Capital Requirements for Entry into Property and Liability Underwriting: An Empirical Examination

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Regulation of insurers has focused primarily on insurer solidity.[1] The concern for solidity centers on safe capitalization requirements for insurers, premium rate adequacy, and investment controls. Although current regulatory concerns frequently address issues of pricing equity and new approaches to risk classification, solidity remains the principal consideration.

Capital adequacy, a key solidity requisite, has generally been addressed from a context of rules-of-thumb and general conservatism. Questions of capital adequacy are relatively complex and analysis of risk theory and finance has been difficult to translate into statutes and difficult for insurance commissioners to incorporate into regulatory practice. Rule-of-thumb analysis, therefore, has held considerable appeal for insurance commissioners.

In recent years, research into the capital adequacy of established insurers has expanded considerably. Aside from the long-standing conceptual contributions of risk theory, advances were stimulated greatly by the linking of portfolio theory to the risk and return analysis of different lines of insurance.[2] The most thorough explanation is the work of Bachman, who employed the optimization features of the portfolio model to estimate minimum capital requirements

[1] Most dimensions of insurance regulation are concerned with insurer solvency. However, solidity is a broader, although less precise, term than solvency and implies a higher standard of surveillance and concern than just solvency alone. The term was first used in the European literature and its acceptance into the U.S. literature on insurer regulation has resulted largely from the writings of Spencer L. Kimball. See, Spencer L. Kimball, "The Purpose of Insurance Regulation: A Preliminary Inquiry in the Theory of Insurance Law." *Minnesota Law Review*, March 1961, especially pp. 478-486.

[2] See J. Robert Ferrari, "A Theoretical Portfolio Selection Approach for Insuring Property and Liability Lines," *Proceedings of the Casualty Actuarial Society*, 1967, pp. 33-54. So far as we can tell, Ferrari was the first to apply the Markowitz portfolio analysis in an insurance underwriting context.

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associated with optimal combinations of insurance lines, grouped in such a way as to minimize the variance or risk of the entire underwriting portfolio.[3] The National Association of Insurance Commissioners has also been active in developing and refining its "Early Warning System," a series of financial tests designed to identify insurers with questionable solidity. Our own work has also explored the application of portfolio theory towards the estimation of capital required for conduct of the underwriting function.[4] Empirical research dealing with the capital required for entry into the various lines of insurance, however, has been sparse.

The purpose of the present paper is to examine empirically the entry capital for nonlife insurers required to conduct the insurance underwriting function, to estimate differences in underwriting risk among insurance lines which can be associated with entry level underwriting activity, and to develop information which enhances the ability of regulators to assess entry risk.[5] The paper first discusses the significance of the entry topic and summarizes current capital requirement statutes. Then, industry-wide data are employed to prepare estimates of the underwriting risk at entry for the interval of the study, 1972-1975. Lines which were consistently of high risk are identified and estimates are made of the maximum ratios of premium volume to capital which can safely be accommodated in each line of insurance. Finally, suggestions are made for improvement of entry capital requirement statutes.

Entry Capital Requirements[6]

Most of the statutes specifying entry capital requirements are straightforward, simply indicating an absolute amount to be met as a condition for licensure. Most were almost certainly formed judgmentally without reference to

[3] James E. Bachman, *Capitalization Requirements for Multiple Line Property-Liability Companies,* Huebner Foundation Monograph No. 6., (Homewood, Illinois: Richard D. Irwin Co., 1978). The bibliography of the monograph provides a thorough listing of publications dealing with insurer financial analysis and also with its links to portfolio theory.

[4] J.D. Hammond and Ned Shilling, "Some Relationships of Portfolio Theory to the Regulation of Insurer Solidity," *Journal of Risk and Insurance,* September 1978; also reprinted by the American Bar Foundation as *Research Contributions of the American Bar Foundation,* 1978, No. 2. Also, a part of the National Science Foundation Study on which the current paper is based examined underwriting capital needs in an empirical, portfolio theory context. Technical Report NSF Grant Apr75-16550 A01, *The Regulation of Insurer Solidity through Capital and Surplus Requirements.* One of the difficulties in application of the theory to underwriting portfolios is that variances of lines of insurance do not remain constant as premium volume changes.

[5] Established insurers generally face a different and probably more stable set of risks than new insurers. The beneficial pooling effects of large numbers are more likely to be present, the expense drain of start-up costs has disappeared, market niches and identities are apt to be present, with survival implying at least some ability to withstand competitive and perhaps regulatory constraints.

[6] Unless otherwise noted, the word capital is used throughout the study to denote both capital and surplus. We are grateful to the National Association of Independent Insurers for supplying a summary of the capital requirement laws of all states. The compilation is complete into 1976.

any formal research techniques. The capital requirements of New York State were enacted in 1939 and have not been appreciably altered since.[7] A recently proposed revision would simply double the requirements of the existing New York law.

Entry capital requirements also reflect some balance between concern over insurer solidity and the marketplace benefits associated with ease of entry. The emphasis is not uniform across states, however. The Insurance Department of Illinois, for example, described the problem:

> The minimum capital and surplus requirements were substantially increased to their present levels in 1971. It is doubtful legislation to require additional capital and surplus . . . One of our major concerns and responsibilities is to encourage competition among insurers. Such competition is largely dependent upon ease of entry into the Illinois market. Excessive or unreasonable statutory capital and surplus requirements would, in the long run, stifle that competition by discouraging the growth of new companies in Illinois.[8]

Illinois requirements for underwriting on a multiple-line basis amount to $1,000,000 of capital and surplus. On the other hand, those of New York specify approximately $6,000,000. Nonetheless, the New York Department states that:

> It is now practically impossible for a new company financed on the minimum basis (required by law) to maintain adequate financial strength and to write sufficient volume to absorb the necessary overhead expenses and leave an underwriting margin after losses. The low amounts presently required by law have permitted the formation of companies which have encountered considerable difficulty in maintaining proper financial strength to meet their commitments.[9]

No more is required to illustrate the varying philosophies among states concerning entry capital requirements.

Market Importance of Entry

In the last 10 years, 390 new property and liability insurers have been formed. The details are shown in Table 1.

Of the 390 new formations, 321 were stock insurers which attracted a total of $709,367,000 from investors.[10]

[7] Insight did not extend to the generally presumed effects of underwriting diversification. To underwrite all lines of property and liability insurance, simply requires, under New York law, the sum of the capital required for each individual line of insurance. That is not true, however, of all statutes.

[8] State of Illinois Department of Insurance, *Financial Regulation of Illinois,* December 1977, p. 49.

[9] Memorandum of the New York State Insurance Department, February 14, 1977.

[10] Estimates of the aggregate capital of the remaining 69 insurers are not conveniently available. Some of these could have been sizable, however, because of the formation of some relatively large physicians' cooperatives in response to market shortages of medical malpractice insurance in the mid-1970s. During this same interval, a few of the large mutual life insurers also established property-liability subsidiaries, contributing substantial amounts of capital in the process.

TABLE 1

Number of New Property and Liability Insurers: 1969 to 1978

Year	Number of New Companies
1969	15
1970	32
1971	34
1972	63
1973	58
1974	35
1975	25
1976	46
1977	38
1978	44
	390

Source: *Best's Review, Property/Casualty Edition,* March 1979, p. 10.

Although the number of new insurers formed in the past 10 years provides an idea of entry magnitude, some important details are obscured. That interval includes the formation of some very important entrants. The Prudential Property and Casualty Insurance Company was incorporated in 1972 and held an initial capital of $1,000,000 and contributed surplus of $4,000,000. Capital was raised to $2,500,000 in 1973 and in 1974, the parent organization contributed $44,000,000 more to surplus. By the end of 1976, its net premium volume was over $300,000,000. The Metropolitan Property and Liability Insurance Company was also formed in 1972, with a paid-in capital of $2,000,000 and contributed surplus of $8,000,000. Its premium volume was $116,000,000 at the end of 1976. Both insurers received over $200,000,000 in surplus contributions in 1976 from their parents. Other insurers also formed new subsidiaries during the 1970s.[11]

Physicians also formed their own medical malpractice insurers during the 1970s. The Medical Insurance Exchange of California, for example, was formed in 1975 with an initial capital of $500,000. At the end of that year, its net premiums written totaled over $5,000,000.[12]

While the entry of large mutual life insurers and medical associations into the property and liability insurance business may be viewed in some sense as unusual and nonrecurring events, it does indicate the impact upon the supply of insurance which new entrants can have. Moreover, the formation of important new insurers continues. The recent formation of the New York Insurance Exchange, although comprised of individual underwriting syndicates, had to meet the entry capital requirements of New York law.[13] It is viewed by many ob-

[11] *Best's Insurance Reports, Property and Casualty Edition,* 1977, p. 985.

[12] *Ibid.*, p. 532B.

[13] In general, the exchange would be free of traditional forms of rate regulation if its business were confined to larger commercial account business.

servers as a potentially large competitive force in both the domestic and international insurance markets. Other states are also considering appropriate statutes to permit establishment of such insurance exchanges. Also, a relatively recent Colorado statute was designed to facilitate the formation of "captive" insurers.[14] Any change in U.S. tax laws which would permit premiums to such captives to be wholly deductible would almost certainly spur legislative review of capital requirement statutes.[15]

Assessment of current price or supply problems in some areas of insurance may again direct attention towards new entry as a market response. Products liability and insurance coverages for municipalities are two current examples.[16,17]

Summary of Existing Statutes

Statutes affecting entry do not focus exclusively on capital. Insurers may be required to deposit securities with the state, specify plans for conducting business, or certify that management is free of association with insurer failures within the past five years. Nonetheless, the most common statutory requirement and probably the most important from a solidity viewpoint is the condition for licensure that each new insurer possess and maintain prescribed amounts of capital and surplus. The requirements are sometimes so low as to constitute only a nominal barrier to entry and provide little support for the solidity objective. In other instances, the prescribed capital amounts are more formidable.[18]

[14] In this context, a captive insurer is a wholly owned subsidiary of a non-insurance parent firm. The principal and frequently sole purpose of the captive is to insure some or all of the risks of the parent firm. Most captives are domiciled in Bermuda where entry capital requirements are quite modest. Observers estimate that about 700 to 800 such captives are domiciled in Bermuda.

