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Reinsurance and the management of regulatory ratios and taxes in the property–casualty insurance industry

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Abstract

Reinsurance transactions provide an immediate enhancement to insurers' earnings and equity. The study investigates the use of reinsurance for regulatory and tax purposes. Traditional and financial reinsurance are examined separately, since the latter does not transfer significant insurance risk to reinsurers, and is viewed by regulators primarily as a means for enhancing statutory and financial reports. Both a univariate analysis and a multiple regression analysis support the hypothesis that insurers enter into financial reinsurance transactions to reduce regulatory costs. The results do not support the hypothesis that insurers adjust their reinsurance level as a function of their marginal tax rates.

Key words: Reinsurance; Earnings management; Regulation; Taxes

JEL classification: M4; G22

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1. Introduction

This paper investigates decisions made by property–casualty insurance firms to engage in reinsurance transactions for reporting purposes. Reinsurance has been used primarily for the purpose of risk management (henceforth 'risk reinsurance') by enabling insurers to retain desirable insurance risks while transferring undesirable risks to reinsurers. Reinsurance constitutes a major business activity and an integral part of insurers' business.[1] On average, insurers spend more than 25% of their premium proceeds on the purchase of reinsurance.

Reinsurance transactions provide an *immediate* enhancement to insurers' earnings and equity, generating opportunities for management to meet regulatory, tax, and financial objectives. In recent years, these reporting opportunities have expanded with the emergence of *financial reinsurance* transactions. These transactions transfer *insignificant* insurance risk to reinsurers, challenging the basic concept of reinsurance and leading regulators to question their validity as reinsurance transactions. Retrospective financial reinsurance, the most prevalent form of financial reinsurance, enables insurers to implicitly discount their loss liabilities from future values to present values while recognizing the discount as current income. This immediate enhancement effect hinges on (1) the future-value presentation of loss liabilities on insurers' balance sheets and (2) the classification of funds which are deposited with reinsurers for several years and which accumulate a predetermined investment income as 'retrospective' reinsurance premiums.

The insignificant transfer of insurance risk in retrospective financial reinsurance has led to the recent issuance of SFAS 113, *Accounting and Reporting for Reinsurance of Short-Duration and Long-Duration Contracts.* SFAS 113 directs that, as of fiscal year 1993, retrospective transactions should not be classified as reinsurance, but rather, as investment deposits on insurers' balance sheets. Insurers, opposing the guideline, have argued in favor of the previous reporting practice, suggesting that it corrects a flaw in the accounting system where liabilities are presented in future values rather than present market values. Hence, insurers claim that these transactions enable them to present a balance sheet that better reflects the economic reality of their business and is more relevant to users.

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[1]The insurance enterprise typically revolves around three major transactions. First, coverage is provided to policyholders in return for premiums. Second, those premiums are invested in a portfolio of assets to generate investment income over time. Third, primary insurers use a portion of the original policyholders' premiums to purchase reinsurance from reinsurers in order to manage their underwriting risk.

SFAS 113 refers explicitly to the possible use of reinsurance transactions for purposes other than the transfer of risk:

> An insurance enterprise may purchase reinsurance to reduce exposure to losses from events it has agreed to insure, similar to a direct insurance contract purchased by an individual or noninsurance enterprise. *The insurance enterprise may also contract with a reinsurer to facilitate the writing of contracts larger than those normally accepted*, to obtain or provide assistance in entering new types of business, or *to accomplish tax or regulatory objectives* (italics added).

Following the above assertion, the study seeks to determine whether stock insurers utilize risk and financial reinsurance to reduce regulatory costs and/or to manage taxes. The study focuses exclusively on the regulatory and tax hypotheses for the following reasons. First, regulatory financial ratios and taxable income are both derived from statutory reports that are used as data source in this study. Second, statutory reports may be enhanced by using either financial or risk reinsurance, whereas GAAP reports may be enhanced by financial reinsurance only. Statutory reports, therefore, provide a richer setting in which both risk reinsurance and financial reinsurance can be investigated, separately, as means of enhancement. The statutory setting also enables to examine whether insurers utilize risk reinsurance and financial reinsurance *differently* due to their different cost/benefit implications. Finally, insurers may be reluctant to use financial reinsurance in GAAP reports (for financial reporting purposes); a 'reinsurance' classification may be perceived as a manipulation attempt due to the insignificant transfer of insurance risk, and may consequently trigger law suits and SEC investigations. In contrast, a similar manipulation attempt in statutory reports is likely to trigger only a request to restate the reports.[2]

As opposed to financial reinsurance, which does not transfer significant insurance risk, risk reinsurance generates real risk implications and, at the same time, enhances statutory reports. This provides a unique opportunity to investigate whether companies utilize *real* transactions to achieve regulatory and tax reporting objectives. Since the purchase of traditional reinsurance is influenced by industry- and firm-specific risk factors (e.g., geographic concentration),

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[2]The report issued by the Committee on Energy and Commerce (1990) states: 'When state insurance laws and regulations are violated . . . there is very little apparent investigation and enforcement to punish offenders and act as a deterrent. State regulators do not aggressively look for causes of wrong-doing and gross mismanagement, or issue sanctions and penalties when they are found. State law enforcement authorities also seem lax in persecuting insurance violations . . .' It appears that even though state insurance commissioners have powers to evoke formal liquidation proceedings (see Footnote 10), they typically use these powers only after it becomes apparent that the insurer is insolvent.

managers of insurance firms may utilize such factors to rationalize any specific level of reinsurance when confronted by regulators and tax authorities.[3] In testing the regulatory and tax hypotheses, the study incorporates several risk factors which were previously found to influence the demand for traditional reinsurance. These risk factors control for risk-related purchases of reinsurance, leaving the remaining portion of reinsurance to be potentially explained by the research hypotheses. Another unique feature of risk reinsurance as a tool for statutory-earnings management is that, as opposed to discretionary accruals and other real transactions, the demand for it can be adjusted periodically without being linked to previous levels of reinsurance.[4]

As mentioned previously, the research hypotheses are investigated separately with respect to financial and risk reinsurance. Since the annual reports disclose the volume of reinsurance transactions in total, the paper develops a measure that determines which reinsurance programs are 'financially oriented' (i.e., incorporate a relatively large portion of retrospective financial reinsurance transactions) and which are 'risk-oriented'.

The study builds on the literature of regulatory, tax, and earnings management in both the insurance and banking industries. In the insurance industry, Grace (1990) and Petroni (1992) find that managers of insurance firms use their discretion over the estimates of outstanding claim losses to reduce regulatory costs, minimize tax payments, and smooth fluctuations in reported income. In the banking industry, several studies have found evidence that bank managers adjust loan loss provisions, investment security sales, and other accounting accruals to maintain regulatory capital, taxes, and earnings goals.[5] This paper contributes to this literature by focusing on regulatory and tax management through the use of two unique transactions: financial reinsurance, which essentially classifies investment deposits as retrospective reinsurance, and risk reinsurance, a central business transaction with real economic consequences.

The remainder of the paper is organized as follows. Section 2 provides institutional background on risk reinsurance and financial reinsurance. Section 3 develops the regulatory and tax hypotheses. Section 4 contains sample selection criteria, variable definitions, and descriptive statistics. Section 5 presents the

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[3]Similarly, Holthausen, Larcker, and Sloan (1994) assert that 'the likelihood that a manager's earnings manipulation is detected by altering real decisions is potentially smaller than by manipulating accruals'.

[4]Since insurance and reinsurance policies typically cover one-year periods, the amount of reinsurance purchased in the current year should not affect the amount of reinsurance purchased in the next year. In contrast, earnings management through the use of discretionary accruals is constrained via the reversal of these accruals in successive periods. Similarly, advertising, R&D, and capital expenditures are long-term investment decisions that affect investment decisions in future years.

[5]See for example, Moyer (1990), Scholes, Wilson, and Wolfson (1990), Carey (1994), Chen and Daley (1994), Beatty, Chamberlain, and Magliolo (1995), and Collins, Shackelford, and Wahlen (1995).

empirical results of the univariate and multivariate analyses. Section 6 concludes.

2. Institutional background (see Appendix D for a glossary of insurance terms)

2.1. Traditional (risk) reinsurance

> Reinsurance is an agreement whereby an insurance firm transfers all or part of its liabilities arising from policies sold in the customer market (the primary market) to another insurer. The reinsurer shares in the losses of the reinsurance portfolio, in return for payment of a reinsurance premium, or a share of the original premium revenue. (Berger et al., 1992)

Reinsurance transactions help achieve several business objectives. The primary purpose of reinsurance is risk management. For example, certain reinsurance agreements enable the primary insurer to retain losses which are relatively predictable, while sharing large and infrequent losses with the reinsurer. Second, transferring risk to the reinsurer reduces the strain on the insurer's capital, hence reinsurance effectively serves as a substitute for capital. Third, professional reinsurers provide informal consulting services to primary insurers in areas of underwriting, marketing, and pricing. Fourth, the use of reinsurance enables small insurers to provide coverage for larger amounts, thus improving their ability to compete against large insurers in the primary market.

