with an estimated $1.1 billion excess of liabilities over assets, is expected to cause guaranty fund annual assessment caps to be reached in a number of states, perhaps for several years, and especially in the states' separate workers' compensation insurance guaranty funds. Although existing procedures that permit or facilitate borrowing by guaranty funds should allow America's largest property-casualty insurer insolvency to be handled in a relatively smooth fashion, the possible insolvencies of one or more other sizable insurers with relatively large workers' compensation portfolios would stress the system. Proposals are being discussed for new funding arrangements where solvent insurers would advance funding above the caps to be credited against future assessments. The Reliance insolvency and the recent financial difficulties of a number of other insurers in large part reflect intense price competition during the prolonged "soft" market for commercial property-casualty insurance in the 1990s and unexpected growth in claim costs for business written at relatively low rates. Thus, in many respects these problems illustrate the inherent risks of insuring property-casualty risk.

[13] The UK guaranty system covers personal lines, financed by ex post assessments. (The Financial Services Authority recently proposed extending the guaranty system to Lloyds' of London.) France covers motor liability, financed ex ante by premium taxes. Germany covers motor liability with ex post assessments for covered claims. See Swiss Re (2000). Norway has a guaranty system; Ireland and the Netherlands have recently introduced such systems (IAIS, 2000b).

implicit federal guarantees (e.g., the "too big to fail" doctrine, which protected nominally uninsured deposits at very large banks). In addition (and related), private incentives for safety and soundness may be stronger in insurance if franchise value tends to be greater for insurers than banks as a by-product of insurance production and insurer investments in reputation for quality service.

The conclusion that market discipline is stronger in insurance than banking and strongest in reinsurance does not imply that insurance guarantees are free from moral hazard. Instead, a number of empirical studies provide evidence that the adoption of guarantees in the U.S. increased insurer risk-taking (Lee, Mayers, and Smith, 1997; Brewer, Mondschean, and Strahan, 1997; Downs and Sommer, 1999; also see Bohn and Hall, 1999). But the conclusion that market discipline is stronger in insurance is hardly controversial in view of the large literature on moral hazard and excessive risk-taking in banking. As one example, Billet, et al. (1997), provide evidence that banks downgraded by rating agencies increase their insured deposits following the downgrade. My own work with Karen Epermanis, however, documents that rating downgrades are followed by revenue declines for U.S. non-life insurers compared with insurers that experienced no rating change (see Figure 1 and Epermanis and Harrington, 2001; also see Zanjani, 2002, for related analysis of ordinary life insurance policy terminations). Fenn and Cole (1994) provide evidence that policyholders' reactions to asset quality problems at life insurers in the late 1980s and early 1990s targeted weak institutions and thus were consistent with a rational flight to quality as opposed to pure contagion. As noted earlier, Brewer and Jackson (2002) provide evidence that pure contagion is much greater in banking than in life insurance.

In summary, economically efficient regulation implies a tradeoff between the types and intensities of regulation and the degree of market discipline that is closely linked with the magnitude of systemic risk and government guarantees of financial institutions' obligations. *Greater market discipline in insurance implies that insurance/reinsurance solvency regulation and capital requirements should be less restrictive than in banking.* The next section elaborates this issue conceptually in the specific context of capital requirements.

III. Capital Regulation with Imperfect Risk Assessment

Risk-based capital standards may provide regulators and other parties with valuable information about institutions' capital adequacy. They also can provide regulators with greater authority and motivation to take specific actions against insurers that violate the standards. Perhaps more important, capital standards can induce some financially weak institutions to hold more capital (or limit their risk in relation to existing capital). This section focuses on such inducement. I ignore a variety of complicating factors, such as possible gaming of capital requirements by banks or insurers.

Market discipline will generally be inadequate for some firms. They will hold too little capital in relation to risk, thus making the values of their default put options ("default puts") socially excessive. Ignoring specific details about government insurance/guarantees and the incidence of excessive put costs, and assuming crude or risk-insensitive charges for guarantees, the problem's essence is that some firms' put values will be inefficiently high compared with the costs of holding additional capital (or reducing risk) to reduce those values. Holding more capital (or reducing risk) would lower total costs (the sum of the firm's default put and capital costs). But because some default costs are not internalized to the firm, it rationally foregoes minimization of social costs.

By requiring some firms to hold more capital in relation to their observed risk, risk-based capital rules may reduce their put values. With perfect information and costless enforcement, capital standards could correspond exactly with a firm's risk. Each firm could be forced to hold the efficient level of capital. But risk assessment is costly, inherently imperfect, and perhaps even relatively crude in the best of circumstances. Two types of errors are therefore inevitable with risk-based capital. First, capital standards will involve Type 1 errors; they will cause some otherwise adequately capitalized ("sound") firms (i.e., those with efficient put values) to hold too much capital (or to reduce their risk inefficiently). Second, capital standards will involve Type 2

errors; they will fail to cause some firms with excessive put values to hold enough capital in relation to risk.

The cost of Type 1 errors reflects capital costs in excess of any marginal reduction in sound firms' put values. Those costs will in large part be borne by customers (insurance policyholders, bank depositors and borrowers) through higher prices or less favorable terms. The benefit from inducing some weak firms (those that otherwise would have excessive put values) to hold more capital is the reduction in their put values above the marginal increase in their capital costs. The sum of the costs and benefits of capital standards depends on their ability to target weak firms.

The design of capital standards therefore confronts a difficult tradeoff. Up to some point, increases in capital requirement stringency will cause a greater number of weak firms to hold more efficient levels of capital (or reduce their risk), but it also will cause a greater number of sound firms to hold too much capital (or inefficiently shed risk). For a given degree of accuracy, efficient capital standards balance the net benefits from getting some weaker firms to hold more capital with the net costs imposed on some found firms.

It is useful to distinguish conceptually two dimensions of the accuracy of risk-based capital systems, even though those dimensions are implicit or blurred in practice. In effect, risk-based capital systems classify some firms as having too little capital and others as having adequate capital. One dimension of accuracy relates to the additional capital amounts that firms classified as having too little capital must hold. The second dimension of accuracy relates to classification precision. The distinction highlights two closely related issues: (1) the optimal stringency of capital requirements for firms explicitly or implicitly classified as having too little capital, and (2) the optimal degree of classification accuracy. Most of my brief comments deal with the first issue. The Appendix outlines a simple model that supports the main points.

Tempering Capital Requirements to Reflect Market Discipline

Any specific capital standard will (1) encourage some weak firms to hold more capital, (2) require some sound firms to hold too much capital (Type 1 errors), and (3) fail to mitigate capital inadequacy for some weak firms (Type 2 errors). Up to some point increasing the rule's stringency generally causes more weak firms to be constrained, reducing the Type 2 error rate and associated costs. But increased stringency also increases the Type 1 error rate (the proportion of sound firms whose decisions are inefficiently distorted), which again increases costs. The key question is how to set stringency in order to minimize total costs.[14]

The qualitative answer that the optimal capital rule(s) should satisfy two general principles. First, *the additional capital required for firms believed to be inadequately capitalized should be less than the amount that would be required if they were known with certainty to be inadequately capitalized.* With imperfect risk assessment (classification), capital requirements for firms that *appear* weak should be tempered: they should be lower than the optimal amounts with perfect risk assessment. The intuition is straightforward. Because higher capital requirements distort some sound firms' decisions (and fail to constrain some weak firms), tempering of the requirements reduces those costs and minimizes total costs. While tempering sacrifices benefits for correctly classified weak firms, it reduces costs for sound firms that are mistakenly constrained by the rule.

The second general principle deals with the relationship between capital requirement stringency (the efficient level of tempering) and the extent of market discipline. As market discipline increases, fewer firms will hold too little capital in relation to risk without capital regulation. For a given Type 1 error rate (proportion of sound firms forced to hold more capital), higher market discipline therefore implies that decisions of a greater number of sound firms' will be inefficiently distorted. Moreover, for a given level of power to identify weak firms correctly,

[14] This problem is a straightforward application of standard analyses of loss functions in statistical testing.

greater market discipline implies a smaller number of weak firms and thus fewer total benefits from requiring firms classified as weak to hold more capital. Both factors imply that tempering should increase – capital standards should be less stringent – as market discipline and the proportion of sound firms increases (see Appendix for more details).