[15] The interest in ease of entry would likely dominate discussions of safety because the insurers' policyholder is a corporate parent and not a member of the public. Legislation can take on several concerns, however, and one is a possible requirement for captives to write at least some "public" insurance, in which case concerns again focus on solidity.

[16] Because underwriting returns in most lines of insurance are cyclical, an adequate insurance supply is almost certain to deteriorate. If the deterioration is severe, and if the line of insurance is major, corrective legislative and/or market forces usually appear.

[17] For instance, Werner Pfennigstorf of the American Bar Foundation observes that municipalities frequently experience difficulty in obtaining insurance coverage and suggests the development of a mutual insurance organization by municipalities as a possible solution. Capital requirements for entry would again be prominent along with the concerns of balance between solidity and ease of entry. Werner P. Pfennigstorf, "Insurance Mutuals: A Solution to Municipal Risks Coverage," *Risk Management,* September 1978, pp. 12-21.

[18] See Allen L. Mayerson, "Enduring the Solvency of Property and Liability Insurance Companies," *Insurance, Government, and Social Policies,* Herbert S. Denenberg and Spencer L. Kimball, eds. (Homewood, Illinois: Richard D. Irwin Co., 1969), pp. 151-160. Mayerson generally believed capital requirements to be inadequate. See, also, P.L. Joskow, "Cartels, Competition, and Regulation in the Property-Liability Insurance Industry," *The Bell Journal of Economics and Management Science*, Autumn, 1973, pp. 388-391. Joskow generally assesses all entry barriers to be low, including capital requirements. The only exception is the relatively higher promotional costs of new direct writers which are incurred to establish product recognition.

Existing statutes typically specify amounts for both initial capital and initial surplus. The majority of states permit a surplus less than the initial minimum after an insurer has operated for a period of time, five years being common. For example, the California statute requires an initial capital and surplus of $200,000 each for entry into fire insurance. After five years, surplus can be $100,000. The lowered requirement suggests that expenses of established insurers can be met out of operating income and that increasing size (to the extent associated with increasing age of the insurer) may provide greater stability in underwriting experience.

Statutes typically differentiate capital requirements by line of insurance and according to the legal form of insurer. Since mutual insurers issue no capital stock, they are generally expected to begin with more surplus than stock insurers. The typical requirement is to specify that the initial surplus of mutual insurers equal the combined amount of capital and surplus for stock insurers. The same stipulation generally holds for reciprocal and Lloyds' organizations. The vast majority of statutes indicate capital requirements for each separate line of insurance (e.g., fire) or for general groupings of insurance lines such as "property" or "casualty." Those insurers which wish the authority to write any or all forms of nonlife coverages must meet the requirement set by the law for "multiple-line" insurance.

Property vs. Casualty Requirements.

Many statutes do not show insurance lines in detail but rather merge fire and allied coverages into the single designation of "property and liability" coverages and miscellaneous casualty lines into "casualty." Differences in capital requirements for different lines or line groupings presumably reflect regulatory judgments about the relative riskiness of insurance lines: if one line requires more capital than another, a judgment has been made that it is more risky. The most consistent distinctions are between the capital required for writing casualty and that required for writing property (or similarly for writing liability or writing fire). They are shown in Table 2.

The majority of statutes make no distinction between the capital requirements for property or casualty even though lines in the latter category include such troublesome coverages as products liability and professional malpractice. The volatility of these coverages, however, may be too recent to be reflected in existing laws. Only one statute, however, implies that casualty lines are less risky (i.e., require less capital) than property lines and several view casualty lines as riskier than property coverages.

Statutes frequently identify fidelity or surety bonding for separate capital requirements. Statutes sometimes alter casualty capital requirements depending on whether or not surety bonds are to be written. If they are, as part of the casualty license, additional capital is sometimes required. Table 3 summarizes these distinctions by contrasting, as in Table 2, fidelity and surety requirements relative to capital required for transacting a property insurance business.

TABLE 2

Casualty Capital Requirements as a Percentage of Property Capital Requirements

Percentage	Number of States[19]
0.50	1
1.00	24
1.14	1
1.30	1
1.33	5
1.42	1
1.50	5
1.67	1
2.00	2

Source: Compiled from National Association of Independent Insurers Summary.

TABLE 3

Fidelity or Surety Requirements as a Percentage of Property Capital Requirements

Percentage	Number of Statutes[20]
0.50	1
1.00	17
1.14	1
1.25	7
1.33	2
1.42	3
1.50	1
1.67	1
2.33	1
2.40	1
2.50	2

Source: Computed from N.A.I.I. Summary.

[19] The wording of some statutes makes it difficult to determine capital differentiation based on "property" or "casualty" or "fire" or "liability." Totals, therefore, amount to less than 50. These statutes are omitted from the tabulation.

[20] See footnote 19.

In general, fidelity and surety lines require about the same capital as casualty, although some states require more and some require less.

Multiple-Line Requirements.

An interesting and important dimension of capital requirement statutes is the extent to which the diversification effects of multiple-line operation are recognized. If risk is reduced through the writing of several lines of insurance instead of only one, then the capital required for writing several lines should be less than the sum of all individual-line capital requirements. Nearly all statutes reflect presumed diversification benefits, but to varying degrees. Table 4 shows multiple-line requirements as a percentage of the sum of individual-line capital requirements; the lower the percentage, the greater is the recognition of the presumed benefit of underwriting diversification.

Table 5 shows the absolute requirements for multiple-line licensure.

A plurality of states require about one-third the capital for multiple-line activity compared to the aggregate of individual-line requirements. The highest requirement for multiple-line licensure is approximately $6,000,000, while the lowest is $300,000.

TABLE 4

Multiple-Line Capital Requirements as a Percentage of the Sums of Capital Requirements for Individual Lines[21]

Percent of Individual Total	Number of States
less than 10	1
10-19	3
20-29	3
30-39	13
40-49	2
50-59	5
60-69	4
70-79	1
80-89	3
90-99	0
100	4

Source: Compiled from N.A.I.I. Summary.

[21] See footnote 19.

TABLE 5

Capital Requirements for Multiple-Line Licensure

Requirements (000 omitted)	Number of States
$0- 499	3
500- 999	10
1,000-1,499	14
1,500-1,999	8
2,000 and over	3

Source: Compiled from N.A.I.I. Summary.

Judgmental Statutes.

Vermont and Wisconsin allow capital requirements to be set partly at the discretion of the insurance commissioner. These statutes, particularly the Wisconsin law, warrant elaboration.

(1) *Vermont Statute.* The Vermont law for stock insurers reads as follows:

> To qualify for authority to transact the business of insurance, a stock insurer shall possess and thereafter maintain unimpaired paid-in capital of not less than $250,000 and, when first so authorized, shall possess free surplus of not less than $150,000.
>
> *The Commissioner may prescribe additional surplus* if it appears to him that the kind of insurance to be transacted so requires. (emphasis supplied)[22]

The commissioner has the same discretion with respect to mutual insurers.

(2) *Wisconsin Statute.* The Wisconsin statute is more elaborate and requires the proposed insurer to file a business plan with the commissioner as well as allowing the commissioner discretion with respect to initial capital requirements. It reads as follows:

> (1) The commissioner shall specify the minimum capital for a stock corporation or the minimum permanent surplus for a non-assessable mutual being organized under this chapter. It shall be sufficient, in accordance with sound business practice, to provide for the needs of the proposed business, but in no case except a segregated account bearing no risks that are not assumed by the corporation's general account shall it be less than $200,000, nor shall it be more than $2,000,000. In specifying the amount, the commissioner shall take into account all the information in the business plan, the projection supplied under Section 611.13(2)(k), the general economic situation, the reinsurance market available to the proposed corporation, and any other factors relevant to its needs for capital and surplus.

[22] Quote taken from compilation of statutes by National Association of Independent Insurers.

> (2) A corporation organized under this chapter shall have an initial expendable surplus, after payment of all organizational expenses of at least 50% of the minimum capital or minimum permanent surplus specified under sub. (1), or such smaller percentage as the commissioner specifies.[23]

The Wisconsin law goes on to point out the purpose of the statute governing initial capital and surplus requirements.

> The "minimum capital" (for stock corporations) and "minimum permanent surplus" (for mutuals) are intended to provide solidity at the time a new corporation is launched, and for its formative period. The amount needed depends on what the new company intends to do, and it has to be fixed on the basis of the information given to the commissioner at the time of incorporation. It is specified under Section 611.19[24]

The Wisconsin law is similar to the German Insurance Law which calls for new insurance firms to submit a "Geschaftsplan" (business plan) which is obliged to set forth the purpose and organization of the insurer, the territory of its proposed operations, and in particular must state the facts and data intended to show that its future obligations can be continuously met.[25] The business plan specified in the Wisconsin laws is defined to include: the geographical area in which business is to be done in the first five years; types of insurance to be written in the first five years; the proposed marketing methods; to the extent requested by the commissioner, the proposed methods for the establishment of premium rates; and a projection of the anticipated operating results of the insurer at the end of the first five years of operation, based on reasonable assumptions of loss experience, premiums, and other income, operating expenses, and acquisition costs.

Statutory Reference to Premium Volume.

Although the Wisconsin statute allows the Commissioner to consider premium volume by implication (as part of the business plan) in determining capital requirements, the vast majority of statutes prescribe capital requirements only as fixed amounts and without reference to premium volume. The New Mexico law however, is an exception. It requires a fixed amount of capital for the initial authorization to conduct business. Subsequent to authorization, insurers with multiple-line authority must meet additional minimum requirements based upon annual premium volume. The capital-premium volume relationships are specified as follows:

Premium Volume	*Capital*
$ 0 – 10,000,000	$300,000
10 – 25,000,000	$450,000
over 25,000,000	$675,000

[23] Wisconsin Insurance Laws, Section 611.19.
[24] Wisconsin Insurancé Laws, Section 623.11.
[25] Wisconsin Insurance Laws, Section 611.13(2)(k).

The requirements are in addition to the $300,000 for initial authorization which is required for any line designation. Insurance writing less than multiple-line portfolios must meet similar requirements.[26]

Capital Requirements for Entry: Summary and Comment:

Statutes governing capital requirements for new insurers are diverse and amounts of capital required for a given line of insurance vary widely. Statutes differ on whether to differentiate requirements by line of insurance and the extent to which risk diversification is recognized varies widely. Most statutes do not relate capital requirements to premium volume. This diversity reflects, at the least, different judgments on matters of underwriting risk and solidity regulation. It may also reflect a lack of adequate information for the legislative process. The Wisconsin statute in particular places a considerable burden upon regulatory judgment.