Another possible use of risk reinsurance is that it may be purchased for the purpose of 'financial-results management' (Casualty Actuarial Society, 1990). Specifically, risk reinsurance enhances insurers' *statutory* net income and policyholders' surplus (shareholders' equity). Since risk reinsurance does not affect *GAAP* earnings and shareholders' equity, its use as an enhancement tool is limited to regulatory and tax reporting, which are based on statutory reports.

Among all forms of risk reinsurance, quota-share reinsurance treaties are the most likely to yield the largest statutory earnings enhancement. Appendix A illustrates the enhancement effect of these treaties on statutory earnings, balance sheet, and financial ratios. Since the enhancement effect is immediate upon entering into the transaction, 'it is common to observe many of these reinsurance treaties signed towards the end of the year' (College of Insurance, 1980).

2.2. Financial (nontraditional) reinsurance

There are two main characteristics that help distinguish financial reinsurance from risk reinsurance transactions. First, the level of underwriting (insurance) risk transferred to the reinsurer is insignificant, and second, investment rates constitute a key component in the contract. Taken together, the two

characteristics imply that future reimbursement payments to be received from the reinsurer are *not* a function of the direct insurance losses suffered by the primary insurer, but rather a function of the initial reinsurance premiums and accumulated investment income. Thus, in contrast to risk reinsurance, which serves primarily to reduce insurers' exposure to insurance risk, many view financial reinsurance treaties as 'treaties whose main, and sometimes only, purpose is financial-results management' (Casualty Actuarial Society, 1990).

Retrospective financial reinsurance transactions, the most prevalent form of financial reinsurance, is a mechanism that enables insurers to implicitly discount their loss reserves. Both Statutory Accounting Principles (SAP) and GAAP require insurers to establish loss reserves based on the expected *ultimate* (nominal) value of incurred losses. These losses are expected to be paid during future years (usually in five to seven years) after claims are settled. In retrospective arrangements, the insurer transfers loss reserves to the reinsurer and pays a reinsurance premium equal to the *present value* of the transferred reserves. At the time of the transaction, the insurer reduces its loss liabilities by the amount of the transferred reserves, and incurs a decrease in cash equal to the premium amount. The resulting immediate increases in equity and income reflect the discounting effect, i.e., the difference between the future value (book value) and the present value of the transferred reserves.[6] This implicit discounting effect is addressed by Arthur Andersen & Co.:

> The primary reason for the FASB project on this topic is concern among users of financial statements, auditors, and preparers, that certain reinsurance transactions are used to 'window dress' the balance sheet and achieve 'back-door discounting' resulting in elimination of recorded liabilities and recognition of gains. Because [accounting] models generally do not recognize the time value of money, preparers are motivated to enter into reinsurance transactions that permit them to selectively recognize the time value of money.

Suppose that prior to a retrospective reinsurance transaction the net loss reserve liability is \$150, decomposed as follows:[7]

Gross Loss Reserves	\$200
Associated Reinsurance Recoverables	(\$50)
Net Loss Reserves	\$150

[6]The reinsurer's fee is incorporated into the premium (the fee is typically between 2% and 5% of the premium paid). This implies that the actual enhancement effect is slightly smaller than the discounting effect.

[7]Gross loss reserves represent the legal liability of the primary insurer to policyholders, a liability which does not depend on the reinsurance program of the insurer. The associated reinsurance recoverables represent the reinsurer participation in these losses, as a function of the reinsurance program of the insurer.

Suppose the insurer pays the reinsurer \$80 as a reinsurance premium, while transferring reserves in the amount of \$100. Following the transaction, the net loss reserve liability is decomposed as follows:

Gross Loss Reserves	\$200
Associated Reinsurance Recoverables	(\$150)
Net Loss Reserves	\$50

The reinsurer is committed to pay \$100 in the future *regardless* of the actual losses that will eventually be paid to policyholders by the primary insurer. Even though there was no transfer of insurance risk, the income statement presents the \$20 discounting effect as an immediate underwriting income (operating income) rather than an investment income that should be realized over time. Insurers, opposing the present accounting system in which loss liabilities are presented in future values, argue that the discounting effect adjusts equity to reflect losses in *present value* terms. In particular, they argue that the enhancement of underwriting income reverses the overstatement in losses incurred (previously recorded in future value terms).

3. Hypotheses development

3.1. The regulatory hypothesis

The Insurance Regulatory Information System (IRIS) has been the principal analytical tool used by insurance regulators to identify troubled insurance companies (Petroni, 1992, provides a detailed description of IRIS).[8] IRIS consists of two phases. Under the statistical phase of IRIS, eleven financial ratios are computed based on the accounting data available from insurers' annual statutory statements. Each of these eleven ratio results is defined as either 'usual' or 'unusual', where usual ranges are predetermined by the NAIC (Appendix B describes the eleven ratios and their usual ranges). Firms are classified as 'failing' the statistical phase when more than three ratio results are outside the usual ranges. These firms enter the analytical phase of the system, in which a team of examiners and senior financial analysts review their statutory statements. The examiner team then designates some of the firms as requiring 'immediate regulatory attention' or 'targeted regulatory attention' by state regulators.

Since financial and risk reinsurance result in an immediate enhancement to statutory earnings and equity, their effect is to reduce the number of unusual

[8]The recently proposed Risk Based Capital (RBC) requirements replace IRIS as the principal regulatory tool in monitoring insurers' capital (for a discussion, see Cummins et al., 1994).

IRIS ratio results. In particular, financial and risk reinsurance enable insurers to improve the results of IRIS ratio #1, net premiums written to policyholders surplus, ratio #8, agents' balances to surplus, and ratio #11, estimated reserve deficiency to surplus. Ratio #7, liabilities to liquid assets, is also typically improved. Insurance regulators have concluded that 'such arrangements ... distort underwriting results and the results of the NAIC's IRIS ratio calculations, which are used to detect troubled companies'.[9] For example, the Committee on Energy and Commerce (1990) describes a financial reinsurance transaction initiated by the Transit Casualty Company, which allowed the company to boost its statutory surplus by $4.6 million for regulatory purposes. The Committee's report states that 'the only apparent purpose of the deal was to artificially increase Transit's surplus for state regulators'.

As in Petroni (1992), the regulatory hypothesis focuses on the sharp drop in expected regulatory costs which occurs once insurance companies move from 'failing' the statistical phase.[10] The 'regulatory' hypothesis is, therefore, stated as follows:

H1: Insurers which barely passed the statistical phase of IRIS exhibit abnormally high levels of reinsurance.
An insurer is classified as 'barely passing' the statistical phase if it passed the statistical phase, but would have failed it if the enhancement effect of reinsurance had been removed.

3.2. The tax hypothesis

Insurers' taxable income is calculated based on the accounting numbers in the annual statutory reports, prepared under Statutory Accounting Principles (SAP). The immediate effect of reinsurance on statutory income provides insurers with incentives to engage in reinsurance transactions for tax-related purposes. Walker (1991) states that tax-motivated reinsurance transactions were the biggest concern of the Joint Committee on Taxation (1987). The Committee's report states that 'significant tax benefits can be derived by reinsuring, because the transaction may alter the timing of income and deductions'.

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[9]Business Insurance (November 12, 1990), V. Laurenzano, chief examiner of the N.Y. Insurance Department Property Companies Bureau.

[10]Regulatory costs are typically imposed via the state insurance commissioner. The commissioner has powers to limit the type and volume of business transacted (e.g., limit direct premiums written in a certain line of business), restrict payments of dividends, and restrict certain types of investments. In extreme situations, a commissioner may evoke formal rehabilitation or liquidation proceedings.

The level of reinsurance is expected to be negatively related to insurers' marginal tax rates. A higher marginal tax rate implies that a marginal increase in the reinsurance level is more costly due to an increase in taxable income. Similarly, insurers with net operating losses (NOLs) effectively face a low marginal tax rate, hence are expected to exhibit relatively higher levels of reinsurance.

The 'tax' hypothesis is stated as follows:

H2: Other risk and economic factors fixed, insurers facing a high marginal tax rate exhibit a lower level of reinsurance relative to insurers facing a low marginal tax rate.