Thus, the implications of this discussion are: *As long as market discipline motivates some firms to be adequately capitalized without capital requirements, (1) imperfect risk assessment favors less stringent capital standards for firms that appear inadequately capitalized, and (2) the stringency of capital standards should decline as market discipline increases.*

Optimal Risk Assessment and Market Discipline

Up to some point, additional expenditures on risk analysis and assessment (for data, model development and validation, expert evaluation, and so on) should increase accuracy; i.e., it should reduce explicit or implicit Type 1 and Type 2 error rates for a risk-based capital system. Risk assessment is costly, however, and will remain inherently imperfect even if much higher costs are incurred. The optimal degree of accuracy (crudity) will (1) reflect those costs and inherent inaccuracy, and (2) will be lower the greater are the costs of improving accuracy.

Intuitively, accuracy becomes more important as the stringency of capital standards increases. For a given Type 1 error rate, for example, more stringent capital requirements increase the costs of Type 1 errors. Greater stringency therefore increases the potential benefits from lowering the Type 1 error rate (and from lowering the Type 2 error rate as well). Because optimal stringency is inversely related to the degree of market discipline, the optimal degree of accuracy (error rate) should likewise be inversely related to market discipline. When market discipline is strong, capital requirements should constrain relatively few firms, and classification accuracy is less important. When market discipline is weak, capital requirements should be more stringent and accuracy is more important. Of course, an alternative to more stringent capital requirements and a continued search for greater refinement of those requirements is to encourage

market discipline (see U.S. Shadow Financial Regulatory Committee, 2000, for extended discussion).

The overall implications of this discussion are:

1. *The stringency of capital requirements should be inversely related to the degree of market discipline (positively related to the degree of market failure).*
2. *The accuracy of capital requirements in relation to risk is more important when standards are stringent, which ideally will not be the case unless market discipline is weak.*
3. *A conceptual and in some instances practical alternative to more stringent capital requirements would be to increase market discipline (e.g., by encouraging more stakeholders to care about default risk).*

IV. Capital Regulation in Practice

This section briefly describes insurance capital regulation in practice and how it compares with the preceding analysis, focusing on the U.S. and the E.U. I briefly describe bank capital regulation as a point of departure. I then turn to regulation of direct insurance, first in the U.S. and then in the E.U. I then discuss supervision and capital regulation for reinsurers and conclude with brief comments on the regulation of financial conglomerates and cross-sector risk transfers.

Lessons from Banking

The 1988 Basle Accord was designed to harmonize capital standards and increase capital adequacy for international banks. The original system defining tier 1 and tier 2 capital standards in relation to risk-weighted assets focused on credit risk. Market risk was added later, along with provisions that allowed banks to use internal models to determine their required capital for market risk under certain conditions. Basle II establishes a three-pillar approach: (1) risk-based capital standards, (2) supervision, and (3) market discipline (i.e., disclosure requirements). Formula based capital standards are the default under pillar 1, with basic and advanced internal model

provisions for banks that qualify. A major emphasis is placed on achieving more accurate standards, thus continuing the search for the Holy Grail of highly accurate requirements.

The evolution of the Basle framework illustrates the underlying dilemma of bank solvency regulation. Systemic risk is significant; deposit insurance mitigates systemic risk but materially undermines market discipline. The Basle view is that stringent capital standards are therefore necessary. That stringency in turn stimulates the search for greater accuracy in relation to risk. Inherent limitations on the accuracy of fixed weight approaches create pressure for more sophisticated modeling to capture the risk of different institutions. Regulation evolves from standard setting and compliance monitoring to active encouragement and supervision or even regulatory micro-management of risk modeling by banks. These regulatory responses involve direct and indirect costs.

An alternative approach to addressing the deposit insurance / moral hazard conundrum would be to promote stronger market discipline. The market discipline feature (pillar 3) of Basle II stresses disclosure of risk and risk management by banks to provide outsiders with better information. But that approach by itself does not increase stakeholders' sensitivities to insolvency risk. A significant increase in market discipline instead might be achieved by (1) requiring banks to issue and maintain highly rated subordinated debt (see U.S. Shadow Committee, 2000, for detailed discussion and a specific proposal; also see Evanoff and Wall, 2003) and/or (2) by reducing – or at least not increasing – the scope of deposit insurance and implicit government guarantees of banks' obligations.

Capital Requirements for U.S. Insurers and Reinsurers

Until the early 1990s, U.S. insurers were only required to meet absolute minimum capital standards to establish and continue operations in a state. These requirements, which still serve as absolute minimums and usually vary depending on the type of insurer (stock or mutual) and the broad type of business written (e.g., non-life versus life insurance), average around $2 million,

varying from several hundred thousand dollars in a few states up to $5 million or more in a few others. During 1991-1994, the NAIC developed RBC standards to supplement the absolute minimums for adoption by the states. Those standards became effective in 1993 for non-life insurers and in 1994 for life insurers. The capital charges vary in relation to the specific amounts and types of an insurer's assets, liabilities, and premiums. The development of insurance RBC standards followed (1) a significant deterioration in insolvency experience and state guaranty fund assessments from the mid-1980s to the early 1990s (see Figures 2 and 3), (2) associated Congressional hearings and proposed legislation to establish federal insurance and reinsurance solvency regulation, and (3) promulgation of the 1988 Basle capital standards for banks.[15]

Description of RBC standards. There currently are separate RBC standards for non-life insurers, life insurers, and health insurance / HMO organizations. Table 2 provides a simplified summary of the NAIC non-life and life RBC systems.[16] The NAIC's RBC formula for non-life insurers encompasses four major risk categories (buckets): (1) asset (investment) risk, (2) credit risk, (3) underwriting risk, and (4) miscellaneous off-balance sheet risks, such as the risk associated with rapid premium growth. The life insurer formula includes components for (1) asset risk, (2) insurance risk (underwriting risk associated with sickness and mortality), (3) interest rate risk (which focuses on the risk that policyholders will withdraw funds to invest elsewhere if market yields increase), and (4) miscellaneous business risks, such as the risk of guaranty fund assessments. The specific RBC risk-weights for the items in each bucket and the formulas for aggregating the buckets' charges are complex, including non-linear combination of various factors to allow crudely for diversification (covariance risk). In the vast majority of states that have adopted the NAIC's RBC standards, regulators can and/or must take specific actions if the insurer's actual capital falls below specified percentages of its RBC (see Table 2).

[15] During 1979-1997, non-life insurance guaranty assessments in the U.S. averaged 0.15 percent of net premiums with a maximum of 0.47 percent (Swiss Re, 2000).

[16] See American Academy of Actuaries (2001) for comprehensive details. KMPG (2000a) and Swiss Re (2000) provide basic details and examples.

Most insurers and reinsurers easily exceeded the RBC thresholds when the systems were adopted. The RBC standards nevertheless were purported to (1) encourage weak insurers to limit their risk or increase their capital, (2) encourage faster corrective action by regulators and thus discourage unjustified forbearance, and (3) help regulators identify insurers with too little capital.

RBC ratios for non-life and life insurers. Figure 4 summarizes the distribution of ratios of total adjusted capital to company action level RBC for non-life and life insurers in 1999. For an admittedly crude comparison, Figure 4 also includes information on bank RBC ratios (total capital / risk-weighted assets) as a percentage of the required minimum (8%) for "adequate" capitalization.[17] The median non-life insurer had capital equal to 327 percent of its company action level RBC; the median life insurer had capital equal to 387 percent of its company action level RBC. The median bank had a total capital to risk-weighted assets ratio of 14.24 percent, which equaled 178 percent of the 8 percent threshold. Figure 5 plots non-life insurer RBC ratios (total adjusted capital / company action level RBC) against net premium volume. There is some tendency for capital ratios to decline with premium volume, but most of the larger insurers have ratios well above 100 percent. The comparisons clearly indicate that insurer RBC requirements bind for relatively few insurers and suggest that bank RBC standards are more stringent than those for insurers.[18]

Available research indicates that relatively few non-life insurers that failed in the late 1980s and early 1990s would have violated the RBC thresholds for regulatory action one to three years prior to insolvency (Cummins, Harrington, and Klein, 1995; Grace, Harrington, and Klein, 1998). Adding the ratio of actual capital to RBC also does not appear to increase the forecast accuracy of financial-ratio based monitoring systems used by regulators or to improve accuracy very much compared to using simple ratios, such as the ratio of surplus to premiums (see Figure 6, which

[17] The bank ratio percentiles are for 2001 (which I could readily obtain), which probably are slightly lower than would be true in 1999. The result for the total banking industry uses data for 1999 (the same year as for the insurers).