Estimates of Underwriting Risk Relevant to Entry

A study for the National Association of Insurance Commissioners held that potential problem insurers could be screened out in part by the establishment of adequate capital and surplus requirements for new insurers.[27] That analysis also identified underwriting losses as a major cause of insolvencies in the past decade, with most of the insolvencies involving smaller insurers.[28] A more recent study by Munch and Smallwood similarly suggests that insolvent insurers are below average size.[29] Their analysis also showed that insolvencies tended to be more common among firms writing automobile insurance and less common among firms writing only commercial lines. Their most robust finding was that insolvencies occur more frequently under inexperienced management.[30]

Data and Methodology

Sample Characteristics: Our analysis rests upon the analysis of underwriting data for nearly the complete universe of property and liability insurers operating

[26] This requirement is similar to the Great Britain Companies Act of 1967 which also relates minimum capital to premium income. If premium income does not exceed £250,000, required capital is £50,000. If premium volume is between £250,000 and £2,500,000, 20 percent of premium income must be held as capital. For premium volume in excess of £2,500,000, capital must be £500,000 plus 10 percent of premium volume in excess of £2,500,000.

[27] McKinsey & Company, "Strengthening the Surveillance System, Final Report to the NAIC," April 1974, as reprinted in the *NAIC Proceedings*, Volume II, 1974, p. 234.

[28] *Ibid*, p. 253.

[29] Patricia Munch and Dennis Smallwood, "Solvency Regulation in the Property/Casualty Insurance Industry," Paper presented at the National Bureau of Economic Research Conference on Public Regulation, Washington, D.C., December 15-17, 1977, p. 42.

[30] *Ibid*, p. 43. New companies, of course, are more likely than established firms to have inexperienced management.

in each line of insurance over the 1972-1975 interval.[31] Specifically, for each line of insurance the study data consist of (1) net premiums earned, (2) net premiums written, and (3) losses and expenses incurred. The number of insurers analyzed for each year, beginning with 1972, was: 979, 998, 1,003, and 1,000. Individual underwriting results in a line of insurance were omitted if annual net premiums written were less than $1,000 or if the experience produced a negative loss or expense ratio. The exclusion of results based on less than $1,000 of premiums was chosen to eliminate a small number of insurers with unusually small retentions and which introduced a source of variability into the data inconsistent with the aims of the study. A negative loss or expense ratio reflects unusual reinsurance transactions and again injects data variation not a part of study objectives. The data do not differentiate on the basis of the legal form of insurers.

Entry Risk Measurement: Capital required for underwriting is directly related to the level of risk associated with the activity undertaken. Underwriting risk, in turn, is directly affected by fluctuations in claim frequency and severity, competition, economic conditions, insurer size,[32] access to the reinsurance market, and any regulatory constraints which might be present. The study of underwriting risk for new insurers is a difficult task which is complicated by the absence of an operating history.

One approach to the study of new insurer capital needs would be to trace the experience of a cohort of new entrants in each line of insurance over a period of time. The problems of changing economic conditions, competition, regulatory philosophies,[33] changing insurer size, and differences in insurance lines entered,[34] make such an approach difficult. Moreover, shifts in societal attitudes can quickly affect both claim frequency and severity. This appears to have been true in various liability lines, particularly products and medical malpractice. These are all familiar problems in time series analysis. Therefore, an industry cross-sectional approach to analysis of the data was chosen, where small premium volumes of existing insurers were used to estimate the underwriting risk for new insurers.[35]

[31] The data were prepared on tape by A.M. Best and Company for the research purposes of the study.

[32] The pooling or large number effects commonly associated with size tend to reduce year-to-year variation in those events which are poolable, such as random fluctuations in the collective value of claims. It does not have the potential to pool out variation resulting from social change, competition, regulatory constraints and the like.

[33] Successive commissioners in a given state may pursue different regulatory philosophies, and differences among commissioners may also exist at any point in time.

[34] Some lines of insurance are not commonly represented in the many cohorts of entrants.

[35] A time-series analysis of the problem, utilizing only the experience of new insurers, would still be helpful. Our approach is not in lieu of that but represents a more convenient starting point for an unresearched area. Observations of the growth patterns for new insurers point strongly to the presence of small premium volume, at least in the first year of operation and sometimes longer. Exceptions have been among physicians' cooperatives entering the medical malpractice line and insurers formed by large corporate parents and provided with an initially large capital, sometimes augmented by transfers soon after formation, and large enough to support a premium volume beyond that usually associated with new insurers.

By including 1972, a year of record underwriting profits, and 1975, a year of record underwriting losses, a focus was provided on well-defined conditions of strong interest to insurance regulators. The nature of underwriting risk under those conditions is described, so that they may serve as guidelines should they again prevail.

The empirical approach is also contrained by the form in which data are conveniently available. Claims and expense data for each line of insurance are reported directly to insurance commissioners on the expense exhibit, a prescribed regulatory form. Data on the actual distribution of individual claim amounts are available only from internal records of insurers and may not be available at all.[36] Therefore, claims and expense data reported on the Insurance Expense Exhibit were employed. These data can easily be reduced to two values widely used in the analysis of underwriting gains and losses. They are:

(1) Loss Ratio: The ratio of losses and loss adjustment expenses incurred to net premiums earned.

(2) Expense Ratio: The ratio of underwriting (nonclaim) expenses incurred to net premiums written.

It is standard practice to add the loss and expense ratios to produce a single measure of underwriting performance known simply as the combined ratio.[37]

For the purpose of this study, underwriting return is measured by the complement of the combined ratio, i.e., 1 − (loss ratio + expense ratio) and risk is measured by the standard deviation of this function. The analysis revolves about the development of the standard deviation of returns to a particular line of insurance across specified size subsets of insurers.

Insurance line designations are those which are required for the Insurance Expense Exhibit. The lines are:

1. Fire
2. Allied Lines
3. Farm
4. Homeowners Multiple-peril
5. Commercial Multiple-peril
6. Ocean Marine
7. Inland Marine
8. Earthquake
9. Group Accident and Health
10. Other Accident and Health

[36] Statutory accounting requirements govern much of the way in which data are maintained and may discourage the transcription and retention of data in alternate forms.

[37] Statutory accounting is a mixture of cash and accrual accounting. Prepaid expenses are not allowed as an asset. Where premium volume is expanding, underwriting gains are slightly understated by the statutory system. Combining the loss and expense ratio is a shorthand approach to estimating underwriting results, taking prepaid expenses into consideration. A combined ratio of 100 percent, for example, means that the underwriting functions (ignoring possible investment gains or losses) essentially broke even.

11. Workers Compensation
12. Liability Other than Auto
13. Private Passenger Auto Liability
14. Commercial Auto Liability
15. Private Passenger Auto Physical Damage
16. Commercial Auto Physical Damage
17. Aircraft
18. Fidelity
19. Surety
20. Glass
21. Burglary and Theft
22. Boiler and Machinery
23. Credit
24. International
25. Reinsurance
26. Miscellaneous
27. All or Total
28. Medical Malpractice[38]

Diverse coverages, such as accounts receivable insurance, mobile home insurance, extra expense insurance, "floater" contracts, and countless others are all submerged among the categories listed above. Therefore, a particular line designation is not necessarily homogeneous across insurers because the offering of such coverages is not consistent across all insurers. Thus, a "line" of insurance may consist of several related coverages.

The cross-sectional measure of risk serves as a good estimate of the underwriting variability for small premium volumes under certain ideal condtions:

(1) The content of a line of insurance is essentially the same for all insurers writing that line. For example, nonautomobile liability written by insurer A encompasses the same period and coverages as for insurer B, C, D, E, etc.[39]
(2) All insurers in a given line have essentially the same underwriting objectives. Variation in underwriting results across insurers represents random departures from a consistent set of objectives and expectations.
(3) Each insurer faces the same regulatory constraints where underwriting variations across insurers are independent of regional differences that may reflect different regulatory patterns.

Insurers may, of course, exhibit different underwriting objectives, attempt to appeal to different markets, write diverse coverages, and operate under vary-

[38] Medical malpractice was added to the Expense Exhibit as a separate line in 1975. Prior to that, it was a part of Liability Other than Auto.

[39] The line "liability other than auto", for example, is identified by the expense exhibit as a separate line. However, it encompasses several different liability lines including products liability and, until 1975, medical malpractice.

ing regulatory constraints. Unfortunately, the nature of available data does not permit consistent identification of such differences among insurers. The results of the analysis, therefore, can approximate underwriting risk and related values but not measure it precisely.[40]

Underwriting Risk Differences among Lines: The Empirical Evidence

The data base of the present study permits direct cross-sectional observations of underwriting risk differences among lines of insurance and among any desired size strata of insurers.

New insurers typically begin operations in one or only a few lines of insurance and premium volume, particularly for a single line, frequently remains below $500,000 for the first year of operation.[41] Accordingly, the data which follow include annual retained premium volumes in each insurance line up to $500,000. The size classifications constructed for such analysis are:

$ 1,000 – $ 99,999
100,000 – 499,999

By presenting underwriting risk differences only for small size classifications, the possible effects of size from the inclusion of larger volumes is greatly reduced.[42] Tables 6 through 9 array underwriting risk differences among lines of insurance for each of the years 1972 through 1975; those lines with lowest risk values begin each array for each year.

This section attempts to identify from the underwriting risk array of Tables 6 through 9 those lines which presented high levels of underwriting risk in each of the four years. The identification problem is somewhat analagous to that of legislators or regulators confronting the same problem. If a line is in fact low risk but is misclassified as high risk, the error is not in conflict with the solvency or solidity regulatory objective. To classify a line as low risk, however, when it is not, does conflict with that objective. Identification, therefore, focuses only on the high-risk classification. Those lines with the highest risk values for the two lowest size classifications are identified for each year. Any such lines are then surveyed for consistency of the high-risk classification across the four year interval.

[40] Some insurers do not even maintain detailed accounts of claim experience for coverages not identified on the expense exhibit. However, if the study were conducted for only the business written within a particular state, the problem of varying regulatory patterns would not exist. It would be relatively easy for state departments of insurance to undertake.