The empirical analysis investigates the tax hypothesis separately for the periods prior to and following the Tax Reform Act of 1986 (TRA 86) for the following reasons. First, prior to TRA 86, insurers' taxable income for federal tax purposes was determined using the statutory net income figure (with few minor variations). As of TRA 86, taxable income is computed using certain adjustments to statutory net income. The overall effect of these adjustments was to increase the average federal tax rate paid by the industry, from about 4% prior to TRA 86 to about 20% following it (Walker, 1991). Whereas the maximum tax rate decreased following TRA 86 (from 46% to 34%), the minimum tax rate increased from 0% to 20% (due to the Alternative Minimum Tax provision). During the period prior to TRA 86, many insurers managed to maintain a 0% marginal tax rate (mainly by utilizing NOLs), hence the very low average tax rate of 4%. Second, TRA 86 also required insurers to compute loss reserves on a present value basis for tax purposes, hence retrospective financial reinsurance transactions do not affect taxable income following 1986 (risk reinsurance still increases taxable income following 1986).

4. Sample, variables, and descriptive statistics

4.1. Data

Data for this study are generated from the annual A.M. Best's tapes, covering the period 1976–1990. The tapes include selected data items from the statutory statements filed by insurance companies. The following selection criteria are applied: (1) firms are unaffiliated-single insurers; (2) firms are stock insurers; (3) firms are not professional reinsurers; and (4) firms write less than 25% of their total direct premiums in the medical malpractice and the workers' compensation lines of business.

The first criterion excludes consolidated groups and group members, since prior to 1988 groups reported reinsurance transactions with group affiliates and unaffiliated insurers under the same categories, confounding the measure of the

volume of reinsurance.[11] In addition, IRIS ratios may be computed less accurately for group insurers than single unaffiliated insurers.[12] The second criterion excludes mutuals, reciprocals, and Lloyds insurers which are different in their organizational structure. The third criterion excludes professional reinsurers since the study focuses on the purchase of reinsurance by primary insurers. The fourth criterion is applied because certain states have permitted loss reserves associated with the medical malpractice and workers' compensation lines to be presented on a discounted basis. Since this study investigates the implicit discounting of loss reserves via retrospective reinsurance arrangements, significant amounts of reserves which are already presented on a discounted basis would confound the results.

The selection criteria result in a sample of firms which are homogeneous in terms of capital structure, product lines, and structure of assets and liabilities. Furthermore, statutory reports are stricter in their format than GAAP reports, hence the comparability of data across sample insurers is increased. The resulting sample includes approximately 3,500 insurer-year observations for the period 1976–1990.

4.2. Volume of reinsurance transactions

Total volume of reinsurance transactions

The overall volume of reinsurance transactions is measured utilizing the variable used commonly in previous research investigating the demand for reinsurance (e.g., Berger et al., 1992; Garven, 1991; Mayers and Smith, 1990):

$$REINS_t = \frac{Ceded\ Premiums\ Written_t}{Gross\ Premiums\ Written_t},$$

where *Ceded Premiums Written* is the dollar amount of premiums reinsured and *Gross Premiums Written* is the overall dollar amount of premiums written during the year. *REINS* measures the *total* volume of reinsurance transactions since it reflects all forms of reinsurance (risk and financial).

Volume of retrospective financial reinsurance transactions

As illustrated by the example in Section 2.2, retrospective financial reinsurance arrangements affect loss reserves by increasing the *reinsurance recoverables* portion of the reserves, leading to a reduction in the net loss reserves liability

[11] This criterion was also applied by Mayers and Smith (1990) and Garven (1991).

[12] The study computes the IRIS ratio results based on raw data. This computation is incomplete in the case of group insurers since transactions between affiliated insurers cannot be taken into account.

account. Since no information is available in the financial statements regarding the exact volume of financial reinsurance transactions, *RETRO* is developed as a proxy variable for the volume of these transactions:

$$RETRO = \{Reinsurance\ Recoverables_t / Gross\ Loss\ Reserves_t\} - \{Reinsurance\ Recoverables_{t-1} / Gross\ Loss\ Reserves_{t-1}\}.^{13}$$

RETRO measures *disproportionate* changes in reinsurance recoverables on losses already incurred. A direct comparison of the dollar amount of reinsurance recoverables at year-end to that at the beginning of the year would be insufficient since it ignores the effect that changes in gross loss reserves have on the associated reinsurance recoverables; specifically, as management updates its estimate of gross reserves over time (as more information becomes available), the associated reinsurance recoverables are also reestimated, typically proportional to the change in gross reserves. As in previous papers, it is assumed that the reinsurance program of the insurer is proportional, i.e., the reinsurer participates proportionally in losses incurred by the primary insurer. Referring to the example in Section 2.2, *RETRO* would be calculated as $150/200 - 50/200 = 0.50$.

It is important to note that *RETRO* would not be affected if *risk* reinsurance were undertaken. As shown in Appendix A, risk reinsurance affects the balance sheet account of unearned premiums; it does not affect the balance sheet accounts of gross loss reserves and reinsurance recoverables.

4.3. Risk factors

In testing the research hypotheses, exogenous risk factors which affect the demand for reinsurance need to be controlled for. The following risk variables and their expected relationship to reinsurance draw on previous studies (e.g., Mayers and Smith, 1990; Garven, 1991; Hoerger et al., 1990) which investigated the demand for reinsurance (see Appendix C for detailed variable definitions and discussion of expected relationships):

SIZE = direct premiums written (−),
HERF_B = Herfindahl index for the insurer's business concentration across lines of business (− / +),
HERF_G = Herfindahl index for the insurer's geographic concentration across states (− / +),
PSRATIO = ratio of direct premiums written to beginning-of-year equity (+),

[13] Amounts at time t are the sum of loss reserves at time t and losses paid out during year t, excluding amounts related to losses associated with policies written during year t.

SCHEDP = direct premiums written in Schedule P liability lines as a percentage of total direct premiums written (+),
BEST = rating designated to the insurer by A.M. Best company (−),
VOLATIL = insurer's time-series measure of loss volatility, computed over the sample period (+).

4.4. *Variables testing the research hypotheses*

The regulatory variables

The evidence in Petroni (1992) suggests that insurance companies that barely passed the statistical stage exhibited a higher level of reserve understatement relative to other sample firms. Following Petroni, the regulatory hypothesis is investigated using a two-step procedure. The first step identifies a subgroup of insurers for which it is *feasible* that they passed the statistical phase of IRIS using reinsurance transactions. The identified insurers are those that passed the statistical phase of IRIS, but would have failed it if the enhancement effect of reinsurance had been reversed. The second step applies a regression analysis to investigate whether those insurers exhibit abnormal levels of reinsurance after controlling for exogenous risk factors.

The first step of the procedure differs from the one used in Petroni (1992) in two ways, both related to the unique characteristics of reinsurance. First, insurers are not restricted with respect to the amount of reinsurance they can purchase, whereas they are indirectly restricted with respect to the level of reserve understatement. Specifically, since errors in the estimation of loss reserves are revealed in future years as actual losses are paid, and since these reserve errors adversely affect future IRIS ratios, insurers are in fact limited to a 'reasonable' level of understatement (between 5% and 10%). In contrast, insurers may purchase as much reinsurance as they desire by paying reinsurance premiums. The first step in this paper, therefore, reverses the *entire* enhancement effect of reinsurance, in contrast to Petroni (1992) which reverses a 'reasonable' degree of understatement (5–10%).[14]

Second, the statutory-earnings enhancement effect of reinsurance has to be *estimated* before it is reversed, since unlike reserve understatement which affects

[14]Obviously, the more reinsurance purchased, the greater the enhancement effect. Reversing the entire enhancement effect of reinsurance may cause concern of circularity in the regression model, however, this concern is largely mitigated by the built-in inclusion of risk factors. Specifically, insurers with high levels of reinsurance that stem from *risk* reasons will *not* contribute to the significance of the regulatory variable, since these high levels of reinsurance are explained by high levels of risk, as measured by the risk factors. Insurers with high levels of reinsurance that stem from *regulatory* reasons *will* contribute to the significance of the regulatory variable, since the risk factors will only pick up risk-related portions of these levels.

earnings through a one-to-one relationship, the effect of reinsurance on earnings depends on the reinsurance program of the insurer. In particular, the enhancement effect is a function of the *type of contract*, i.e., retrospective financial reinsurance versus risk reinsurance. Since no direct information is available in the statutory statements to distinguish between these two forms of reinsurance, it is necessary to assess which reinsurance programs are 'financially oriented' and which are 'risk-oriented'. Insurers are classified as having 'financially oriented' reinsurance transactions if *RETRO* is in the upper quartile of the sample distribution.[15] The following two variables test the regulatory hypothesis separately with respect to financial reinsurance and risk reinsurance (see Appendix C for a detailed description of these variables):

REG_FIN = 1 if an insurer with *RETRO* in the upper quartile passed the statistical phase of IRIS, but would have failed it if the IRIS ratios had been recalculated based on a reversal of financially oriented reinsurance transactions,

0 otherwise.