[18] This point is noted in IAIS (2001, p. 5); also see p. 53 of that study, which discusses ratios of capital to Company Action Level RBC for life and non-life insurers.

summarizes some results from Grace, Harrington, and Klein, 1998). The extent to which RBC standards have increased capital levels or reduced risk-taking is unknown.[19] Capital positions of non-life and life insurers generally increased during the 1990s, and many life insurers curtailed asset risk following asset quality problems in the late 1980s and early 1990s. Those changes largely reflect market discipline, given limited guaranty fund protection and insurer incentives to preserve franchise value that could be eroded by financial difficulty.

Criticisms of RBC. Like the Basle standards, the NAIC RBC standards have been criticized on a variety of dimensions.[20] One line of attack is that the types of risk reflected, the risk-weights, and the aggregation methods are ad hoc and unnecessarily crude. As suggested earlier, however, it almost always can be argued that capital standards, although complex, are not complex enough to mimic market discipline (or sophisticated financial models) and that additional refinements could improve accuracy. A few observers suggest that the relatively low levels of total RBC compared to total insurance industry capital indicate that the formulas do not require enough capital.

Given substantial market discipline in the insurance industry, however, relatively low levels of RBC in relation to actual capital for the bulk of insurers represent a virtue of the system.[21] The levels suggest that RBC standards distort the decisions of relatively few sound insurers. Although the standards are complex, that complexity is probably relatively harmless given the modest levels of required capital. Attempting to achieve additional refinements in insurer capital standards and to increase the overall level of RBC materially would inevitably lead to undesirable

[19] In contrast to extensive research on the effects of the Basle Accord on banks, much of which is inconclusive (see Jackson, 1999, for an excellent survey), there has been relatively little work on the effects of U.S. RBC standards on behavior, perhaps because the required capital amounts are relatively low and a variety of non-regulatory factors led to larger capital ratios in the 1990s.

[20] Cummins, Harrington, and Niehaus (1993 and 1995) review some of the arguments. Also see chapter 10 of KPMG (2000a). A 1997 report (European Commission, 1997) by the European Commission noted, "[T]he superiority of [the U.S. RBC approach] over the Community regulatory [solvency margin] approach has not been demonstrated. Such models are characterized in particular by their complexity and comparatively greater arbitrariness."

[21] Dave Cummins, Greg Niehaus, and I argued this in our 1993 paper.

distortions in decisions of many sound insurers. The effects could include reduced willingness of these insurers to provide coverage, less efficient investment strategies, and/or higher prices, especially following any large, negative shocks to insurer capital.

The preferred approach to enhancing efficiency is to consider possible methods of increasing market discipline where such discipline remains inadequate. The case for mandatory subordinated debt for large insurers is less forceful than for banks, because of greater market discipline in the insurance sector that is associated with less comprehensive guarantees for insurer obligations. While evidently not politically viable, a strong case can be made for simpler capital requirements based on leverage, perhaps along the lines of the E.U. solvency margin requirements described below, in conjunction with possible targeted changes to promote market discipline (such as further reductions in guaranty fund protection for commercial policyholders).

Federal insurance regulation and extension of the Basle approach to U.S. insurers. There is a risk that pressure will increase for further extending the Basle approach to insurers in the U.S. (and abroad, see below). U.S. state regulators often face pressure to mimic developments in bank regulation to stave off federal insurance regulation. The enactment of the Graham-Leach-Bliley (GLB) Act in 1999 increased debate over the direct and indirect costs of state regulation of rates, forms, and producer licensing in an environment of financial modernization, growing electronic commerce, and global competition. Representatives of many large U.S. non-life insurers specializing in business insurance and their main trade association, the American Insurance Association (AIA), advocate optional federal chartering and regulation as a means of regulatory modernization (i.e., of escaping inefficient state regulation of rates and certain forms). Representatives of many U.S. life insurers and the American Council of Life Insurance (ACLI) also favor optional federal regulation as a means to escape inefficient form regulation and compete more effectively with banks.

State responses to the GLB Act, to increased concern about antiquated regulatory practices, and to the threat of federal chartering include the elimination in many states of prior approval

regulation of rates and policy forms for "large" commercial policyholders. A large majority of states passed laws to meet GLB provisions dealing with reciprocity for non-resident producer licensing and prevent federal licensing of producers. Various NAIC working groups are attempting to (1) develop uniform state standards and centralized approval for policy form filings for "appropriate" life-health-annuity products, (2) streamline and homogenize non-life insurance rate and form filing and review processes, and (3) promote regulation that recognizes competition. Those state actions have not prevented numerous proposals for dual chartering in the U.S. House and Senate and by the AIA, the ACLI, and the American Bankers Insurance Association.

Optional federal chartering and regulation of U.S. insurers could ultimately undermine market discipline and create a demand for more stringent solvency regulation and capital requirements. A federal guaranty covering the obligations of all insurers could be a precondition for an effective optional chartering system. It is highly probable that federal guarantees of both federally and state-chartered insurers would be inevitable with dual chartering, even if initial legislation eschewed federal guarantees and required federally chartered insurers to participate in state guaranty funds or established a federal guaranty system for federal insurers. A dual chartering system that required federally charters to participate in the state guaranty system without a federal guarantee would be unstable. Insolvency of a federally chartered insurer or a number of state chartered insurers would create strong pressure for a federal guarantees patterned after deposit insurance. The state guaranty system would likely be seriously weakened without participation of federally chartered insurers. A federal guaranty system would likely expand to cover both federally and state chartered insurers.

The danger is that federal guarantees would repeat some of the mistakes of deposit insurance. Specifically, they might inefficiently expand protection of insurance buyers against loss from insurer insolvency (e.g., by reflecting a policy, de facto or de jure, of "too big to fail"). Such expansion would materially undermine incentives for safety and soundness. More

regulatory constraints on insurer operations, such as more stringent capital requirements and the extension of the Basle II approach to insurance and reinsurance, would eventually ensue. The ultimate result of dual chartering could therefore be less market discipline and more reliance on regulation.

Solvency Margin Requirements for E.U. Insurers

Compared to U.S. risk-based capital standards, "solvency margin" requirements for E.U. direct insurers generally are much simpler, at least at present. Although there exist cross-country differences in accounting procedures and other details, the main form of solvency requirements has been harmonized for direct E.U. insurers for many years. Table 3 summarizes some of the main features of the E.U. requirements for non-life and life insurers as amended by the European Commission and Parliament in March 2002, which will take effect in 18 months.[22] In contrast to the U.S. system, the E.U. solvency margin requirements are expressed as relatively simple proportions of relevant premiums, claims, or claim-related liabilities. There is no explicit provision for asset risk. Until the 2002 changes, the non-life requirements did not distinguish types of cover. The 2002 changes increase the required margin for aviation, marine, and general liability insurance compared with other covers.[23]

Figure 7 illustrates the required solvency margin for non-life insurers as a ratio of net (after reinsurance cessions) premiums under four different scenarios (and assuming factor A in Table 3 produces the higher required margin). The figure illustrates the increased margin that can result from giving greater weight to higher risk covers. It also shows the effects of the treatment of reinsurance ceded. Because the required margins limit the maximum reduction in the margin from ceding reinsurance to 50 percent, materially higher requirements result when an insurer

[22] The current rules date back to 1973 (non-life) and 1979 (life). Appendix 10.1 of KPMG (2000a) provides a useful introduction to current solvency margin requirements. Also see Swiss Re (2000). The rules also define absolute minimum amounts of capital (the "minimum guarantee fund"), which will be indexed with inflation under the new amendments.