[41] Observation of the total premium volumes of a sample of 80 new insurers generally confirms that premium volume usually remains below $500,000 through the first year of operation and frequently through the first two years. Where volume is in excess of that, it appears to be clearly associated with capital contributions from a parent corporation.

[42] The study data consistently show decreasing risk values to be associated with increasing size classifications. The complete set of data is not shown here but is available from the authors upon request. A paper on underwriting-size effects is being prepared separately.

TABLE 6

1972 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

Net Premium Volume			
$1,000 – 99,999		$100,000 – 499,999	
1. Earthquake	0.0000 (0)	Earthquake	0.0000 (0)
2. Glass	0.2520 (288)	Burglary and Theft	0.1510 (72)
3. Group A & H	0.3250 (45)	Glass	0.1550 (47)
4. Commercial Mult. Peril	0.3580 (159)	Farm	0.1830 (8)
5. Allied Lines	0.3660 (199)	Fire	0.2180 (211)
6. Pvt. Pass. Auto. Phys. Dmge.	0.3800 (70)	Homeowners Mult. Peril	0.2200 (145)
7. Credit	0.3810 (47)	Pvt. Pass. Auto. Phys. Dmge.	0.2270 (129)
8. Farm	0.4000 (11)	Inland Marine	0.2290 (167)
9. Burglary and Theft	0.4140 (277)	Commercial Auto. Phys. Dmge.	0.2290 (145)
10. Ocean Marine	0.4220 (55)	Allied Lines	0.2390 (211)
11. Commercial Auto. Phys. Dmge.	0.4330 (176)	Fidelty	0.2650 (27)
12. Fire	0.4400 (102)	Air	0.2770 (26)
13. Other Accident and Health	0.4750 (66)	Credit	0.3110 (27)
14. Homeowners Mult. Peril	0.6450 (72)	Other Accident and Health	0.3230 (45)
15. Workers Comp.	0.8230 (60)	Commercial Mult. Peril	0.3310 (113)
16. Inland Marine	0.8270 (284)	Commercial Auto. Liab.	0.3390 (125)
17. Air	0.8370 (54)	Group A and H	0.4300 (38)
18. Fidelity	0.9770 (104)	Ocean Marine	0.4650 (39)
19. Boiler and Machinery	1.1590 (58)	Liab. Other Than Auto.	0.4730 (177)
20. Liab.	1.6070 (95)	Workers Comp.	0.4790 (88)
21. Liab. Other Than Auto.	2.5890 (177)	Pvt. Pass. Auto. Liab.	0.6060 (77)
22. Pvt. Pass. Auto. Liab.	2.6890 (51)	Boiler and Machinery	0.6770 (13)
23. Surety	5.6310 (73)	Surety	1.4150 (58)
24. All Lines	0.9660 (27)	All Lines	0.3450 (69)

TABLE 7

1973 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

	Net Premium Volume			
	$1,000 – 99,999		$100,000 – 499,999	
1.	Group A & H	0.1800 (40)	Burglary and Theft	0.1830 (79)
2.	Credit	0.2450 (42)	Other Accident and Health	0.1970 (39)
3.	Glass	0.3100 (298)	Glass	0.2100 (43)
4.	Commercial Multi. Peril	0.3900 (147)	Boiler and Machinery	0.2270 (16)
5.	Inland Marine	0.4010 (271)	Farm	0.2290 (52)
6.	Commercial Auto. Phys. Dmge.	0.4560 (178)	Pvt. Pass. Auto. Phys. Dmge.	0.2310 (128)
7.	Pvt. Pass. Auto. Phys. Dmge.	0.5330 (77)	Allied Lines	0.2470 (211)
8.	Fire	0.5840 (107)	Homeowners Multi. Peril	0.2480 (142)
9.	Burglary and Theft	0.6210 (264)	Commercial Multi. Peril	0.2620 (133)
10.	Liab. Other Than Auto	0.6270 (166)	Inland Marine	0.2660 (195)
11.	Commercial Auto. Liab.	0.6540 (100)	Workers Comp.	0.2730 (84)
12.	Other Accident and Health	0.6770 (64)	Commercial Auto. Phys. Dmge.	0.2970 (155)
13.	Farm	0.7150 (90)	Pvt. Pass. Auto. Liab.	0.3160 (74)
14.	Allied Lines	0.7490 (205)	Credit	0.3580 (17)
15.	Earthquake	0.7840 (60)	Fidelity	0.3870 (30)
16.	Surety	0.8460 (76)	Commercial Auto. Liab.	0.3910 (143)
17.	Ocean Marine	0.8850 (70)	Liab. Other Than Auto.	0.4140 (179)
18.	Fidelity	0.9000 (97)	Air	0.4280 (41)
19.	Homeowners Multi. Peril	0.9130 (92)	Group A and H	0.4350 (41)
20.	Workers Comp.	1.1220 (70)	Earthquake	0.4540 (23)
21.	Air	1.2560 (58)	Ocean Marine	0.5150 (42)
22.	Pvt. Pass. Auto. Liab.	1.3120 (64)	Surety	0.9730 (57)
23.	Boiler and Machinery	2.4770 (49)	Fire	3.5660 (226)
24.	All Lines	0.6350 (22)	All Lines	5.4380 (56)

TABLE 8

1974 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

Net Premium Volume			
$1,000 – 99,999		$100,000 – 499,999	
1. Glass	0.2800 (301)	Group A and H	0.1590 (41)
2. Earthquake	0.3760 (60)	Glass	0.1770 (37)
3. Other Accident and Health	0.4100 (65)	Other Accident and Health	0.2160 (43)
4. Ocean Marine	0.4670 (65)	Earthquake	0.2320 (28)
5. Pvt. Pass. Auto. Phys. Dmge.	0.4980 (87)	Pvt. Pass. Auto. Phys. Dmge.	0.2790 (130)
6. Burglary and Theft	0.5910 (270)	Burglary and Theft	0.2960 (81)
7. Allied Lines	0.6010 (216)	Commercial Multi. Peril	0.2980 (126)
8. Farm	0.6500 (82)	Fire	0.2990 (224)
9. Fire	0.6700 (116)	Farm	0.3040 (61)
10. Air	0.7740 (48)	Commercial Auto. Phys. Dmge.	0.3140 (148)
11. Commercial Multi. Peril	0.7830 (149)	Allied Lines	0.3380 (214)
12. Fidelity	0.8370 (109)	Inland Marine	0.3580 (192)
13. Surety	0.9760 (86)	Homeowners Multi. Peril	0.3620 (135)
14. Commercial Auto. Liab.	1.0730 (121)	Ocean Marine	0.4570 (61)
15. Commercial Auto. Phys. Dmge.	1.0930 (193)	Boiler and Machinery	0.4640 (22)
16. Pvt. Pass. Auto. Liab.	1.1540 (70)	Fidelity	0.4800 (32)
17. Group A and H	1.1960 (46)	Workers Comp.	0.4910 (72)
18. Inland Marine	1.2810 (257)	Pvt. Pass. Auto. Liab.	0.4910 (73)
19. Homeowners Multi. Peril	1.4330 (101)	Commercial Auto. Liab.	0.5210 (142)
20. Credit	2.3000 (42)	Liability Other Than Auto	0.5900 (186)
21. Workers Comp.	2.3670 (88)	Air	0.8260 (46)
22. Boiler and Machinery	2.4910 (53)	Surety	0.9080 (62)
23. Liability Other Than Auto	13.6530 (167)	Credit	0.9200 (24)
24. All Lines	2.5980 (17)	All Lines	0.3150 (61)

TABLE 9

1975 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

	Net Premium Volume			
	$1,000 – 99,999		$100,000 – 499,999	
1.	Earthquake	0.2770 (70)	Glass	0.1870 (35)
2.	Glass	0.3320 (286)	Farm	0.2920 (63)
3.	Credit	0.3800 (34)	Fire	0.2970 (215)
4.	Fidelity	0.4520 (99)	Earthquake	0.2970 (25)
5.	Allied Lines	0.4700 (209)	Commercial Auto. Phys. Dmge.	0.3130 (157)
6.	Homeowners Multi. Peril	0.5070 (87)	Other Accident and Health	0.3150 (40)
7.	Farm	0.5440 (86)	Pvt. Pass. Auto. Phys. Dmge.	0.3200 (135)
8.	Commercial Auto. Liab.	0.5600 (106)	Allied Lines	0.3310 (213)
9.	Burlary and Theft	0.6120 (268)	Boiler and Machinery	0.3320 (26)
10.	Pvt. Pass. Auto. Phys. Dmge.	0.6160 (74)	Homeowners Multi. Peril	0.3490 (135)
11.	Group A and H	0.7740 (46)	Burglary and Theft	0.4080 (78)
12.	Liability Other Than Auto	0.8060 (167)	Inland Marine	0.4190 (186)
13.	Air	0.8560 (44)	Commercial Auto. Liab.	0.4630 (134)
14.	Commercial Auto. Phys. Dmge.	0.8690 (187)	Group A and H	0.4770 (36)
15.	Inland Marine	0.8770 (244)	Air	0.5410 (57)
16.	Pvt. Pass. Auto. Liab.	0.8780 (47)	Liability Other Than Auto.	0.5530 (168)
17.	Commercial Multi. Peril	1.0530 (112)	Ocean Marine	0.5530 (52)
18.	Surety	1.1000 (86)	Pvt. Pass. Auto. Liab.	0.6360 (84)
19.	Fire	1.1300 (115)	Workers Comp.	0.6830 (76)
20.	Ocean Marine	1.2900 (55)	Fidelity	0.7240 (42)
21.	Other Accident and Health	1.3050 (70)	Surety	0.8000 (50)
22.	Boiler and Macheriny	1.6360 (53)	Medical Malpractice	0.8100 (33)
23.	Medical Malpractice	5.3900 (22)	Credit	0.8820 (24)
24.	Workers Comp.	9.3000 (60)	Commercial Multi Peril	1.2430 (151)
25.	All Lines	0.3400 (10)	All Lines	0.9730 (69)

There are 24 principal lines of insurance identified on the expense exhibit.[43] The eight lines exhibiting the highest underwriting risk values were classified as high or possibly high risk, depending upon whether they appear among the top eight in both of the size categories. Specifically, the judgmental criteria used for such identification were as follows:

(1) If a line is among the eight most risky lines in both of the size classifications, it is classified as high risk.
(2) If a line is among the eight most risky lines in either of the smallest size classifications, it is classified as possibly high risk.