Insurers which are not classified as having financially oriented reinsurance transactions are assumed to engage in risk reinsurance transactions:

REG_RISK = 1 if an insurer with risk-oriented reinsurance transactions passed the statistical phase of IRIS with ratio #3 in the usual range, but would have failed the statistical phase if the IRIS ratios had been recalculated based on a reversal of risk reinsurance transactions,[16]

0 otherwise.

The tax variables

Best's tapes provide no information regarding the Net Operating Loss (NOL) carryforward or the marginal tax rate of insurers. The study, therefore, utilizes

[15]Since *RETRO* does not measure the *absolute* level of retrospective financial reinsurance transactions, it is useful mainly as a *relative* measure, i.e., a measure which compares the insurer's reliance on retrospective reinsurance transactions relative to other sample insurers.

[16]IRIS ratio #3, Surplus Aid to Surplus, is included in IRIS to measure the insurer's reliance on *risk* reinsurance. Once ratio #3 is outside the usual range (above 25%), the NAIC requires to recalculate certain IRIS ratios in order to reverse the effect of risk reinsurance on these ratios. This essentially limits the enhancement effect of risk reinsurance – once it is large enough to render the result of ratio #3 unusual, it is removed altogether due to the recalculation. In contrast, ratio #3 is ineffective in the case of retrospective financial reinsurance, since the ratio result is actually *reduced* (i.e., improved) when the insurer enters into these transactions.

the following two alternative proxies to measure insurers' marginal tax rates:

$TAX = 1$ if federal taxes are paid out or if a tax refund is received,

0 otherwise.

Insurers with NOL carryforward are considered to have a low tax rate. It is assumed that insurers do not have an NOL carryforward if they are currently paying taxes or receiving a refund of prior-year taxes.

$MUNI$ = ratio of interest income from bonds exempt from U.S. tax to total investment income.

Similar to Collins, Shackelford, and Wahlen (1994), this measure is adjusted by subtracting the yearly sample mean of the variable from the bank-specific level.

As discussed in Section 3.2, the tax hypothesis is tested separately for the periods prior to and following TRA 86 using two distinct variables (e.g., *TAX79_86* and *TAX87_90*).

Finally, since both risk and financial reinsurance have negative cash flow implications, insurers' cash position is included in the regression as a control variable. The amount of reinsurance is expected to be positively related to insurers' cash position, defined as

$CASH$ = ratio of cash on hand to total assets.

4.5. Descriptive statistics

The general selection criteria (see Section 4.1) resulted in about 3,500 insurer-year observations for the period 1976–1990. Two lags are required to calculate the IRIS ratios, hence years 1976 and 1977 were excluded. In addition, sample year 1978 was excluded since Best's ratings are available in Best's Key Rating Guides starting at 1979. Finally, insurer-year observations were deleted if variable results were found to be outside their expected range, suggesting data errors. The final sample (after exclusion of missing observations) includes 1,968 insurer-year observations, for the period 1979–1990. The distribution of sample observations across sample years is fairly uniform, ranging from 288 to 324 observations per year.

Table 1 provides descriptive statistics. Since the sample excludes insurers affiliated with groups, it excludes some of the largest insurers in the U.S. To the extent that large insurers address regulatory and tax issues differently from small insurers, the results may not be generalizable to large insurers. Sample means of total assets and direct premiums written are significantly larger than the respective medians, implying that the sample is skewed towards large firms. More than 25% of sample observations have policies written in a single state ($HERF\_G = 1$). The mean (median) of reinsurance is 29% (22%), implying that

Table 1
Descriptive statistics on exogenous and endogenous variables, stock insurers, 1,968 insurer-year observations, 1979–1990

Panel A: Exogenous variables

Variable	Mean	Std. dev.	Q1	Median	Q3
Total assets[a]	$39,002	$74,741	$6,593	$16,901	$38,013
D.P.W.[a]	$24,252	$38,835	$4,882	$12,584	$26,187
HERF_B	56.44%	26.77%	34.46%	51.21%	78.53%
HERF_G	64.48%	35.69%	29.26%	72.96%	100.00%
SCHEDP	48.56%	34.77%	6.34%	58.16%	76.06%
PSRATIO	305.62%	302.52%	119.19%	242.45%	391.23%
VOLATIL	25.45%	57.66%	9.14%	13.49%	24.69%
BEST[b]	3.34	2.37	0	4	5

Panel B: Endogenous variables

Variable	Mean	Std. dev.	Q1	Median	Q3
REINS	28.68%	25.93%	6.21%	22.05%	45.94%
RETRO	2.82%	14.57%	− 2.47%	0.03%	5.63%
IRIS ratio #3	12.30%	50.59%	0.00%	1.00%	10.00%

[a] Variable is expressed in thousands of 1990 dollars.
[b] Best's rating is available for a subset of 1,765 observations.

D.P.W. = direct premiums written = *SIZE*; *HERF_B* = Herfindahl index for business concentration, based on direct premiums written across lines of business; *HERF_G* = Herfindahl index for geographic concentration, based on direct premiums written across states; *SCHEDP* = percentage of direct premiums written in Schedule P liability lines; *PSRATIO* = ratio of direct premiums written to previous-year surplus; *VOLATIL* = insurer's time-series measure of loss volatility, computed over the sample period; *BEST* = Best's rating, where 6 = A +, 5 = A, down to 1 = C. Zero represents no assignment; *REINS* = ratio of ceded premiums written to gross premiums written; *RETRO* = ratio of reinsurance recoverables to gross loss reserves (t) minus ratio of reinsurance recoverables to gross loss reserves ($t-1$); *IRIS ratio #3* = the result of IRIS ratio #3, surplus aid to surplus.

on average sample insurers cede (reinsure) one fourth of their annual gross premiums. Assuming a 20% ceding commission ratio (see Appendix A), this implies that the average income enhancement effect of reinsurance is equal to about 5% of gross premiums.

Panel A of Table 2 reports correlations among the exogenous risk variables. The − 0.23 correlation between the insurer's leverage (*PSRATIO*) and the insurer's financial strength (*BEST*) is anticipated ($p = 0.0001$). Similarly, as anticipated via default risk arguments, *BEST* is negatively correlated with business concentration, geographic concentration, and loss volatility, and positively correlated with firm size.

Panel B of Table 2 reports correlations between the variables testing the research hypotheses and the exogenous risk factors. There are 41 (46)

Table 2
Pearson correlation coefficients, stock insurers, 1,968 insurer-year observations, 1979–1990

Panel A: Correlations among exogenous variables

	SIZE	*HERF_B*	*HERF_G*	*PSRATIO*	*SCHEDP*	*VOLATIL*	*BEST*
SIZE	1						
Prob > 0	0						
HERF_B	−0.1274	1					
Prob > 0	0.0001	0					
HERF_G	−0.2601	0.0169	1				
Prob > 0	0.0001	0.4525	0				
PSRATIO	0.1743	−0.0879	0.0959	1			
Prob > 0	0.0001	0.0001	0.0001	0			
SCHEDP	0.1794	−0.3214	−0.0292	0.0829	1		
Prob > 0	0.0001	0.0001	0.1961	0.0002	0		
VOLATIL	−0.0696	0.0750	−0.0183	−0.1398	−0.0488	1	
Prob > 0	0.0020	0.0009	0.4168	0.0001	0.0303	0	
BEST[a]	0.1636	−0.0746	−0.1617	−0.2357	−0.0742	−0.0694	1
Prob > 0	0.0001	0.0036	0.0001	0.0001	0.0038	0.0068	0

Panel B: Correlations between variables testing the research hypotheses and exogenous variables

	SIZE	*HERF_B*	*HERF_G*	*PSRATIO*	*SCHEDP*	*VOLATIL*	*BEST*
REG_FIN[b]	− 0.0129	− 0.0202	− 0.0015	0.0761	− 0.0003	− 0.0187	− 0.0625
Prob > 0	0.5672	0.3717	0.9481	0.0007	0.9901	0.4062	0.0149
REG_RISK[c]	− 0.0042	− 0.0766	− 0.0131	0.0487	0.0594	− 0.0168	− 0.0707
Prob > 0	0.8527	0.0007	0.5614	0.0306	0.0084	0.4577	0.0058
TAX	0.1283	− 0.0306	− 0.0991	− 0.1057	− 0.0550	− 0.0335	0.2476
Prob > 0	0.0001	0.0896	0.0001	0.0001	0.0023	0.0825	0.0001
MUNI	0.1663	− 0.0496	− 0.1149	− 0.0478	− 0.0325	− 0.0635	0.2334
Prob > 0	0.0001	0.0059	0.0001	0.0087	0.0717	0.0010	0.0001

[a] Best's rating is available for a subset of 1,765 observations.
[b] Binary variable, equals 1 for 41 observations.
[c] Binary variable, equals 1 for 46 observations.