[23] That change reflected concerns expressed in the Muller Group Report. The 2002 amendments also strengthened provisions for regulatory intervention.

retains less than 50 percent of claim liabilities (25 percent in two of the scenarios). The 50 percent limit has been a point of some contention.[24]

As is true in the U.S., evidence indicates that most E.U. insurers generally have held considerably more capital than the required solvency margin (Swiss Re, 2000).[25] Studies of European insolvencies have concluded that the system has performed reasonably well (Muller Group Report, 1997). The relative simplicity of the requirements and their lack of stringency compared to actual capital levels are virtues in view of the degree of market discipline in insurance. Pressure is nonetheless mounting from several sources for refinements in the solvency margin requirements that would consider other types of risks and possibly adopt the internal modeling, supervision, and market disclosure features of the Basle proposals. A study by KPMG for the European Commission (KPMG, 2002a), as part of its Solvency II project, endorses the application of a Basle-like three-pillar approach to insurers (also see European Commission, 2001). The European Commission describes that project as follows (European Commission, 2002a):

> The basic objective will be to try to better match solvency requirements to the true risk encountered by an insurance undertaking and also to encourage insurers to improve their measurement and monitoring of risks they incur. In this way, the objectives of the Solvency II project parallel those of the revision of the Basle Capital Accord for banks.[26]

The Financial Services Authority is developing a three-pillar approach for U.K. insurers and working for such application throughout the E.U. (Tiner, 2002; Davies, 2003).

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[24] The CEA supports a maximum deduction higher than 50 percent (CEA, 2000, p. 9).

[25] The Swiss Re study also provides evidence that the U.S. non-life RBC rules produce higher required capital on average than the E.U. solvency margin requirements.

[26] A news story (see Bolger, May 1, 2002) based on the press release for the KPMG report (2000a) quoted a KPMG executive who noted that insurers' "risk management systems – with some exceptions – have not evolved in line with advances made in the banking sector.... The existing solvency rules ... do not adequately reflect the full range of risks to which insurers are exposed." A co-author of the report was quoted as stating: "While the solvency requirements for insurance undertakings in the E.U. have generally worked well in protecting policyholders, they have been in place for many years and the need for reform has become pressing." One outcome of applying a three-pillar approach with emphasis on internal modeling would be significant expansion in the demand by insurers for risk modeling consulting services.

Reinsurance Supervision and Capital Requirements

U.S. regulation and credit requirements. Although the details are complex, the U.S. system of reinsurance regulation is relatively straightforward. State regulators review direct insurers' reinsurance arrangements. State licensed reinsurers are subject to the same sorts of solvency regulation and are governed by the same RBC systems as direct insurers. U.S. direct insurers can only take credit on their balance sheets for premiums and liabilities ceded to reinsurers if (1) the reinsurer is licensed in the state, (2) the reinsurer is accredited in the state, which requires inter alia that it be licensed in at least one state, (3) the reinsurer collateralizes its obligations by deposits in an individual or multiple beneficiary trust, including a contingency reserve (surplus amount), or (4) the reinsurer provides a letter of credit from a financial institution guaranteeing its obligations to each of its ceding insurers (see, for example, Hall, 2001; and Hall and Hall, n.d.).[27] Many non-U.S. entities satisfy these requirements by establishing a U.S. subsidiary (or U.S branch) that is licensed or accredited in the states where it conducts business.

The rationale for the U.S. system, as expressed by state regulators and the Reinsurance Association of America (RAA), the leading trade association for U.S. reinsurers (see Hall, 2001), is that credit for reinsurance rules are necessary to protect U.S. policyholders given that U.S. regulators cannot be expected to have detailed familiarity or knowledge of hundreds of non-U.S. reinsurers. Representatives of non-U.S. reinsurers criticize the U.S. system as being overly burdensome and creating unnecessary barriers to free cross-border trade.[28] U.S. regulators and reinsurer representatives retort that U.S. reinsurers face the same state licensing and accreditation rules in the U.S. as non-U.S reinsurers, and that those rules have not prevented a large amount of

[27] A few states' regulators have been reluctant to accept domiciliary state recommendations that a particular reinsurer qualifies for accreditation (Hall and Hall, n.d.)

[28] Representatives of non-U.S. reinsurers have pressed for reductions in funding requirements for multiple beneficiary trusts. The U.S. also imposes a 1 percent excess tax on reinsurance ceded to non-U.S. reinsurers (4 percent for direct insurance) absent any reciprocity arrangement with the tax authorities in the reinsurer's home country.

cover on U.S. risks from being ceded abroad (about 40 percent of U.S. non-affiliated ceded premium, see Hall, 2001).

Reinsurance regulation in the E.U. Reinsurance in the E.U. is not yet subject to any directives related to solvency regulation (see KPMG, 2002b). The supervision of reinsurers is based on the laws of different E.U. countries. There is considerable diversity in those laws and procedures, ranging from virtually no regulation of domestic reinsurers in Belgium, Greece, and Ireland to regulation that largely mimics that for direct insurers in the U.K. and Italy. Some countries directly supervise reinsurers; some focus more on indirect supervision by reviewing direct insurers' reinsurance programs; some practice both direct and indirect supervision.[29] Table 4 summarizes some of the main differences across countries within the E.U.[30] Several countries do not require reinsurers to be licensed; many do not require non-domestic reinsurers to submit financial statements to regulators. Relatively few E.U. countries have required solvency margins for reinsurers.

Pressure is mounting for harmonization of direct supervision of reinsurer solvency and application of uniform solvency margin requirements to E.U. reinsurers. The leading trade association of European insurers has proposed harmonization around a set of core principles and a single passport system to the European Commission (CEA, 2000). In October 2002 the International Association of Insurance Supervisors adopted a statement of principles calling for direct regulation of reinsurers. The KPMG study prepared for the European Commission on the question of reinsurance supervision has recommended harmonization and direct supervision, including solvency margin requirements and possible extension of the Basle approach to

[29] Section 6.4 of KMPG (2002a) contains detailed discussion of procedures used to assess ceding insurers' reinsurance programs in different countries. France has a particularly stringent system; it requires collateralization of all ceded reserves.

[30] See KPMG (2002b) for detailed discussion. According to KPMG, the two largest European reinsurers, Munich Re and Swiss Re, are only regulated to a "limited extent."

reinsurance (KPMG, 2002b).[31] However, extensive market discipline in reinsurance – a wholesale market – suggests considerable caution in increasing the scope and intensity of reinsurance regulation.

Proposals for harmonization and more stringent supervision are partly motivated by the hope that they would eventually produce mutual recognition between U.S. and E.U. regulators, which would allow E.U. reinsurers to operate in the U.S. (and vice versa) without having to be licensed (or accredited) in numerous jurisdictions. But there are several impediments to that development, and it would entail considerable risk. U.S. reinsurer representatives generally are strongly opposed to mutual recognition unless their companies can also obtain a single passport for operating in the U.S. (i.e., unless they can obtain a federal charter). At least for the moment, optional federal chartering of U.S. insurers and reinsurers does not appear imminent. Those representatives also have expressed concern that core regulatory requirements for reinsurers suggested in European Commission documents could be "far weaker" than regulation is some countries, such as the U.S. (Hall, 2001, p. 15) and that promulgation of international accounting standards is another prerequisite for meaningful discussion of mutual recognition.[32]

Cross-border differences in the tax treatment of insurers/reinsurers also may substantially impede harmonization and mutual recognition, even apart from state insurance regulation in the U.S. As noted earlier, double taxation of investment earnings on insurers' capital can constitute a major cost of holding such capital. Some E.U. countries mitigate those tax costs by integrating corporate and personal taxation or through other mechanisms. Reinsurers in Bermuda and a number of other tax havens have attracted substantial reinsurance volume in large part because they face lower capital costs (including about $20 billion in new capital since September 11, 2001). U.S. rules governing credit for reinsurance increase the costs to non-U.S. reinsurers of

[31] Nebel (2001) provides a counter-view supporting liberal regulation of reinsurance.

[32] Insurance liability and asset reporting procedures currently vary significantly across countries both within and outside of the E.U. See Chapters 4 and 5 of KPMG (2000a) for detailed discussion. Chapter 8 of that report considers possible changes in international accounting standards.

assuming U.S. business. As such, those rules probably lessen the amount of reinsurance that is ceded to reinsurers operating in more tax-favored regimes. A certain degree of tax harmonization may be a prerequisite for substantial regulatory harmonization and mutual recognition, even if the U.S. permits federal chartering of insurers and reinsurers.