The classification of a line as either high risk or possibly high risk in a given year may not be significant. Assume, for example, that in any given year each line has an equal opportunity to fall within the high-risk category. Under that condition, the probability that a line would be in the high-risk grouping would be 1/9 or 0.111. The probability that a line would be in the possibly high-risk category is 4/9 or 0.444[44] The appearance of any line in a single year as high risk or possibly high risk need not, therefore, be surprising.

The classifications, of course, apply only to the years under observation. Table 10 identifies those lines judged as high risk or possibly high risk.

If a line remained in the high-risk classification over the entire four-year interval, that would offer improved affirmation of its high-risk status. Also, if a line appeared as either high risk or possibly high risk in each of the four years, that too would be further affirmation of its high-risk potential. These kinds of observations are summarized in Table. 11.

As indicated previously, if it is assumed that each line has an equal chance of being identified as high or possibly high risk in a given year, the probability is relatively high that it will occupy one of these classifications. Should it remain in either of those groupings for every year of the study, however, it would lend considerable credence to the hypothesis that a given line is, in fact, risky. Again, assume that the underwriting risk value of a given line is a random variable, independent and identically distributed with equal probability of being in any risk category. Under these conditions, the chance that a particular line will remain in the high-risk category over the four years is $(1/9)^4$ or 0.00015; for three of the four years $32/9^4$ or 0.0049; and for two of the four years $384/9^4$ or 0.05853.[45] Similarly, the probability of being in either but not both, the high-

[43] International, miscellaneous, and reinsurance are not included in the presentation. Although they are a part of the data, they do not represent well-defined loss exposures and have little, if any, relevance to capital statutes dealing with entry.

[44] The probability of falling into the high-risk grouping is 1/3 for each of the two small-size categories, so that the probability of the joint occurrence is 1/3 x 1/3 = 1/9. The probability of falling in only the possibly high-risk grouping is 2/9 + 2/9 − 0 = 4/9.

[45] The probability that a line will be a high-risk line for n of the four years is:

$$\binom{4}{n} \left(\frac{1}{9}\right)^n \left(\frac{8}{9}\right)^{4-n}$$

TABLE 10

Lines Developing High Cross-Sectional Risk Values: 1972-1975

1972		1973		1974		1975	
High Risk	Possibly High Risk	High Risk	Possibly High Risk	High Risk	Possibly High Risk	High Risk	Possibly High Risk
–Surety	–Fidelity	–Air	–Boiler and Machinery	–Liability Other Than Automobile	–Boiler and Machinery	–Workers Compensation	–Boiler and Machinery
–Private Passenger Automobile Liability	–Air	–Ocean Marine	–Private Passenger Automobile	–Workers Compensation	–Homeowners	–Medical Malpractice	–Other Accident and Health
–Liability Other Than Automobile	–Inland Marine	–Surety	–Workers Compensation	–Credit	–Inland Marine	–Ocean Marine	–Fire
–Commercial Automobile Liability	–Workers Compensation		–Homeowners	–Private Passenter Automobile Liability	–Group Accident and Health	–Surety	–Private Passenger Automobile Liability
–Boiler and Machinery	–Ocean Marine		–Fidelity		–Fidelity	–Commercial Multiple Peril	–Credit
	–Group Accident and Health		–Commercial Automobile Liability		–Commercial Automobile Liability		
			–Liability Other Than Automobile		–Air		
			–Group Accident and Health		–Surety		
			–Earthquake				
			–Fire				

TABLE 11

High Risk Classification Consistency Across
1972-1975 Interval for Small Premium Volumes

Number of Years Appearing as High Risk				Number of Years Appearing as Either High Risk or Possibly High Risk			
ONE	TWO	THREE	FOUR	ONE	TWO	THREE	FOUR
–Commercial Automobile Liability –Boiler and Machinery –Air –Credit –Medical Malpractice –Commercial Multiple Peril	–Private Passenger Automobile Liability –Liability Other Than Automobile –Ocean Marine –Workers Compensation	–Surety	–	–Earthquake –Medical Malpractice –Commercial Multiple Peril –Other Accident and Health	–Inland Marine –Fire –Credit –Homeowners Multiple Peril	–Fidelity –Air –Ocean Marine –Group Accident and Health –Boiler and Machinery –Commercial Automobile Liability –Liability Other Than Automobile	–Workers Compensation –Private Passenger Automobile Liability –Surety

isk and the possibly high-risk classification in all four years is 0.0951 and in hree of the four years is 0.2024.[46]

Three lines appeared in either the high- or possibly high-risk categories over he four years: workers compensation, private passenger auto liability, and surety. While no line appeared as high risk for four years, surety appeared for hree, thereby strongly suggesting it to be, in fact, high risk. Private passenger uto liability, liability other than auto, workers compensation, and ocean marine ppeared as high risk for two years.[47]

Risk classification was also performed for premium volume up $1,000,000 by adding a third size class of $500,000 – $999,999. The number of lines identified as high- or possibly high-risk was fewer. However, surety again continued in one of these categories in at least one of the three size groupings in each of the four years. Similarly, liability other than auto continued for three years.

Cross-sectional risk values for small premium volumes provide a basis for developing hypotheses and supplementing regulatory judgment regarding initial capital requirements among lines. The data may be especially useful to Wisconsin-type statutes which allow regulatory discretion in establishment of initial capital amounts and for revisions of statutes specifying fixed capital amounts for entry into various insurance lines.

While the classification scheme for determining high-risk and potentially high-risk classes may also be used to identify low-risk counterparts, it is important to note again the consequences of misclassification error. If a line is classified as high risk when it is not, the consequence is over-capitalization, at least initially. On the other hand, misclassification of a line as low risk could lead to insolvency. Until more data are available, prudence is required in the identification of low-risk lines from the study data.

Some lines did appear to be low risk, using the same classification system as before. Glass appeared in the low-risk classification in each of the four years and private passenger automobile physical damage appeared as low risk in three of the four years. Other lines did not develop such consistency. The high-risk classifications of Tables 10 and 11 suggest that the highest capital requirements for entry should be for surety and perhaps for private passenger automobile liability, liability other than automobile (principally products and malpractice), ocean marine, and workers compensation. These lines developed the most consistent high-risk patterns.[48]

[46] The probability that a line will be in either, but not both, the high-risk and the possibly high-risk classifications in n of the four years is:

$$\sum\sum_{n_1 + n_2 = n} \frac{4!}{n_1!\, n_2!\, (4 - n_1 - n_2)!} \left(\frac{1}{9}\right)^{n_1} \left(\frac{4}{9}\right)^{n_2} \left(\frac{4}{9}\right)^{4 - n_1 - n_2}$$

[47] Liability other than auto would almost certainly have appeared as high risk for three years had not the medical malpractice component of the line been separately identified for the last year, 1975. The latter appeared as high risk for that year.

[48] The experience of the liability other than auto line may change given it no longer includes medical malpractice. It does encompass products liability, however, and that generally remains as a troublesome line.

As noted, automobile physical damage produced lower risk patterns than automobile liability. Statutes specifying entry capital requirements, however, frequently make no such distinction. Statutes do, however, frequently require high capital for entry into the surety lines, a requirement consistent with the empirical observations shown here. Since medical malpractice was identified as a separate line only in 1975, it could have been separately identified only once. Its 1975 risk value and the situation leading to price and supply problems strongly suggest that classification as a high-risk line would be reasonable.

Low-risk lines tend to be those with relatively low catastrophe potential. Both the glass and automobile physical damage risks, for example, are characterized by a well-defined and relatively low maximum loss per insured unit and a relatively small chance of a single occurrence effecting large numbers of exposures simultaneously. On the other hand, risky lines tend to have a higher catastrophic potential. Surety contracts cover diverse loss exposures and aggregate claims can be unpredictable and large. Changing socio-economic conditions and attitudes have elevated the large-loss potential of all liability lines. It is not surprising that private passenger automobile liability and liability other than automobile fall into high-risk groupings (with medical malpractice as well).[49] The workers compensation risk is beset with similar pressures, higher medical care costs and income payments increased by inflationary pressures. Ocean marine is also characterized by a large maximum loss potential.

Capital and Premium Volume

Statutory capital requirements typically make no reference to new insurer premium volumes. Yet, the adequacy of any capital amount can be judged only in reference to the premium volume which may be associated with it. Premiums are approximately the expected value of future losses and expenses and if actual underwriting results always coincided with those expected, there would be no need for a financial cushion to absorb fluctuations in underwriting experience. In the context of underwriting, capital is equivalent to a financial buffer.

The presumed stabilizing effects of large premium volumes suggest that new insurers, to remain at a given level of safety, would be constrained to a smaller ratio of premiums to capital than larger firms. The ratio is not only conceptually important but also continues as one of the key guidelines used by regulators in assessing solvency. Over the years, a premiums-to-capital ratio of 2.0 has been commonly used rule-of-thumb in judging the capital adequacy of all nonlife insurers.[50] The ratio, however, has usually been applied and spoken of without reference to insurer size or to differences in the mix of underwriting portfolio.

[49] The finding is consistent with the Munch and Smallwood findings that insolvency tended to be greatest among firms writing automobile insurance. Munch and Smallwood, p. 42.

[50] The 2.0 ratio is usually referred to as the "Kenney Rule": that an insurer's premium volume should not normally exceed 200 percent of its capital and surplus. The Early Warning System of the National Association of Insurance Commissions prescribes 3.0 as an upper limit but still without direct reference to size or business mix.

The study data can be employed to estimate maximum ratios of premiums to capital for each line of insurance and for any size classification of insurers. The most straight-forward estimation can be made from a standard statistical formulation resting upon the assumption of normality in the underlying data, in this case, the distribution of the combined loss-and-expense ratio. Specifically:

$$C = P(Z \cdot \sigma_X + X - 1)$$

where: C = capital
X = expected combined ratio
P = estimated premium volume
σ_X = estimated standard deviation of expected combined ratio
Z = value from a normal distribution associated with a selected probability of ruin value.

The formulation was employed in this context a decade ago by Hofflander.[51] His study provided a major empirical insight into the relationship between monoline underwriting variability and maximum ratios of premium to capital.

For purposes of illustration, it is assumed that the highest probability of ruin acceptable to regulators is 0.001 ($Z = 3.09$). For example, if the data for a given line indicate an average combined ratio of 0.99 with a standard deviation of 0.05, the maximum premiums-to-surplus ratio for that line would be estimated as follows:

$$C = 100\,(3.09 \times 0.05 - 0.01)$$

C = \$14.45 for every \$100 of premiums or an estimated permissible ratio of 6.92.