SIZE = direct premiums written; *HERF_B* = Herfindahl index for business concentration, based on direct premiums written across lines of business; *HERF_G* = Herfindahl index for geographic concentration, based on direct premiums written across states; *PSRATIO* = ratio of direct premiums written to previous-year surplus; *SCHEDP* = percentage of direct premiums written in Schedule P liability lines; *VOLATIL* = the insurer's time-series measure of loss volatility, computed over the sample period; *BEST* = Best's rating, where 6 = A +, 5 = A, down to 1 = C. Zero represents no assignment; *REG_FIN* = 1 if the reinsurance program of the insurer appears to be 'financially oriented', and if the insurer passed the statistical phase but would have failed it had the surplus-relief effect of retrospective financial reinsurance been removed, 0 otherwise (see Section 4.4); *REG_RISK* = 1 if IRIS ratio $\neq 3$ is below 25%, and if the insurer passed the statistical phase but would have failed it had the surplus-relief effect of risk reinsurance been removed, 0 otherwise (see Section 4.4); *TAX* = 1 if federal taxes are paid out or if a tax refund is received, 0 otherwise; *MUNI* = ratio of interest income from tax-exempt bonds to total investment income.

Table 3
Sample means and medians of *MUNI*, by year, 1,968 insurer-year observations, 1979–1990

Year	Mean	Median
1979	19.65%	9.80%
1980	19.58%	10.73%
1981	17.36%	7.90%
1982	18.74%	8.12%
1983	20.12%	9.92%
1984	19.10%	8.26%
1985	18.24%	7.63%
1986	19.15%	8.65%
1987	17.30%	5.98%
1988	14.83%	3.65%
1989	10.98%	0.91%
1990	10.22%	0.00%

MUNI = ratio of interest income from tax-exempt bonds to total investment income.

insurer-year observations classified as $REG\_FIN = 1$ ($REG\_RISK = 1$), i.e., insurers which may have used retrospective financial reinsurance (risk reinsurance) to pass the statistical phase of IRIS. In total, 4.4% of sample observations are classified as insurers which may have used financial or risk reinsurance transactions to pass the statistical phase, a portion comparable to that in Petroni (1992).[17] The negative and significant correlations between *BEST* and the two regulatory variables suggest that insurers which may have used financial or risk reinsurance to pass the statistical stage have, on average, lower Best's ratings relative to other sample insurers.

Table 3 reports yearly sample means and medians of *MUNI*. During the period 1979–1986, mean tax-exempt investment income as a percentage of total investment income is fairly stable, ranging between 17.36% and 20.12%. Subsequent to TRA 86, mean *MUNI* drops gradually from 17.30% in 1987 to 10.22% in 1990. In fact, the median firm in 1990 receives no interest income from tax-exempt sources. This pattern is expected, since as of TRA 86, 15% of income from tax-exempt bonds is taxed.[18]

[17]About 2% of Petroni's sample observations were classified as being close to regulatory attention based on a similar definition of a regulatory variable associated with reserve understatement.

[18]In addition, the untaxed portion of tax-exempt income is taxed if the insurer is subject to Alternative Minimum Tax (AMT). Whereas the previous optimal strategy for maximizing after-tax income was to achieve a zero taxable income, the current optimal strategy is to earn just enough taxable income to equate the regular tax liability with the AMT liability (Walker, 1991). This requires a smaller tax-exempt bond portfolio than prior to TRA 86.

5. Empirical results

5.1. Univariate analysis

The regulatory hypothesis proposes that insurers which barely passed the statistical phase of IRIS exhibit excessive levels of reinsurance. Under this proposition, the sample distribution of *RETRO* across the number of unusual IRIS ratios should reveal excessive levels of *RETRO* for insurers with three unusual ratios (the cutoff point between passing and failing the statistical phase). Note that a similar pattern is not expected with respect to *REINS*, since under a univariate analysis there is no control for risk factors that influence the level of *risk* reinsurance.[19]

Table 4 provides the sample distribution of *REINS* and *RETRO* across the number of unusual IRIS ratios, and Fig. 1 plots mean *RETRO* as a function of the number of unusual ratios. The figure reveals that mean *RETRO* is increasing monotonically from zero to three unusual ratios, where the maximum of *RETRO* is achieved at three unusual ratios. For observations with more than three unusual ratios, mean *RETRO* is generally decreasing in the number of unusual ratios. Consistent with the regulatory hypothesis, this pattern suggests a clustering of insurers with excessive levels of *RETRO* at three unusual ratios. The statutory reports of these insurers, therefore, appear to be enhanced by an excessive use of retrospective financial reinsurance transactions.

In general, firms experiencing financial difficulties may have incentives to engage in retrospective arrangements to reduce financial distress costs, for example, by improving their Best ratings. However, as firms become more distressed and exhibit a higher number of ratio violations, their ability to purchase financial reinsurance is reduced due to a lower liquidity. It is possible that the pattern in Fig. 1, whereby firms with low to medium number of ratio violations exhibit a higher *RETRO* than firms with a high number of ratio violations, reflects financial distress incentives. As a related issue, it is possible that firms which anticipate future ratio violations begin to purchase retrospective reinsurance in earlier years as part of multi-year optimization decisions. This may weaken the power of the tests of the regulatory hypothesis since firms with one or two ratio violations may actually exhibit a relatively high level of *RETRO* (this is partially supported by Fig. 1).

[19]One of the factors affecting the level of risk reinsurance is insurers' default risk. Since insurers' default risk may be measured by the number of unusual IRIS ratios (as well as Best's ratings), *REINS* is expected to increase in the number of unusual ratios. Partial evidence regarding this relationship is provided in Table 4.

Table 4
Distribution of *REINS*, *RETRO*, and frequency of sample observations, by number of unusual IRIS ratios, stock insurers, 1979–1990

	0	1	2	3	4	5	6
REINS:							
Mean	20.41	27.78	30.53	35.62	33.20	41.19	38.53
Median	15.19	21.42	22.17	28.12	30.30	44.30	46.16
RETRO:							
Mean	2.36	2.53	4.06	5.78	3.68	1.66	− 0.02
Median	0.00	0.30	0.09	0.79	0.04	0.83	− 0.07
Frequency of sample observations	610	429	326	217	135	83	70

	7	8	9	10	11	Total
REINS:						
Mean	33.09	41.32	34.25	54.16	50.72	28.68
Median	27.88	48.16	33.98	56.97	53.07	22.05
RETRO:						
Mean	− 1.29	− 2.43	− 0.62	− 0.69	− 6.72	2.82
Median	− 0.76	− 0.03	0.00	0.68	− 6.80	0.03
Frequency of sample observations	38	29	16	9	6	1,968

IRIS ratios #1, #8, and #11 are recalculated if ratio #3 is above 25%; *REINS* = ratio of ceded premiums written to gross premiums written, in percentage terms; *RETRO* = ratio of reinsurance recoverables to gross loss reserves (t) minus ratio of reinsurance recoverables to gross loss reserves ($t-1$).

5.2. *Multivariate regression analysis*

The following pooled (cross-sectional and over time) multivariate regression analysis is used to test the research hypotheses:

$$\begin{aligned} REINS_{i,t} = {} & a + b_1\, SIZE_{i,t} + b_2\, HERF\_B_{i,t} + b_3\, HERF\_G_{i,t} \\ & + b_4\, SCHEDP_{i,t} + b_5\, PSRATIO_{i,t} + b_6\, BEST_{i,t} \\ & + b_7\, VOLATIL_i + b_8\, REG\_FIN_{i,t} + b_9\, REG\_RISK_{i,t} \\ & + b_{10}\, TAX79\_86_{i,t} + b_{11}\, TAX87\_90_{i,t} + b_{12}\, CASH_{i,t} \\ & + b_{13}\, YEAR80_{i,t} + \cdots + b_{23}\, YEAR90_{i,t} + e_{i,t}. \end{aligned}$$

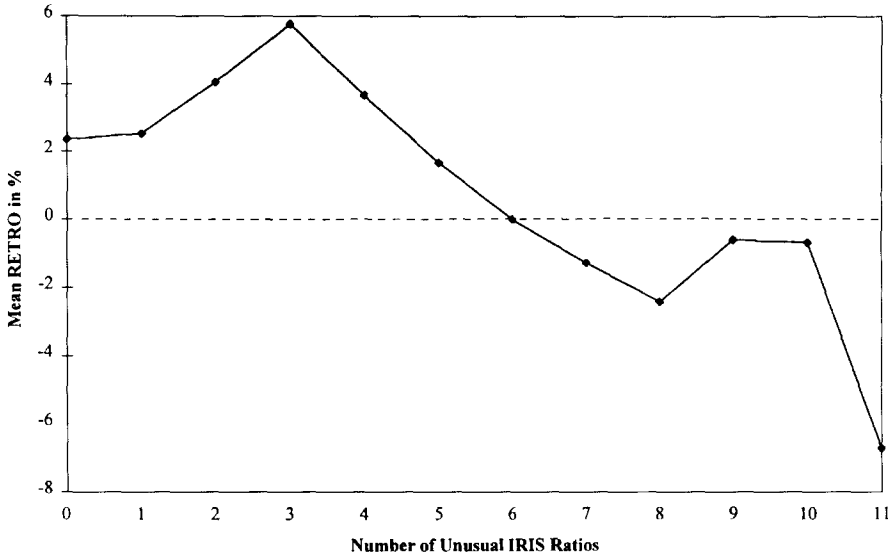

Fig. 1. Plot of mean *RETRO* as a function of the number of unusual IRIS ratios, based on statistics presented in Table 4, stock insurers, 1,968 insurer-year observations.