Financial Conglomerates and Cross Sector Risk Transfers

The GLB Act subjects U.S. "financial service holding companies" to consolidated oversight by the Federal Reserve. Financial holding companies that do not include a commercial bank are not considered financial service holding companies and therefore are not subject to consolidated oversight by the Federal Reserve. The E.U.'s financial conglomerate directive (European Union, 2002c), which has been adopted but not yet implemented, requires financial companies with at least one entity in the insurance sector and at least one entity in the banking *or* investment services sector to be subject to consolidated oversight. Entities based outside of the E.U. that are not subject to "equivalent" consolidated oversight would have to establish an E.U. holding company to conduct business in the E.U.

The emphasis on consolidated oversight in the E.U. reflects concern with the effects on financial stability of combining cross-sectoral activities under common ownership. Debate also has arisen over the effects on financial stability of cross-sector risk transfers, largely as a result of insurers' (mainly global reinsurers and specialist monoline insurers) increased participation in markets for credit risk transfer. Concern has been expressed about possible arbitrage of regulatory capital requirements across sectors. Studies of credit risk and other cross-sector risk transfers by the Financial Services Authority (2002), the International Association of Insurance Supervisors (2003), and the Committee on the Global Financial System (2003) suggest no cause

for alarm, but the general issues suggest possible advantages of centralized regulatory authority over different types of financial firms.[33]

It is unclear how any of these issues will be resolved in the near term and whether they will ultimately give rise to substantially different regulatory structures in the U.S. and abroad. Prudent resolution of the appropriate degree of regulatory harmonization, centralization, and scope of regulatory authority would pay close attention to differences in market discipline across sectors. It would not undermine market discipline by applying banking type guarantees and regulation to sectors with less systemic risk and greater market discipline. It would recognize the basic tradeoff between market discipline and the optimal degree of regulatory stringency.

V. Conclusions

If economically efficient regulation is the goal, capital standards and regulatory supervision should be less stringent for sectors characterized by greater market discipline and less systemic risk. Market discipline is greater and systemic risk is lower for insurance than for banking: capital requirements should be less stringent for insurers. Because market discipline is greater for reinsurance than for direct insurance, capital requirements and related regulation need not be as stringent for reinsurers as for direct insurers. The relative stringency of capital requirements for insurers and reinsurers in the U.S. and the E.U. is by and large consistent with significant market discipline.

Any federal regulation of insurers in the U.S., harmonization of reinsurance regulation in the E.U. and internationally, and changes in the centralization and scope of regulatory authority over different financial activities should evolve under full appreciation of limited systemic risk and significant market discipline in insurance and avoid undermining that discipline. Even if appropriate in banking, extension of the Basle framework to insurance and reinsurance would be ill advised. Relatively simple capital requirements for insurers and reinsurers are a virtue; stringency

[33] Borio (2003) discusses possible advantages of a macro approach to prudential regulation versus the traditional micro (sector specific) approach.

is a vice. Complexity with little stringency is costly but relatively benign. Wise prudential policy would maintain and further promote insurance/reinsurance market discipline, thus obviating the need for intrusive, stringent, and complex capital rules and associated regulatory intervention in private decision-making.

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Appendix

Optimal Capital Standards with Imperfect Risk Assessment

This appendix sketches a simple model between optimal capital standards and the proportion of firms for which incentives would otherwise produce insufficient capital when risk assessment is imperfect. The focus is on the role of capital standards in encouraging some firms to hold more capital than would be true without such standards.

Assume that without capital regulation there would be two types of firms, low risk (L) and high risk (H). The proportion of high-risk firms is α. Each low-risk firm holds the efficient level of capital, defined as the amount of capital that minimizes the sum of the firm's default put value, P_L, and its capital costs, k, where K_L is the amount of capital held and k is the per unit capital cost (due to tax and/or agency costs).[34] Thus, $K_L = K_{Le}$ and $P_L = P_{Le}$, where K_{Le} is the efficient (cost minimizing) level of capital and P_{Le} is the efficient put value for low-risk firms. Also assume for simplicity that each high-risk firm would hold the same amount of capital as low-risk firms, which, given its greater risk, would produce an excessive value for its default put; i.e., $K_H = K_L < K_{He} \Rightarrow P_H > P_{He}$, where K_{He} and P_{He} denote the efficient values of K and P for high-risk firms.

The efficient capital level for firm type i (i = L, H) minimizes the sum of the default put and capital costs:

$$P_i(K_i) + kK_i ,$$

which requires:

$$P_{iK} + k = 0, \qquad (1)$$

where P_{iK} is the derivative of P_i with respect to K_i. K_{ei} equates the marginal benefit from reducing the firm's default put to the marginal cost of holding more capital.

For high-risk firms, total costs are not minimized (the default put is too large) and

$$P_{HK} + k < 0,$$

i.e., high-risk firms could lower costs by holding more capital. If high-risk firms could be identified with perfect accuracy (and with costless enforcement), optimal capital regulation would be trivial: each high-risk firm would be forced to hold $K_{He} > K_L$. Assume instead that (1) high-risk firms can be identified only imperfectly and that (2) all firms classified as high-risk forced to increase capital to $K > K_L$.

Define the Type 1 error rate, π_1, as the probability that a low-risk firm is classified as high risk, and the Type 2 error rate, π_2, as the probability that a high-risk firm is classified as low risk. Then the power to classify a high-risk firm correctly is $1 - \pi_2$. To focus on the issue at hand, π_1 and π_2 are

[34] I assume for simplicity that k is constant and the same for high and low risk firms.

treated as exogenous. A fuller treatment would relax that assumption and incorporate assumptions about the technology and costs of influencing π_1 and π_2.

The benefit from requiring a high-risk firm to hold more capital equals the reduction in its put value less the additional capital cost:

$$P_H(K_L) - P_H(K) - (K - K_L)k > 0.$$

The cost of incorrectly classifying a low-risk firm is the excess of the additional capital cost over the reduction in its put value:

$$(K - K_L)k + P_L(K) - P_L(K_L) > 0.$$

Given this setup, the efficient capital requirement for firms' classified as high-risk maximizes the expected net benefit (the proportion of high-risk firms classified correctly times the associated benefit less the proportion of low-risk firms classified incorrectly times the associated cost):

$$B = \alpha(1-\pi_2)[P_H(K_L) - P_H(K) - (K-K_L)k] - (1-\alpha)\pi_1[(K-K_L)k + P_L(K) - P_L(K_L)].$$

Differentiating B with respect to K gives the first-order condition:

$$B_K = -\alpha(1-\pi_2)[P_{HK} + k] - (1-\alpha)\pi_1[P_{LK} + k] = 0. \qquad (2)$$

This condition equates the marginal expected benefits of reducing put values for correctly classified high-risk firms with the marginal expected costs of requiring incorrectly classified low-risk firms to hold excess capital.

If K is set equal to the amount of capital that minimizes costs for a given high-risk firm, K_{He}, then $P_{HK} + k = 0$ (see expression (1) above) and

$$B_K = -(1-\alpha)\pi_1[P_{LK} + k].$$

Because $P_{LK} + k > 0$ for $K > K_L = K_{Le}$, $B_K < 0$ if $\alpha < 1$, which then implies that K^*, the optimal value of K, is less than K_{He}, the cost minimizing level of K for high risk firms. Thus, *the optimal value of K is less than the value that minimizes costs for a given high-risk firm unless all firms would hold too little capital absent regulation.* Intuitively, errors in classifying firms require a lower capital requirement for firms classified as high risk in order to reduce costs associated with requiring incorrectly classified low-risk firms to hold excess capital.

Equation (2) implicitly defines K^* (the optimal capital requirement for firms classified as high risk). Implicitly differentiating $B_K(K^*)$ with respect to α, π_1, π_2, $P_H(K_L)$, and k (and assuming $B_{KK} < 0$, the sufficient condition for a maximum), it is easy to show that:

1. K^* increases as α (the proportion of high-risk firms) increases;
2. K^* decreases as π_1 (the probability of misclassifying a low-risk firm) increases;
3. K^* increases as $1-\pi_2$ (the power to identify high-risk firms) increases;
4. K^* increases with $P_H(K_L)$ (the default put for high-risk firms that hold K_L) if P_{HK} declines for higher $P_H(K_L)$; and
5. K^* declines as k increases (the per unit cost of holding capital becomes more expensive).