In the above illustration, the combination of profitable and reasonably stable underwriting results produced a relatively high ratio of premiums to surplus.

Table 12 shows the maximum premiums to capital ratios that an insurer could have written, under the assumptions noted, in only one line of insurance and not have exceeded a ruin probability of 0.001. The values, therefore, do not reflect possible balancing effects from writing more than a single line. Only in the values shown for all lines combined is there any indication of the direction and extent of possible diversification effects.

Size difference observations from Table 12 are confined to the two smallest premium volume classes (\$1,000 to \$99,999 and \$100,000 to \$499,999) and to

[51] Alfred E. Hofflander, "Minimum Capital and Surplus Requirements for Multiple Line Insurance Companies: A New Approach," *Insurance, Government, and Social Policy: Studies in Insurance Regulations,* edited by Spencer L. Kimball and Herbert S. Denenberg, S.S. Huebner Foundation for Insurance Education (Homewood, Illinois: Richard D. Irwin Co., 1969). See pp. 80-88 in particular. Hofflander, however, did not attempt to differentiate the ratios on the basis of different size classifications. His work did draw attention to the problem of using arbitrary ratios to assess insurer solidity and capital adequacy.

TABLE 12

Maximum Premiums-to-Capital Ratios for Monoline Underwriting and Selected Line Groupings; For Small Premium Volume and All Insurers Combined, 1972-1975

Line	1972			1973			1974			1975		
	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All
1. Fire	0.79	1.84	8.68	0.55	0.09	0.61	0.46	1.06	2.73	0.28	1.11	2.65
2. Allied Lines	1.12	2.23	5.25	0.46	1.86	3.57	0.53	1.00	1.73	0.71	1.06	2.15
3. Farm	0.80	2.35	3.10	0.44	1.41	2.09	0.44	0.94	1.31	0.55	0.96	1.49
4. Homeowners Peril	0.48	1.57	5.29	0.33	1.28	4.79	0.20	0.78	2.07	0.55	0.80	2.37
5. Com. Mult. Peril	1.14	1.17	6.60	0.97	1.63	5.04	0.42	1.24	2.58	0.31	0.26	1.80
6. Ocean Marine	0.84	0.69	2.57	0.34	0.59	2.15	0.73	0.66	1.99	0.24	0.51	1.40
7. Inland Marine	0.41	1.68	2.47	0.94	1.49	3.26	0.25	0.94	1.96	0.36	0.77	2.12
8. Earthquake	NA	NA	NA	0.48	1.03	0.86	1.48	3.57	4.39	2.97	2.21	5.78
9. Group A & H	1.04	0.76	3.05	1.91	0.72	2.72	0.26	2.21	3.00	0.40	0.66	2.57
10. Other A & H	0.66	1.12	2.77	0.47	1.99	2.41	0.76	1.74	2.08	0.25	1.05	1.82
11. Workers Comp.	0.37	0.69	3.35	0.27	1.28	3.13	0.13	0.62	2.41	0.03	0.45	1.41
12. Liab. Other Than Auto	0.12	0.71	1.09	0.52	0.78	1.32	0.02	0.52	0.43	0.40	0.56	1.02
13. Pvt. Pas. Auto. Liab.	0.11	0.49	3.43	0.22	0.93	3.32	0.26	0.59	2.90	0.33	0.46	2.74
14. Com. Auto. Liab.	0.20	1.03	1.91	0.47	0.80	1.97	0.28	0.61	1.58	0.56	0.67	1.49

15. Pvt. Pas. Auto. P.D.	0.80	1.59	6.93	0.59	1.36	4.01	0.59	1.07	2.01	0.43	0.81	2.03
16. Com. Auto. P.D.	0.78	1.70	4.15	0.72	1.10	3.27	0.29	1.01	1.76	0.36	0.96	1.81
17. Air	0.38	1.21	1.63	0.22	0.64	0.81	0.35	0.33	0.78	0.34	0.49	0.76
18. Fidelity	0.32	1.55	1.81	0.35	0.92	1.63	0.37	0.65	1.24	0.72	0.42	0.92
19. Surety	0.06	0.22	0.69	0.37	0.32	1.35	0.33	0.34	0.66	0.29	0.38	0.64
20. Glass	1.41	2.35	2.04	1.09	1.64	1.85	1.09	1.62	1.69	0.90	1.52	1.32
21. Burg. & Theft	0.88	4.04	3.79	0.54	2.62	2.50	0.56	1.19	1.77	0.52	0.81	1.53
22. Boiler & Mach.	0.24	0.50	1.73	0.13	1.81	1.38	0.12	0.68	1.14	0.19	0.97	1.60
23. Credit	0.88	1.10	0.54	1.32	0.85	0.16	0.13	0.30	0.16	0.96	0.35	0.59
24. Med. Malpractice	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	0.36	0.55
25. All	0.31	0.97	7.20	0.46	0.06	2.68	0.12	0.92	3.20	0.78	0.30	3.15
26. 1+2	1.03	1.86	12.14	0.54	0.10	0.89	0.41	1.19	3.11	0.24	1.06	3.06
27. 1+2+3+4	0.46	1.39	10.90	0.42	0.08	1.29	0.47	0.87	2.84	0.20	0.80	2.95
28. 13+15	0.24	0.95	5.51	0.30	1.07	4.18	0.32	0.94	2.90	0.31	0.91	2.33
29. 14+16	0.21	1.03	2.52	0.67	0.89	2.57	0.42	0.62	1.95	0.54	0.75	1.89
30. 13+14+15+16	0.13	1.14	5.07	0.39	0.98	4.22	0.79	0.87	3.38	0.25	0.76	2.49
31. 1+2+3+4+22	0.46	1.39	10.90	0.42	0.08	1.30	0.47	0.87	2.86	0.20	0.80	2.97
32. 1+2+3+4+12	0.12	0.93	3.57	0.45	0.08	1.32	0.27	0.52	1.76	0.23	0.71	2.28
33. 1+2+3+4+5	0.47	1.31	13.93	0.46	0.08	1.54	0.38	0.84	3.20	0.21	0.71	3.23
34. 11+12+13+14	0.06	0.47	2.64	0.45	0.88	3.22	0.53	0.59	2.41	0.49	0.90	2.38

facilitate comparisons with other insurers, the ratio value calculated from the results of all insurers combined. Size effects are readily apparent. The underwriting experience at small premium volumes consistently develops maximum ratios below those calculated from the experience of all insurers combined. Volumes in excess of $500,000 are consistent with the pattern shown.

Table 12 also shows maximum ratios of premiums to capital for certain selected but standard groupings of insurance lines. The values shown were calculated on the basis of the previously noted assumptions reflecting a ruin probability of 0.001. The data base is the same as for all previous tables and charts.

The premium to capital values are generally consistent with the underwriting variability patterns noted previously. The general decline in the maximum ratios over the 1972-1975 interval reflect the contrast between the profitable and unprofitable years of 1972 and 1975. While it has always been conceptually clear that low combined ratios coupled with stable underwriting can permit premiums-to-capital ratios in excess of those under contrary positions, the extent and magnitude of such differences had not always been clear. Table 12 helps to estimate such differences.[52]

The underwriting experience underlying the small premium volume classifications typically develops maximum ratios well below the 3.0 NAIC Early Warning Value and also the more conservative 2.0 Kenney rule.[53] Private Passenger Auto Liability, Surety, and Liability Other Than Auto developed the lowest ratios at small volumes.

Thus, for insurers just entering a new line of insurance, there would appear to be few if any lines which could accommodate rapid premium growth without commensurate increases in surplus. For example, if the statutory capital requirement for entering private passenger auto liability were $500,000, premium volumes in excess of that amount might raise ruin levels beyond those which regulators were willing to tolerate. A firm which, for example, expected to write $500,000 in private auto liability premiums might reasonably be expected to maintain a capital of at least $500,000 or perhaps considerably more to absorb underwriting fluctuations (assuming that a ruin assumption of 0.001 is reasonable). One of the interesting judgments to be made from the data of Table 12 is the apparent continued relevance of the so-called Kenney rule to the monoline underwriting activities of small insurers. The traditional "two to one" rule may even be optimistic when applied to small premium volumes on a monoline basis, a situation more likely to exist with new insurers than with established ones. Even more dramatic limitations on premium volume or increased capital might be expected of insurers entering the nonautomobile liability field, surety, fidelity and other lines capable of tolerating only modest ratios of premium to capital.

[52] For purposes of comparison, premiums-to-capital ratios were calculated for several size groupings. Consistently similar size effects were observed throughout. Only with credit insurance was higher volume associated with a lower ratio; underwriting variability at higher volumes was relatively high. The line is very cyclical and highly subject to business conditions.

[53] Conversely, the values resulting from the experience at large volumes developed ratios consistently in excess of the 3.0 value. In 1972, a year of record underwriting profit, larger volumes frequently developed values in excess of 2.0 and 3.0 norms.

Insurers entering more than one line at a time might benefit from diversification and experience a more stable underwriting result. Although the cross-sectional data of 1972 through 1975 cannot be used to forecast accurately the underwriting experience of individual insurers, some insights into possible diversification effects can be observed for the permissible premiums-to-capital ratios associated with the line groupings of line 31 through line 39.[54]

The grouped data from Table 12 do not permit clear identification of diversification effects because of the presence of size or pooling effects. Insurers with more than one line of insurance, to remain in the smallest size category, will have small premium volumes in each line thereby injecting a possible increase in variability to go along with the possible decrease associated with diversification. The automobile lines (13, 14, 15 and 16) are grouped to form line 35 which produces a higher premiums-to-capital ratio than for the separate auto liability lines, but lower than for the physical damage lines – a kind of leveling effect. Similar effects appear for other combinations of lines. It is not possible, however, to measure the extent in which such effects are produced by diversification.

Summary and Conclusions

The principal problem in setting capital requirements for entrants is that new insurers have no operating history. Underwriting results, management philosophy, and the impact of economic conditions on capital must be assessed on the basis of collective and not individual underwriting experience. Collective results, however, are usually known only on an aggregate basis, thereby obscuring patterns and variations of relevance to regulatory assessments about capital needs.