The risk factors control for risk-related purchases of reinsurance, leaving the remaining portion of reinsurance to be potentially explained by the research hypotheses. The explanatory variables also include yearly binary variables to control for shocks in the supply of reinsurance (Berger et al., 1992). The general specification of the regression is in levels terms, as in previous papers which investigated factors affecting the demand for reinsurance. Since OLS residuals were found to exhibit significant serial correlations for the majority of sample insurers, autocorrelation coefficients were estimated separately for each insurer, and the regression equation was respecified using the Cochrane–Orcutt procedure.[20] The Cochrane–Orcutt procedure requires one lag, hence the resulting sample covers the period 1980–1990.

The *REINS* regression results are reported in Table 5. The expected sign on the risk variables is based on regression results from previous studies. All of the estimated coefficients on the risk variables have the expected sign, except for *SIZE* (insignificantly different from zero) and *HERF_B* (significantly

[20]Specifically, for each insurer, the autocorrelation coefficient r_i was estimated using the OLS residuals: $e_{i,t} = r_i\ e_{i,t-1} + u_{i,t-1}$ (at least eight time-series observations are required for every insurer). The dependent and the independent variables were then transformed using the quasi-difference transformation, e.g., $y^*_{i,t} = y_{i,t} - r_i\ y_{i,t-1}$.

Table 5
Ordinary least squares regression results, 1980–1990, 1,294 stock observations, 148 insurers, adjusted $R^2 = 0.2996$; variables are transformed based on the Cochrane–Orcutt procedure[a]

$$REINS_{i,t} = a + b_1\ SIZE_{i,t} + b_2\ HERF\_B_{i,t} + b_3\ HERF\_G_{i,t} + b_4\ SCHEDP_{i,t} + b_5\ PSRATIO_{i,t} + b_6\ BEST_{i,t} + b_7\ VOLATIL_i + b_8\ REG\_FIN_{i,t} + b_9\ REG\_RISK_{i,t} + b_{10}\ TAX79\_86_{i,t} + b_{11}\ TAX87\_90_{i,t} + b_{12}\ CASH_{i,t} + b_{13}\ YEAR81_{i,t} + \cdots + b_{22}\ YEAR90_{i,t} + e_{i,t}$$

Explanatory variables	Expected sign[b]	Coefficient (t-statistic)	
Intercept		0.0023	(0.426)
SIZE	−	0.0001	(0.528)
HERF_B	−	0.0736	(2.586)
HERF_G	−	− 0.0208	(− 1.030)
SCHEDP	+	0.2122	(9.691)
PSRATIO	+	0.0120	(7.168)
BEST	−	− 0.0049	(− 2.155)
VOLATIL	+	0.0280	(0.494)
REG_FIN[c]	+	0.0970	(4.412)
REG_RISK[d]	+	(0.0127)	(0.599)
TAX79_86	−	0.0025	(0.269)
TAX87_90	−	− 0.0179	(− 1.197)
CASH	+	0.0906	(3.004)

[a]For each insurer, the autocorrelation coefficient r_i was estimated using the OLS residuals: $e_{i,t} = r_i e_{i,t-1} + u_{i,t-1}$ (a minimum of eight time-series observations were required for each insurer). The dependent and the independent variables were then transformed using the quasi-difference transformation (e.g., $y^*_{i,t} = y_{i,t} - r_i\ y_{i,t-1}$).

[b] Expected sign on the risk variables is based on regression results in Mayers and Smith (1990), Hoerger, Sloan, and Hassan (1990), and Garven (1991).

[c]*REG_FIN* = 1 for 20 observations (before transformation).

[d]*REG_RISK* = 1 for 21 observations (before transformation).

REINS = ratio of ceded premiums written to gross premiums written, in percentage terms; *SIZE* = direct premiums written, in millions of 1990 dollars; *HERF_B* = Herfindahl index for business concentration, based on direct premiums written across lines of business; *HERF_G* = Herfindahl index for geographic concentration, based on direct premiums written across states; *SCHEDP* = percentage of direct premiums written in Schedule P liability lines; *PSRATIO* = ratio of direct premiums written to previous-year surplus; *BEST* = Best's rating, where 6 = A$^+$, 5 = A, down to 1 = C. Zero represents no assignment; *VOLATIL* = the insurer's time-series measure of loss volatility, computed over the sample period; *REG_FIN* = 1 if the reinsurance program of the insurer appears to be 'financially oriented', and if the insurer passed the statistical phase but would have failed it had the surplus-relief effect of retrospective financial reinsurance been removed, 0 otherwise (see Section 4.4); *REG_RISK* = 1 if IRIS ratio #3 is below 25%, and if the insurer passed the statistical phase but would have failed it had the surplus-relief effect of risk reinsurance been removed, 0 otherwise (see Section 4.4); *TAX79_86* = 1 if federal taxes are paid out or if a tax refund is received in 1986 or prior to that, 0 otherwise; *TAX87_90* = 1 if federal taxes are paid out or if a tax refund is received in 1987 or subsequent to that, 0 otherwise; *CASH* = ratio of cash on hand to total assets.

positive).[21] The regression coefficients on *SCHEDP*, *PSRATIO*, and *BEST* are significant, while the coefficients on *HERF_G* and *VOLATIL* are insignificant. The coefficient on *CASH* is positive and significant as expected ($t = 3.004$), suggesting that insurers purchase less reinsurance when they are more cash-constrained.

The coefficient on *REG_FIN* is positive and highly significant ($t = 4.412$), supporting the regulatory hypothesis with respect to retrospective financial reinsurance transactions. The estimated coefficient of 0.0970 suggests that on average, those insurers which may have used retrospective financial reinsurance to pass the statistical phase exhibit an *abnormal* level of reinsurance equal to approximately 10% of their gross premiums written. The overall earnings enhancement effect, by construction of the variable *REG_FIN*, enabled those insurers to shift from 'failing' the statistical phase of IRIS to 'passing' the statistical phase. As opposed to the significant coefficient on *REG_FIN*, the coefficient on *REG_RISK* is positive but insignificantly different from zero. This result suggests that those insurers which may have used risk reinsurance transactions to pass the statistical phase actually do not exhibit abnormal levels of reinsurance after controlling for risk factors. Stated differently, it appears that those insurers did not purchase additional reinsurance over and above the level determined by their risk factors. One limitation of the above analysis is that *REG_FIN* and *REG_RISK* are constructed as mutually exclusive, hence the analysis does not explore a possible positive correlation between the use of financial and risk reinsurance.

Two reasons may explain insurers' reliance on retrospective financial reinsurance for regulatory purposes. First, while financial reinsurance premiums are essentially deposits which are guaranteed to be returned to the insurer in the future after accumulating investment returns, risk reinsurance premiums carry no such guarantee (only to the extent that the insurer incurs losses on reinsured policies, will the reinsurer indemnify the insurer via future reinsurance recoverables). This effectively makes risk reinsurance a more costly means for statutory earnings management relative to financial reinsurance. Second, the use of risk reinsurance as a means for statutory earnings enhancement is limited by IRIS ratio #3 (see Footnote 16).

The coefficients on *TAX79_86* and *TAX87_90* are found to be insignificant. The negative coefficient on *TAX87_90* is, however, almost significant at the 10% level, one-tailed test ($t = -1.197$). This suggests that for the period following TRA 86, insurers with high tax rates may purchase less reinsurance than insurers with low tax rates. The estimated coefficient of -0.018 suggests that on average, the reinsurance level of insurers having a high marginal tax rate

[21] The positive sign on *HERF_B* is, however, plausible under a default risk argument (see Appendix C).

may be lower by about 2% of gross premiums written relative to the that of insurers having a low marginal tax rate.