Given 1 and 4, less market discipline (a higher proportion of high-risk firms and higher put values for those firms) implies higher optimal capital requirements.

Table 1

Safety and Soundness Incentives for Banks and Insurers

Issue	Banking	Non-Life Insurance	Life Insurance	Reinsurance
Risk insensitive demand				
Explicit insurance / guarantees	High	Moderate	Moderate	Negligible
Implicit insurance / guarantees	High	Low	Low-moderate	Low
Imperfect information / costly search				
Buyer sophistication	Moderate	Moderate-high	Moderate	High
Entity transparency	Low	Low	Low	Low
Firm-specific assets (franchise value)				
Production (front-end costs)	Moderate	Moderate-high	High	Moderate
Reputation (service quality)	Moderate	Moderate-high	Low-moderate	Moderate
Overall Market Discipline	Low	Moderate-high	Moderate-high	High
Systemic risk				
Risk of large, common shocks	High	Moderate-high	Moderate-high	Moderate-high
Contractual interdependence	High	High	Moderate	High
Risk of pure contagion	High	Low	Moderate	Low
Need for Regulatory Discipline	High	Low	Low-moderate	Lowest

Table 2

Summary of U.S. Risk-Based Capital System

Non-Life Insurer RBC (Effective 1993)		Life Insurer RBC (Effective 1994)	
Risk Category	**Description**	Risk Category	**Description**
R0	Investment in insurance affiliates	C0	Investment in insurance affiliates
R1	Fixed income investment	$C1_f$	Fixed income investment
R2	Equity investment	$C1_e$	Equity investment
R3	Credit risk	C2	Insurance (underwriting) risk
R4	Loss reserve risk	C3	Interest rate risk
R5	Premium and growth risk	C4	Business risk
Authorized Control Level RBC* = ½ [R0 + $(R1^2 + R2^2 + R3^2 + R4^2 + R5^2)^{1/2}$]		Authorized Control Level RBC* = ½ [C0 + $((C1_f + C3)^2 + C1_e^2 + C2^2)^{1/2}$ + C4]	

Ratio of Total Adjusted Capital to Authorized Control Level RBC	**Action**
≥ 200%*	None
150% - 200%	Insurer must submit plan to remedy deficiency
100% - 150%	Insurer plan; regulator can issue corrective orders
70% - 100%	Regulator authorized to take control of insurer
< 70%	Regulatory control is mandatory

Note: The life formula also includes miscellaneous items related to health provider credit risk and health administration expense. A separate RBC system applies to specialty health insurers.

* 200% of Authorized Control Level RBC is known as Company Action Level RBC.

Table 3

Highlights of E.U. Solvency Margin Requirements
(Directives 2002/12/EC and 2002/13/EC; adopted March 5, 2002)

Required solvency margin for non-life insurance is the greater of A or B:

A. [0.18 of Max (gross premiums*, EUR 50m) + 0.16 of Max (gross premiums* – EUR 50m, 0)]
x Max [(net claims* / gross claims*), 0.5]

B. [0.26 of Max (gross claims*, EUR 35m) + 0.23 of Max (gross claims* – EUR 35m, 0)]
x Max [(net claims* / gross claims*), 0.5]

Required solvency margin for basic life insurance is the sum of C and D:

C. [0.04 of mathematical provisions**] x Max [(net provisions / gross provisions), 0.85]

D. [0.03 of gross capital at risk***] x Max [(net capital at risk / gross capital at risk), 0.5]

Note: Max (x, y) denotes the maximum of x or y; "gross" indicates before deduction for reinsurance ceded; "net" indicates after deduction for reinsurance ceded.

* Gross premiums and claims for aviation, general liability, and marine insurance increased by 50%. Claim amounts are 3-year averages.

** "Mathematical provisions" known as "policy reserves" in the U.S.

*** "Capital at risk" known as "net amount of risk" in the U.S.

Table 4

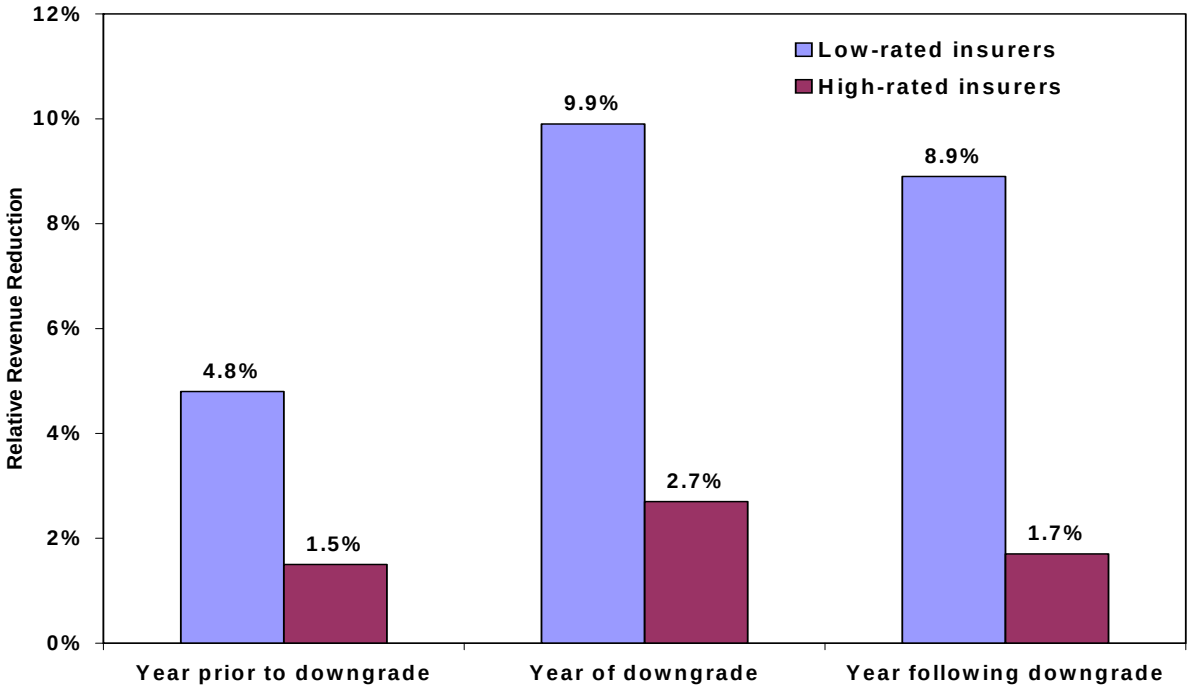
Reinsurer Regulation in the E.U.

Supervision	Germany	France	UK	Nether-lands	Italy	Denmark	Sweden	Spain	Luxem-bourg
License required: domestic			•		•	•	•		•
License required: non-domestic			•		•	•			
Direct supervision	•		•		•	•	•	•	•
Indirect supervision	•	•	•	•		•		•	•
Financials required: domestic	•	•	•	•	•	•	•	•	•
Financials required: non-domestic			•		•				
Solvency margin requirement		pending	•		•				

Note: Domestic professional reinsurers are subject to no supervision in Belgium, Greece, and Ireland.
Source: KPMG Reinsurance Study (2000b).