The cross-sectional measure of risk employed in this analysis measures the variation in underwriting results across essentially all insurers operating in each line of insurance from 1972 through 1975. It is suggestive of the regulatory uncertainty surrounding the specification of capital for new insurers. Lines which develop highly variable underwriting results produce a greater degree of regulatory uncertainty about operating results than those which do not. It is not unreasonable to think that entry of an insurer into such lines requires more capital than entry into lines or classes of business where uncertainty is less.

Possible Regulatory Applications

The data on underwriting variability should help reduce regulatory uncertainty surrounding capital requirement specifications for new insurers. The most important insights into underwriting risk assessment center upon apparent size-effect problems for new insurers and differences in risk among lines.[55]

[54] Technically, the extent to which an underwriting portfolio or more than one line of insurance produces a more stable underwriting experience depends upon the intercorrelations of underwriting results among insurance lines. The information required to study such relationships is best developed from time series on individual firms. See Bachman, *Capitalization.*

[55] These statements by themselves are not startling. Regulatory statutes, guidelines, and regulations, however, frequently do not recognize these points.

Size. Small premium volumes are clearly associated with high underwriting risk. While the study data do not provide conclusive evidence that the smaller premium volume of a given insurer will produce more variation than higher volumes, they strongly suggest it. The evidence supports the notion that small insurers cannot, from a given capital base, write as much insurance as their larger competitors and still maintain the same level of safety.

The information developed thus provides a reasonable basis for regulatory interest in insurer expectations and market realities about premium volume growth in relation to capital.

Risk Difference among Lines. Existing statutory capital requirements for entry frequently specify different amounts for different lines of insurance. The information developed in the study supports such differential requirements and helps to identify lines of highest risk and therefore likely to require the highest amounts of capital.

For small premium volumes, the lines which exhibited the greatest cross-sectional risk were workers compensation, private passenger automobile liability, and surety. These lines exhibited relatively high variability in each of the four years under review. Lines developing high variability values in three of the four years were: fidelity, air, ocean marine, group accident and health, boiler and machinery, commercial automobile liability, and liability other than auto (the latter including medical malpractice in all of the study years except 1975 as well as product liability).

Changes in Statutes

The study interval is particularly interesting since it included a year of record low combined ratios (1972) as well as a year of record highs (1975). The data generally support regulatory and legislative judgment which implied some lines as risky (e.g., surety, liability), thus requiring the greatest amount of capital for entry.

The smaller premium volumes generally linked with new insurers appear sufficiently associated with high underwriting risk to warrant conservative ratios of premiums to surplus. The Kenney "two-to-one" rule appears optimistic when applied to small premium volumes on a monoline basis.

Nearly all statutes specify a fixed amount of capital for entry into a line or class of insurance. Yet, solvency does not depend on the absolute amount of capital but on the premium volume in relation to capital. The expected premium volume of new insurers, however, is affected by management philosophy, competition, profit, and market growth potential, conditions which may change from one year to the next. These in turn may vary from one line to the next. A statute which imposes only a fixed amount of capital cannot accommodate the different risks associated with different ratios of premiums to capital.

The Wisconsin statute, however, by allowing regulatory discretion in the establishment of entry capital amounts and by requiring premium growth plans from prospective insurers (as part of the business plan), can deal with premiums and capital together. The administration of such a statute is in turn facilitated

by studies of underwriting risk and their continued development over time. It is hoped that the analysis and information generated here will encourage the adoption of statutes modeled after the Wisconsin Code and the continued updating and possible refinement of the data.

Discussion

Robert C. Merton*

The two papers to be discussed, "Risk and Capital Adequacy in Banks" by Sherman Maisel and "Capital Requirements for Entry into Property and Liability Underwriting: An Empirical Examination" by J.D. Hammond and Arnold Shapiro, have much in common. Each paper is a summary of a larger study. Both papers examine concern over the effects of regulation on competition among intermediaries. The regulatory aspect that both focus on is the use of quantitative methods in the establishment of appropriate capital requirements. In measuring risk for the purposes of establishing capital requirements, both papers subscribe to the "portfolio approach" although the specific methodology employed in each paper is somewhat different. Thus, I begin with some general points which apply to the topics and approaches of both papers and leave for the end specific points about each paper.

To put the analysis in these papers in perspective, it is useful to review briefly why adequate capital is an important objective for the regulation of financial intermediaries. Even the most elementary and abstract analysis of an economic system would lead one to expect a widespread demand among individuals for financial instruments which are functionally equivalent to bank deposits and insurance. If they did not exist, then such contracts would have to be invented, and hence, it is not necessary to dwell on why they exist. However, in a somewhat less elementary analysis, it can also be shown that the efficiency with which these contracts perform their function is inversely related to their default risk. The loss in efficiency from default risk is caused by significant increases in both information and transactions costs. For example, the holder of a bank deposit which is known to be free of default risk requires little, if any, other information to understand the properties of the financial instrument he holds. However, once there is a possibility of default, then at a minimum, the holder of the deposit must assess the probability of default and in the event of default, the range of possible amounts that he might recover. Of course, to make such an assessment requires data about the type and size of other liabilities of the bank; the assets held by the bank and their risk; the operating expenses of the bank; and the quality of its management. In addition, these data would have to be analyzed to estimate the relevant probability distribution. Moreover, because

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conditions within the bank change over time, such analyses would be required frequently. In effect, the depositor must become a security analyst.

Even if independent firms evolved to provide such analytical services, the depositor would still be left with the problem of evaluating the evaluators. And in any event, prudence would dictate that he diversify by spreading his deposits among many banks. Given the profile of a typical individual who uses bank deposits and the typical amounts involved per person, the aggregated information and transactions costs caused by significant default risk are substantial. Along the same lines, there is a serious loss in efficiency from default risk on insurance contracts. While to some extent there is also a loss in efficiency from default risk on general goods and services provided to individuals, the case of financial intermediaries is special because to receive the services of an intermediary one must become a liability-holder of the firm for the duration of the services and because the aggregate amount of such "customer" liabilities is a significant fraction of the total value of the firm. Therefore, "customer" liabilities of intermediaries differ from the general liabilities of firms in that resources should be spent to ensure that these customer liabilities are virtually default-free.

To ensure that these obligations to customers are met will in general require a third party to set rules for performance by the intermediaries and to provide surveillance to ensure compliance. It may also require that the third party guarantee the customer liabilities. While it is not essential that this party be a government agency, it is important that the capability and willingness of the third party to meet its obligations be virtually beyond question. Otherwise, a fourth party might be required to ensure the performance of the third one; and a fifth for the fourth; and so on. The resulting "layering" of surveillance and other costs are likely to be inefficient. Further, in the absence of detailed information and analysis, customers (e.g., depositors) may well use the size of the guarantor as a selector for greater safety. This tendency could make it difficult to maintain a competitive structure within which the private sector could provide these services at minimum cost. Of course, lack of competition will still be a problem if a government agency provides this "third party" service. That is, if a government agency provides the service, then the usual market forces which tend to enforce efficient operations on the part of private enterprises will be missing. If the government agency also insures the liabilities (as with deposit insurance), then the absence of a market makes the determination of economically sound insurance premiums especially difficult. Whether or not these services should be provided by the private sector or government agencies is far from a resolved issue in theory. However, as a practical matter, government agencies are deeply involved in these activities, and at least, for large scale intermediation such as in the banking system, the view that they should be is not without foundation.

If a government agency such as the Federal Deposit Insurance Corporation does perform this function, then the information and diversification costs of individual depositors are eliminated. Of course, this does not eliminate all such costs since the agency must incur the costs of monitoring the performance of the intermediaries. While common sense suggests that regulations be set so as to keep these costs to a minimum, there are constraints on the form that these

regulations can take. For example, the cost to FDIC ensuring that deposit obligations are met could be minimized by simply requiring that all member banks hold all their assets in short-term, marketable U.S. government securities. While this solution has at times been suggested, it would clearly eliminate the other important functional role for banks which is to make loans to businesses and individuals. The social cost of eliminating this service would most likely exceed the benefit of reduced costs to FDIC. Thus, the regulations should be chosen so as to minimize the costs of insolvency subject to the constraint that the regulations do not significantly impair the intermediaries' capabilities to perform their functional roles.

While "insolvency" has been defined in a variety of ways, the definition used by Maisel (with some slight modification) is an appropriate one for the purpose of regulation. In the Maisel paper, insolvency of an intermediary is said to occur "when the market value of its liabilities exceeds that of its assets reduced by the costs of bankruptcy." It should be noted that "liabilities" as used by Maisel refer to " 'customer' liabilities" (as I have described them) and not the general liabilities of the intermediary which would include equity. While I applaud his emphasis on "market" rather than "book" values for determining insolvency, his definition has a technical difficulty because the limited-liability feature of equity implies that the *market* value of equity (and hence, net worth) cannot be negative. However, if his definition is modified to read "when the value of its liabilities (to consumers), *computed by assuming that the terms of such obligations would be fully met,* exceeds the market value of its assets reduced by the costs of bankruptcy," then net worth, defined as the difference between the value of assets and the value of liabilities computed in this way, can be negative. Under this definition, negative net worth implies insolvency, and its probability is represented by the shaded area of the probability distribution for net worth as illustrated in Figure 1 of the Maisel paper.

The risk of insolvency will depend upon the volatilities of the intermediary's assets, liabilities, and operating costs. It will also depend upon the frequency with which the intermediary is evaluated by the regulators, and on the amount of capital or assurance money provided by the equityholders of the intermediary. Regulatory restrictions can be imposed on all of these items to reduce the risk of insolvency. However, as discussed earlier, there are limits to the restrictions which can be placed on the volatility of either assets or liabilities without significantly interfering with the functions served by the intermediary. It is for this reason that both papers focus on the establishment of adequate capital requirements. In the case of the insurance industry examined by Hammond and Shapiro, the capital adequacy requirement is indeed the central device for protecting policyholders. For the banking industry where most deposits are insured, the central protection is of course deposit insurance. However, the capital requirement is the central device for protecting the insurer of those deposits (e.g., FDIC or FSLIC). The insurance premium charged by FDIC is also an important control at least in principle. That is, banks with smaller amounts of capital or riskier assets could be charged a higher premium. However, as Maisel points out, FDIC charges all banks the same insurance rate independent of their risk, and therefore, under current practices, this second control is not very effective.