Although both the coefficients on *TAX79_86* and *TAX87_90* are insignificant, the stronger significance of the *TAX87_90* coefficient may be related to the increase in the *minimum* tax rate applicable to the industry, from 0% prior to TRA 86 to 20% following TRA 86. To the extent that insurers managed to maintain the minimum marginal tax rate, additional purchases of reinsurance prior to TRA 86 would imply relatively small increases in taxes payable, hence an insignificant coefficient on *TAX79_86*. The comparability of the average tax rates to the minimum marginal tax rates prior to TRA 86 (4% and 0%) and following TRA 86 (20% and 20%) supports the conjecture that insurers managed to keep their marginal tax rates at the minimum during the sample period.

Finally, the evidence suggests that regulatory objectives dominate tax objectives in insurers' decisions with respect to reinsurance. Whereas insurers appear to engage in retrospective reinsurance transactions for regulatory purposes, no similar evidence is found with respect to tax management.

5.3. *Sensitivity analysis*

The above regression was reestimated using the variables *MUNI79_86* and *MUNI87_90* as alternative proxies for insurers' tax position. The nontax variables have similar estimated coefficients and comparable significance levels relative to the original regression. Both coefficients on *MUNI79_86* and *MUNI87_90* are insignificant, where *MUNI79_86* is positive and *MUNI87_90* is negative. The lower coefficient on *MUNI87_90* (as in the *TAX* proxies) is consistent with the increase in the minimum marginal tax rates following TRA 86. One limitation of using the *MUNI* variables is that they may capture changes in insurers' investment portfolio mix as a function of reinsurance levels. Specifically, insurers that plan to purchase high levels of reinsurance are aware of the expected increase in taxable income, and may want to shield some of their investment income by increasing the proportion of tax-exempt investments. Such behavior would imply a positive relationship between *REINS* and *MUNI*, confounding the negative relationship expected by the tax hypothesis.

In the original regression, *REG_FIN* is defined based on an assumption of 25% discounting effect across all insurers (see Appendix C). Since the discounting effect is expected to be higher for insurers specializing in liability lines (where losses are paid several years after the coverage period), *REG_FIN* was redefined using a discounting effect of 25% for insurers specializing in liability lines and 10% for insurers not specializing in liability lines. The regression results are comparable to the previous results. In fact, the significance of *REG_FIN* increases marginally, presumably since the original regression misclassified

certain insurers under $REG\_FIN = 1$ (i.e., insurers for which it is feasible that they passed the statistical phase using retrospective financial reinsurance).

REINS regressions were also estimated separately for each sample year using OLS analysis. This estimation avoids potential econometric problems such as autocorrelation and nonstationarity of data over the sample period, however, it reduces the power of the tests due to considerably fewer sample observations per each regression. The results (not reported) strongly support the regulatory hypothesis with respect to retrospective financial reinsurance transactions. The coefficient on *REG_FIN* is positive in all twelve sample years, and significant at the 10% level (one-tailed test) in six of the years. Using a binomial test, the probability associated with the occurrence of twelve positive coefficients is $p < 0.001$. Similarly, the coefficient on *CASH* is positive in eleven of the twelve sample years, implying $p < 0.003$ using a binomial test. The results do not support the regulatory hypothesis with respect to risk reinsurance, neither do they support the tax hypothesis.[22]

To assess the sensitivity of the results to different estimation procedures, the regression analysis was repeated using a first-differences estimation procedure. The pooled first-differences regression (not reported) supports the regulatory hypothesis with respect to financial reinsurance (the coefficient on *REG_FIN* is positive and significant ($t = 2.0$)). The results do not support the regulatory hypothesis with respect to risk reinsurance, neither do they support the tax hypothesis.

6. Summary and conclusions

This paper contributes to the research investigating the relation between (i) regulatory, tax, and financial reporting incentives, and (ii) managerial decisions regarding accounting, financing, and investing choices. Whereas these issues have received considerable attention in the banking industry, less attention has been directed towards the insurance industry. The paper focuses on the management of regulatory ratios and taxes through the use of reinsurance, a transaction which is integral to the insurance business and which carries real economic consequences. In the insurance industry loss reserve understatement, investigated by Grace (1990) and Petroni (1992), and the use of reinsurance constitute two significant means which are available for the enhancement of regulatory capital and earnings.

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[22]The coefficient on *REG_RISK* is positive in six of the twelve sample years, and the coefficient on *TAX* is negative in eight of the twelve sample years. When the tax hypothesis is tested using *MUNI*, the coefficient on *MUNI* is negative in four of the twelve sample years.

The study first develops a measure to proxy for the level of retrospective financial reinsurance transactions. A univariate analysis of this measure reveals that insurers at the cutoff point between passing and failing the statistical phase of the regulatory system (IRIS) exhibit excessive levels of retrospective financial reinsurance. This evidence is consistent with the use of these transactions for regulatory reporting purposes. The measure is then used in the regression analysis to test the regulatory hypothesis separately with respect to financial and risk reinsurance.

The regression results strongly support the regulatory hypothesis with respect to retrospective financial reinsurance transactions. The relevant regression coefficient is positive and highly significant, suggesting an abnormal level of reinsurance equal to about 10% of gross premiums written for those insurers which barely passed the statistical phase of IRIS. These results are robust to first-differences estimation and to yearly regression analysis. In contrast, there is no support for the regulatory hypothesis with respect to risk reinsurance transactions.

Two reasons may explain the implied preference of using financial reinsurance transactions over risk reinsurance transactions for regulatory purposes. First, financial reinsurance premiums are essentially deposits which are guaranteed to be returned to the insurer in future years after accumulating investment returns, whereas risk reinsurance premiums carry no such guarantee. Second, the enhancement effect of risk reinsurance is technically capped within IRIS, while that of financial reinsurance is not. Nevertheless, financial reinsurance transactions have been increasingly challenged by accounting and insurance regulators, leading to the recent enactment of SFAS 113.

The regression results also very weakly support the tax hypothesis for sample years following TRA 86, suggesting that the volume of reinsurance transactions may be lower for insurers having a higher marginal tax rate. These results, however, are not robust to yearly regression analysis and to first-differences estimation. Finally, regression results suggest that insurers adjust their reinsurance purchases as a function of their cash position. Specifically, insurers that are more cash-constrained purchase less reinsurance, consistent with the negative cash-flow implications of both financial and risk reinsurance.

This paper raises several avenues for future research. First, the use of reinsurance for financial reporting purposes, e.g., management compensation and capital markets, has not yet been explored. Second, future research may look into emerging forms of financial reinsurance that are currently under increased scrutiny by accounting and insurance regulators. For example, *funded catastrophe covers* smooth insurers' earnings by enabling insurers to pay annual premiums over a period of several years, and use the accumulated funds as indemnification for infrequent catastrophic losses. As in retrospective financial reinsurance, the central issue that derives regulatory scrutiny is whether significant insurance risk is transferred to reinsurers. Finally, within the insurance

industry, the tradeoffs and the simultaneity in decisions regarding accounting, financing, investing, and reinsurance choices have yet to be examined.

Appendix A

Quota-share reinsurance treaties

Under a quota-share treaty, the insurer cedes (reinsures) a fixed percentage of each policy in a portfolio of policies, and receives a ceding commission from the reinsurer for the business ceded. The ceding commission is intended to compensate the primary insurer for its initial costs of acquiring that portfolio of policies. In contrast to GAAP, under Statutory Accounting Principles (SAP), the commission received from the reinsurer is recognized in the period in which it is paid, thus net statutory income is increased through a reduction in net commission expenses.[23] The following example illustrates the effect of quote-share reinsurance treaties on insurers' *statutory* balance sheets.

Consider an insurance company which has the following statutory balance sheet at the end of the fiscal year:

Cash	$750	Unearned premiums, net of reinsurance (= net advances from customers)	$1,500
Other assets	2,250	Unpaid loss reserves and other liabilities	1,000
		Policyholders' surplus (= Owners' equity)	500
	$3,000		$3,000

Ratio of assets to liabilities = 1.2

Suppose the company is interested in increasing its surplus from $500 to $700, and assume that the ceding commission is 40% of reinsured unearned premiums. The company enters a 33.3% quota-share reinsurance treaty, i.e., the reinsurer participates in 33.3% of losses associated with that portfolio of policies. Under the treaty, the reinsurer is paid $500 (33.3%*1500) of the company's unearned premiums. The ceding commission paid by the reinsurer is $200 (40%*500). Hence, the insurance company pays a net of $300 to the reinsurer. Follows is the balance sheet of the insurer after entering the treaty

[23]The statutory accounting treatment of the ceding commission is consistent with that of the initial costs of acquiring new policies. In particular, under SAP, both are recognized in the period in which they are paid. Under GAAP, however, the initial costs of acquiring new policies are capitalized and then amortized over time, as are ceding commissions.