Figure 1

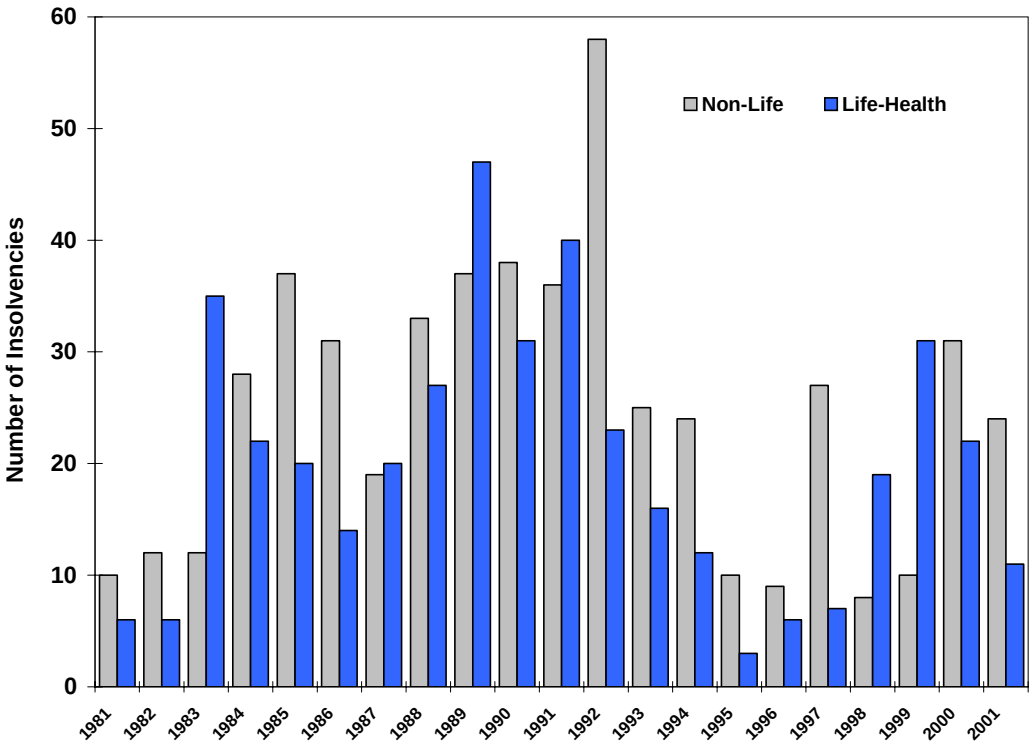
Revenue Reductions for Low-Rated and High-Rated U.S. Non-Life Insurers that were Subsequently Downgraded Relative to Revenue Growth for Non-Life Insurers with No Rating Change
(Low-rated: A.M. Best Rating of B+ or below)
(1991-1996)



Source: Epermanis and Harrington (2001).

Figure 2

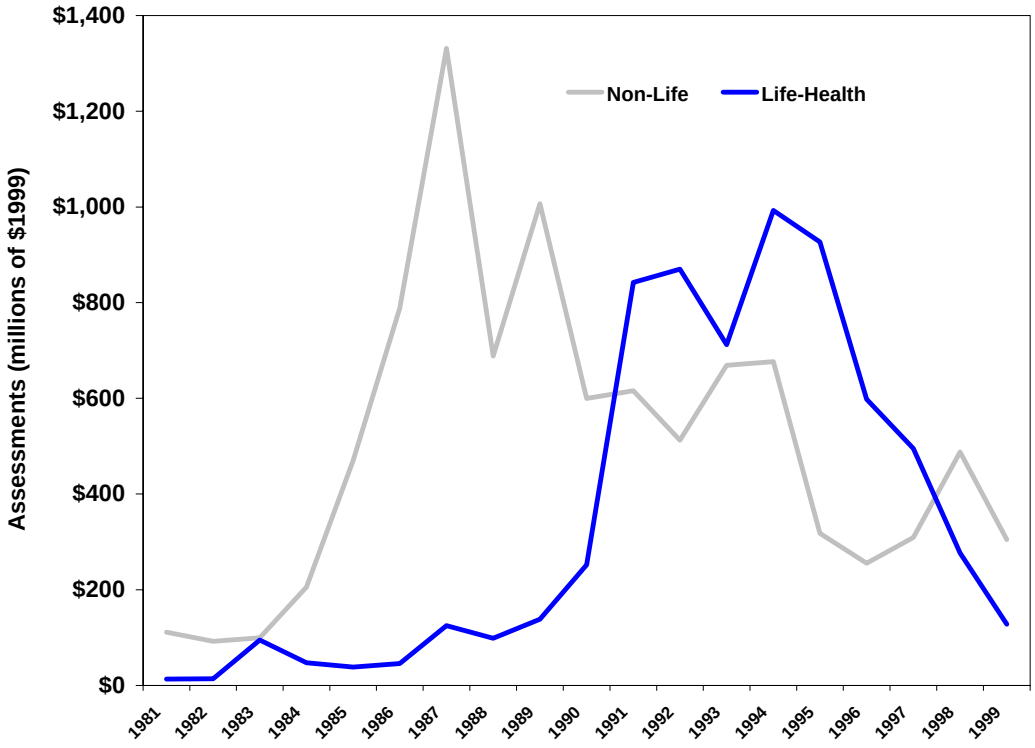
Insurer Insolvency Frequency in the U.S.
(1981-2001)



Sources: NAIC, Standard & Poor's.

Figure 3

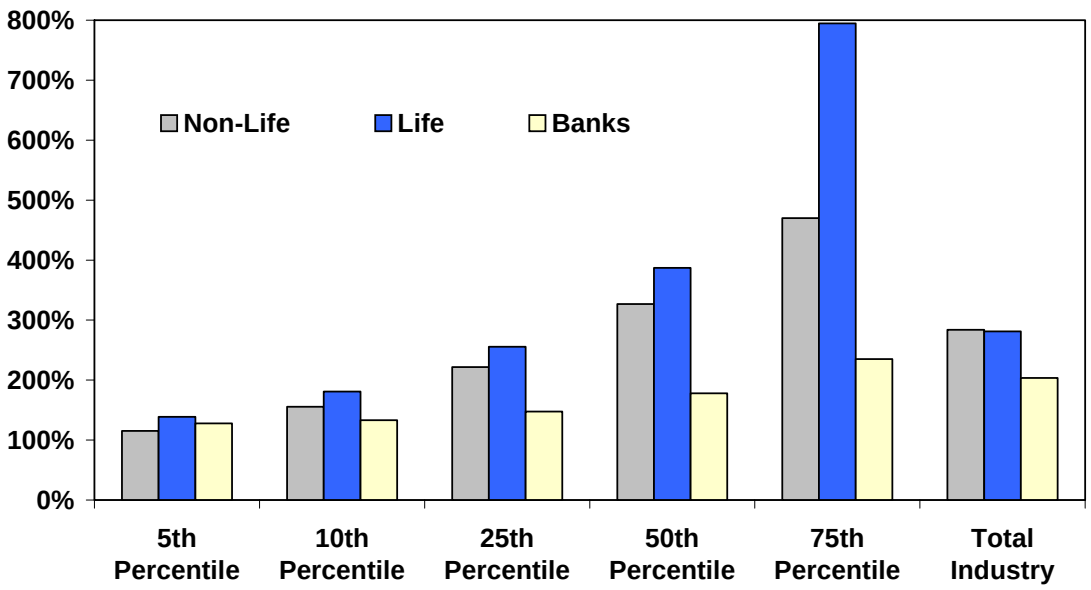
State Insurance Guaranty Fund Assessments in the U.S.
(1981-1999)



Sources: NOLHGA, NCIGF.