The appropriate capital requirement to meet a specified level of insolvency risk will depend upon the volatility of both the intermediary's assets and its liabilities. Both papers fall short of a complete analysis in this respect because Maisel only studies the volatility of the assets and Hammond and Shapiro only study the volatility of the liabilities and operating costs. However, both papers do stress that it is the riskiness of the portfolio (of assets or liabilities) which is important for establishing capital requirements. While this approach will come as no surprise to students of modern portfolio theory, it is in sharp contrast to the traditional treatment of risk in regulation where the practice is to set risk limits on each individual component of the (asset or liability) portfolio held by the intermediary. As the authors of both papers point out, this traditional approach explicitly neglects the important role diversification plays in the reduction of risk. The analyses presented in the Hammond and Shapiro paper provide empirical evidence of the important benefits from diversification across multiple lines of insurance. Further evidence of the importance of diversification can be found in parallel studies on the regulation of money-management fiduciaries and revisions of the "Prudent Man" rules. And indeed, recent guidelines for ERISA-type pension accounts suggest a move away from the traditional view of setting risk standards for each investment in the account and a move toward replacing these standards with ones applied to the account as a whole.

In both papers, the authors chose to measure risk by variance (or equivalently, standard deviation). This choice raises two questions: Should one use "total" risk or only its "systematic" component as the appropriate measure? If "total" risk is the correct measure, does the variance adequately measure it? In his paper, Maisel discusses both questions and I agree with his answers. On the first, because both papers are concerned with measuring default risk, total risk is the proper measure as has been shown elsewhere.[1] On the second, the answer is less clear. If the dynamics of asset and liability value changes are such that they can reasonably be modeled by diffusion processes, then the variance rate will be an adequate statistic. However, if these dynamics involve radical changes in value over a short period of time, then variance will not be sufficient, and more complex measures such as those associated with either stable or Poisson-directed distributions may be required. While the empirical resolution of this question would be important prior to the implementation of either paper's quantitative methods as a formal part of the regulatory process, the qualitative indications for regulatory change as suggested by either paper would be largely unaffected.

I now turn to the specifics of each paper beginning with Maisel's.

Research in finance theory has produced a number of important quantitative tools for analyzing risk and evaluating insurance premiums. These quantitative methods have been subjected to empirical verification and many have be-

[1] See, for example, R.C. Merton, 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance* 29, pp. 449-70 and 1977, "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees," *Journal of Banking and Finance* 1, pp. 3-11.

come standard operating tools in the (private sector) financial community. I am strongly in agreement with Maisel's central theme that these tools should be employed within the bank regulation and examination system to provide more objective evaluations. Indeed, because government agencies such as FDIC and FSLIC do not have a competitive market providing price data on their type of insurance premiums and because they do not have publicly traded share prices to indicate how the market perceives these agencies' performance, the use of these quantitative tools for making objective evaluations may be more important for these agencies than they would be for a corresponding private-sector firm.

Although the issues raised and analyses presented by Maisel are confined to the banking system and deposit insurance, his contribution has added significance because much of what he has done can be applied with minor modification to other areas of public-sector guarantees. Two such areas of particular importance are government loan guarantees and government guarantees of private pension obligations. Both areas promise to be topics for much future discussion, and the role of quantitative methods in making objective evaluations of the costs and benefits will be at least as important in these areas as it is for the banking system.

The Maisel paper covers most of the important issues. He recognizes that the establishment of "adequate" capital requirements cannot be undertaken without a simultaneous analysis of bank asset risks and the schedule of insurance premiums charged by FDIC. In his section titled "Measuring Capital Adequacy in a Bank," he correctly stresses the importance of using "economic, rather than book or reported capital" in assessing the risk of insolvency. He underscores the empirical significance of this point in the section titled "Measuring Net Worth" where he describes the historically large discrepancies between the market and book values of net worth for large banks. I agree with the conditions he describes for "capital to be adequate" in that section although I would replace his description of a "fair" insurance premium as one that ". . . covers the expected losses of the insurer . . ." with ". . . compensates fully the insurer in terms of ex-ante expected return for the risks borne. . .". The reason for this suggested change is that some of the risk borne by the insurer may be market-related or systematic risk in which case the insurer should be compensated by an expected return in excess of the risk-free rate, and therefore, the premium should cover more than expected losses. It should also be mentioned that the probability of insolvency is not a sufficient measure of the risk of insolvency because it does not capture the magnitudes of the losses in the event that insolvency occurs.

In his analysis of bank asset risk (in "Finding the Risk in a Bank"), Maisel lays out the various categories of risk and their relative importance. By emphasizing broad risk classes, he incorporates the effects of diversification and correctly points out that the important risks are the nondiversifiable ones such as interest rate risk. He also points out the importance of taking into account "off-balance-sheet" liabilities such as credit lines and "stand-by" agreements to purchase mortgages in evaluating the bank's risk position. Since these liabilities are essentially option-type financial contracts, the powerful tools developed in finance theory for pricing options could be especially useful in their evaluation.

In discussing moral hazard risks, Professor Maisel states that "Among banks as a whole, the greatest risks and most common cause of failure are due to fraud, either internal or external, and to insider abuse." As one might expect, these moral hazard risks are more important among smaller banks, and therefore, they may not represent a serious threat to the banking system as a whole. Moreover, while it would be naive not to provide safeguards against such abuses, these abuses often violate the criminal code, and therefore, vigorous enforcement of this code may possibly provide the best protection. However, there is another, far more important, moral hazard problem which Professor Maisel discusses in the section titled "Fair Insurance Premia." Namely, by insuring the deposits, FDIC "induces" the banks to pursue more risky investment strategies. Maisel describes the problem in terms of the current system as "A flaw in the present system lies in the fact that banks may find it profitable to increase their risks, since there is only a slight relationship between risks and their costs of insurance. This can lead to a constant losing battle by regulators to force specific banks to reduce their risks."

To solve this problem, Maisel indicates that a system of variable rates would be feasible. While variable rates based upon differences in risk among banks is preferable to a uniform rate, variable rates alone will not solve the problem. If the rate is set on the basis of an *ex ante* assessment of the bank's risk, then there is still an incentive for the bank to "cheat" by following *ex post*, a more risky investment strategy. To deal with this issue, Maisel suggests that "Adjustments in ratings and charges could be made retrospectively to guard against major shifts in operations." The effectiveness of this method is of course an empirical issue, and it will certainly depend upon the frequency and care with which FDIC monitors the risk position of each bank. However, my belief is that such adjustments will not be adequate. Given the level of premiums currently charged by FDIC, even with some adjustment, the "cost" to a bank from pursuing a riskier investment strategy appears small. Indeed, if a bank "wins" on these riskier investments, then it would probably be more than happy to pay the additional assessment. If it "loses," then how does FDIC collect? While a definitive solution to this problem has not as yet been presented, one possible avenue for exploration would be to replace (or at least supplement) the current practice of annual charges with a large "front-end" entry fee for membership in FDIC. As I have shown elsewhere,[2] this type of charge will reduce (and under some conditions, eliminate) the "FDIC-induced" incentives for a bank to pursue a riskier investment strategy. Of course, like larger initial capital requirements, such charges would make entry into the banking industry more costly, and therefore, may have a negative effect on competition.

In summary, the Maisel paper does not resolve all the theoretical problems involved in bank regulation and deposit insurance. There certainly remain many practical difficulties in developing the "standardized" methods of evaluation and the necessary supporting data to implement the procedures recommended. How-

[2] See R.C. Merton, 1978, "On the Cost of Deposit Insurance When There Are Surveillance Costs," *Journal of Business* 51, pp. 439-452 and especially pages 447-450.

ever, these problems and difficulties can be solved, and I firmly believe that the lines suggested by Maisel are in the right direction toward a vastly improved system.

The Hammond and Shapiro paper on insurance regulation is more narrow in focus than the Maisel paper. Specifically, they concentrate on entry capital requirements for nonlife insurance companies, and their principal contribution is to provide empirical estimates of differences in risks among various insurance lines and to demonstrate the benefits of diversification in multiple-line activities. Their quantitative analyses permit an evaluation of the current "rule-of-thumb" practices in setting entry capital and suggest directions for change in entry capital requirement statutes. In their analysis of the appropriate entry capital requirement, they consider only the underwriting and operating expense risks and not the risks associated with the assets held by the insurance company. For many of the same reasons given in footnote five of their paper, it would appear that the risks of the assets held by fledgling insurance companies should be an integral part of the determination of entry capital. In particular, the relatively small size of new insurance companies' asset bases may make them especially vulnerable to significant risks from insufficient asset diversification.

On the whole, the empirical analysis presented is comprehensive and statistically proper. The use of a combined time series and cross-section analysis of the data is especially to be applauded. However, I have some concern with the use of the combined ratio for the purposes here even though it is the standard practice to use it as the measure of underwriting performance. For example, the authors find that smaller (and therefore, presumably newer) insurance companies have a much larger standard deviation of underwriting performance than do larger (and therefore, presumably more established) companies. It seems to this reader that it would be useful for regulatory purposes to know whether this higher variation was principally due to the expense ratio or the loss ratio. If it were the expense ratio, then do these results suggest greater variation in management skills available to the smaller companies? Or do they suggest that new companies tend to enter into the "tougher" part of the market where expenses are more uncertain? Or are these differences principally the result of accounting "biases" which differentially affect smaller, newer, or faster growing insurance companies but which tell us very little about the relative risks of default between small and large companies? If it were the loss ratio, then do these results suggest that the premiums charged by smaller firms are more variable? Or is it that smaller companies attract riskier customers even within the same insurance line?

By separating the two ratios, the authors can verify that a principal source of greater risk to smaller companies is the lack of diversification among customers within a product line. It is well known that for independent customers of about the same size, the variation in the loss experience should be roughly proportional to one-over-the square root of the number of customers. There is no strong reason to expect that expense ratios should similarly benefit from such customer diversification, and indeed, the expense ratio might even increase.

These comments and questions should not be interpreted as a negative report on the paper. Many of these questions may be answered in their cited

larger study or in the works of others. It is also clear that some of the data required to answer these questions may not be available. Moreover, the use of the combined ratio causes fewer problems for the purpose of distinguishing risk differences among insurance lines, and the analysis presented should be helpful to insurance regulators. However, on the specific regulatory issue of entry capital requirements, an expanded analysis of the risk characteristics of smaller insurance companies would seem to be in order.