Figure 4

RBC Ratios for Non-Life Insurers, Life Insurers, and Banks

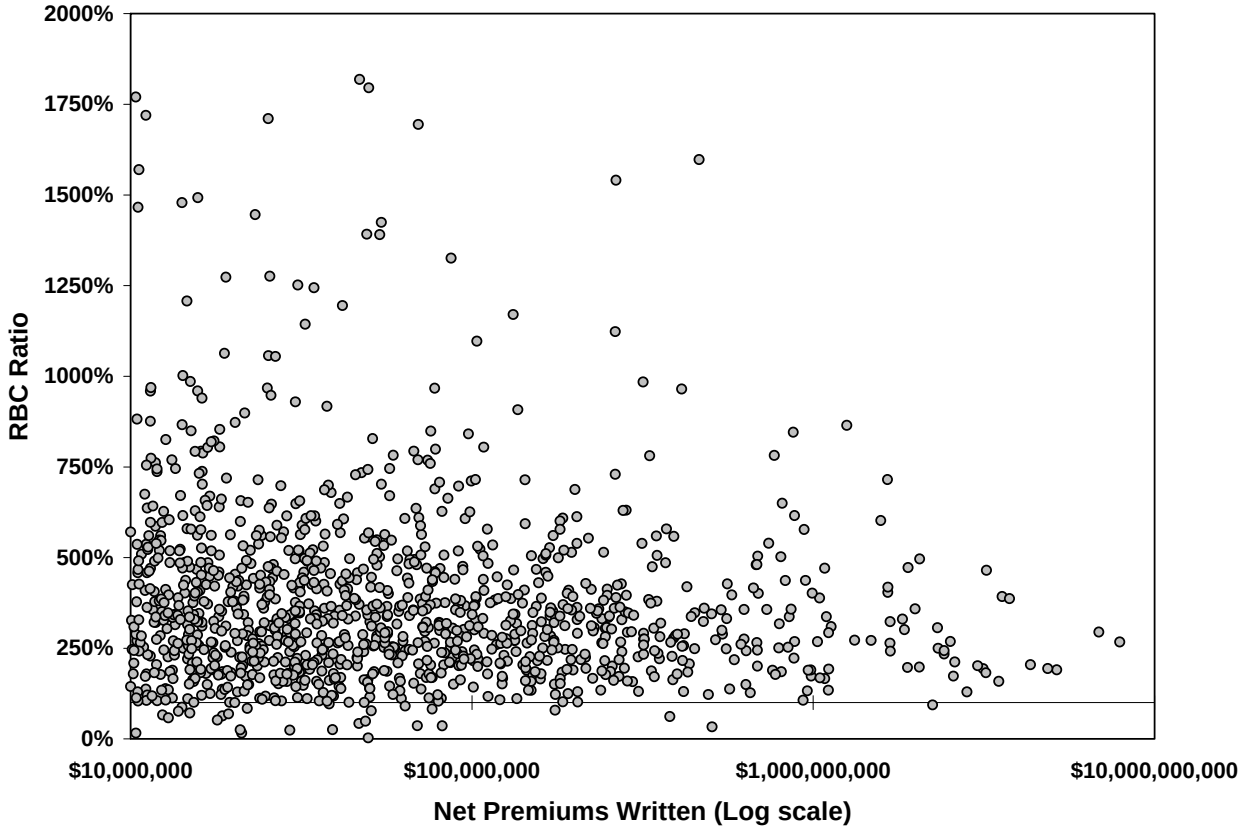


Note: Insurer ratios = Total Adjusted Capital / Company Action Level RBC; Bank ratios = (Total Capital / Risk-Weighted Assets) / 0.08. Bank percentile values for 2001; all other values for 1999.

Sources: NAIC, FDIC.

Figure 5

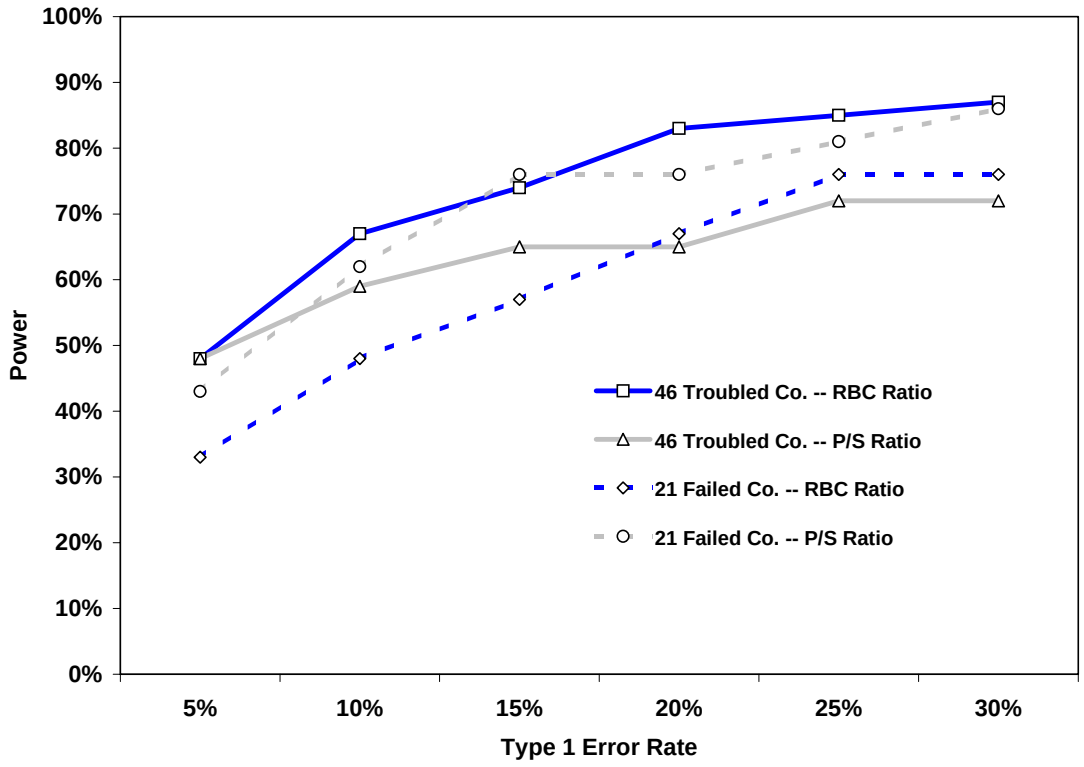
Total Adjusted Capital / Company Action Level RBC
Vs. Premium Volume for U.S. Non-Life Insurers
(1999)



Source: NAIC.

Figure 6

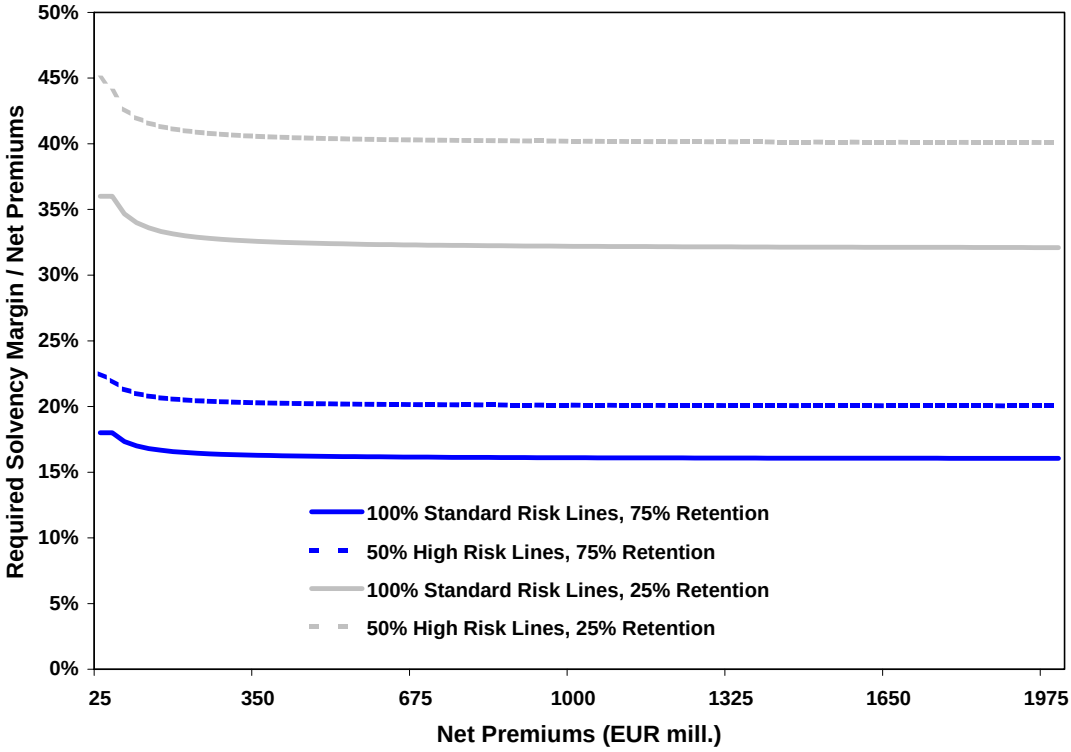
Power of Back-tested Risk-Based Capital Ratios and Surplus to Premium Ratios in 1991 to Identify Insolvent and Troubled Non-Life Insurers during 1992-1994
(Type 1 error rate is the proportion of solvent / non-troubled firms incorrectly categorized.)



Sources: Grace, Harrington, and Klein (1998). NAIC identification of troubled companies.

Figure 7

E.U. Required Solvency Margins as a Percentage of Net Premiums



Note: Calculations assume premium rule (item A in Table 3).

Sources: E.U. Directives. Author's calculations.