(ignoring tax effects):

Cash	$450	Unearned premiums, net of reinsurance (= net advances from customers)	$1,000
Other assets	2,250	Unpaid loss reserves and other liabilities	1,000
		Policyholders' surplus (= owners' equity)	700
	$2,700		$2,700

Ratio of assets to liabilities = 1.35

Underwriting income (the insurer's operating income) is increased by $200, reflecting the $200 reduction in net commission expenses. Consequently, equity is increased by $200, and the ratio of assets to liabilities is improved. Other financial ratios, e.g., net premiums written to surplus and return on assets, are also improved at the time of the transaction.

Appendix B

The eleven IRIS ratios and their usual ranges

Ratio	Title	Description	Usual range
Overall ratios			
1	Premium to surplus	Net premiums written divided by stated policy-holders' surplus.	Below 30%
2	Changes in writings	The increase or decrease in net premiums written, calculated as a percentage of net premiums written in the prior year.	Between − 33% and 33%
3	Surplus aid to surplus	The ratio of ceding commissions to ceded premiums for all reinsurance ceded multiplied by the amount of unearned premiums on reinsurance ceded to nonaffiliated companies divided by policyholders surplus.	Below 25%
Profitability ratios			
4	Two-year overall operating ratio	The loss ratio plus the expense ratio minus the investment income ratio for two years.	Below 100%
5	Investment yield	Net investment income divided by the average invested assets.	Above 6%
6	Change in surplus	The difference between surplus at the end of the current year and surplus at the end of the prior year, calculated as a percentage of surplus at the end of the prior year.	Between − 10% and 50%

Liquidity ratios			
7	Liabilities to liquid assets	Liabilities divided by liquid assets.	Below 105%
8	Agents balances to surplus	Agents' balances in the course of collection divided by stated policyholders' surplus.	Below 105%
Reserve ratios			
9	One-year reserve development to surplus	The developed reserve for the prior year (i.e.,management currently revised estimate of the prioryear reserve) less the reserve reported in the prior year as a percentage of the prior year surplus.	Below 25%
10	Two-year reserve development to surplus	The developed reserve for the reserve of two years ago (i.e., management's currently revised estimate of the reserve of two years ago) less the reserve reported two years ago as a percentage of surplus two years ago.	Below 25%
11	Current estimate dreserve deficiency to surplus	The difference between an estimated reserve for the company and the actual reserve reported as a percentage of current surplus. The estimated reserve is the current net premium earned multiplied by the average ratio of developed reserves to earned premiums for the last two years.	Below 25%

Appendix C

Explanatory variables in the REINS regression

(1) *Risk Factors*

$SIZE$ = direct premiums written ($-$). Assuming that bankruptcy costs are less than proportional to firm size, small firms are expected to purchase more reinsurance. In addition, the reinsurer's consulting services are more valuable for small firms, hence reinsurance is expected to be negatively related to firm size.

$HERF\_B$ = Herfindahl index for the insurer's business concentration across lines of business ($i = 1, \ldots, N$) ($-$ / $+$):

$$HERF\_B = \frac{\sum (Direct\ Premiums\ Written_i)^2}{(Total\ Direct\ Premiums\ Written)^2}.$$

The more concentrated the insurer's business across insurance lines, the higher is its default risk, hence the insurer is expected to purchase more

reinsurance. However, the higher the insurer's business concentration, the less valuable the reinsurer's information, hence less reinsurance is expected.

HERF_G = Herfindahl index for the insurer's geographic concentration across states (− / +). Similar to *HERF_B*, a positive relationship is expected via a default risk argument, while a negative relationship is expected via a consulting-services argument.

$PSRATIO_t$ = ratio of direct premiums written (t) to equity ($t-1$) (+). This variable measures the leverage of the insurer since premiums written are analogous to the issuance of risky debt. The higher the insurer's leverage, the higher its default risk, hence more reinsurance is expected.

SCHEDP = direct premiums written in Schedule P liability lines as a percentage of total direct premiums written (+).[24] In liability lines, losses are expected to be paid out in extended future years. Since loss reserves are established based on nominal amounts, insurers specializing in liability lines will have larger loss reserves, hence a higher leverage. Similar to *PSRATIO*, the higher the leverage, the higher the expected level of reinsurance.

BEST = rating designated to the insurer by A.M. Best company (−). Similar to Mayers and Smith (1990), scores were assigned as follows: $6 = A^+$, $5 = A, \ldots, 1 = C$, and 0 = rating is not assigned. The higher the rating, the lower the expected amount of reinsurance.

VOLATIL = insurer's time-series measure of loss volatility, computed over the sample period (+):

$$VOLATIL = \frac{Std\ (Losses\ Incurred)}{Mean\ (Direct\ Premiums\ Written)}.$$

As the insurer's loss-volatility increases, more reinsurance is expected since the insurer is subject to a higher default risk.

(2) *Variables Testing the Regulatory Hypothesis*

REG_FIN = 1 if an insurer with *RETRO* in the upper quartile passed the statistical phase of IRIS, but would have failed it if the IRIS ratios had been recalculated based on a reversal of financially

[24]Schedule P liability lines include, among others, auto liability, other liability, medical malpractice, and workmen's compensation.

oriented reinsurance transactions. Specifically, equity is reduced by 25% of ceded premiums, and IRIS ratios which include equity in their denominator are recalculated using the adjusted equity; in addition, the results of the reserve-development IRIS ratios are adjusted upward,[25]

0 otherwise.

The definition of *REG_FIN* assumes that the earnings enhancement effect of retrospective financial reinsurance (the discounting effect) is 25% of ceded premiums. The 25% proportion is based on examples from two professional articles.[26]

Insurers which are not classified as having financially oriented reinsurance transactions are assumed to engage in risk reinsurance transactions:

REG_RISK = 1 if an insurer with risk oriented reinsurance transactions passed the statistical phase of IRIS with ratio #3 in the usual range, but would have failed the statistical phase if the IRIS ratios had been recalculated based on a reversal of risk reinsurance transactions. Specifically, equity is reduced by 20% of ceded premiums, and IRIS ratios which include equity in their denominator are recalculated using the adjusted equity,

0 otherwise.

To reverse the enhancement effect of risk reinsurance transactions, *REG_RISK* utilizes the 20% estimated ceding commission ratio which is used by the I.R.S. Sample insurers with an unusual IRIS ratio #3 cannot boost their earnings through risk reinsurance, since an unusual result for ratio #3 removes the enhancement effect of risk reinsurance.

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[25]Retrospective reinsurance transactions bias downward the results of IRIS ratios #9 and #10. Since these ratios measure reserve development using *net* loss reserves, and since retrospective financial reinsurance reduces current net reserves, the reserve development is biased favorably. To correct for this bias, whenever these ratio-results are in the usual range [15, 25] they are considered above 25, i.e., outside the usual range.

[26]Best's Review (March 1991) and Business Insurance (November 12, 1990) both illustrate the effect of retrospective financial reinsurance using a reinsurance premium of $80 and transferred reserves of $100, implying a discounting effect of $20 which is equivalent to 25% * ceded premiums. As a 'reality check', under a retrospective financial reinsurance contract which specifies that losses will be paid three years from the premium payment date after accumulating interest at a rate of 8%, an $80 premium will be translated into $101 of future loss payments.

Appendix D

Glossary of insurance terms

Acquisition Costs: All expenses incurred by an insurance company which are directly related to the acquisition of new business. Those expenses include mainly commissions paid to agents for insurance placement services.

Cede: To transfer to the reinsurer all or part of the insurance written by the insurer (the cedant).

Ceding Commission: The commission paid by the reinsurer to the primary insurer under quota-share reinsurance treaties. The commission is intended to compensate the primary insurer for its initial acquisition costs, and is calculated as a percentage of the reinsurance premium.

Excess-of-Loss Reinsurance: Reinsurance contracts which indemnify the primary insurer for all losses in excess of a predetermined amount, generally subject to a specified limit.

IRIS: Insurance Regulatory Information System (see Appendix B).

Long-Tail Lines: Certain liability lines (e.g., malpractice) for which the determination of the ultimate loss is frequently subject to delays which extend beyond the coverage period.

NAIC: National Association of Insurance Commissioners.

Policyholders' Surplus or *Surplus*: The difference between total assets and liabilities = owners' equity.

Primary Insurer: The insurance company which initially originates the business.

Quota-Share Reinsurance: A proportional reinsurance treaty (see Appendix A).

Reinsurance: An agreement whereby an insurance firm transfers all or part of its liabilities arising from policies sold in the customer market (the primary market) to another insurer (see Section 2.1).

Reinsurance Assumed: That portion of risk that the insurance company accepts from other insurance companies in return for premiums.

Reinsurance Treaty: A reinsurance agreement between the ceding company and the reinsurer, which specifies the technical provisions applicable to the reinsurance of a portfolio of policies (e.g., policies written in a specific line of insurance).

Retrospective Financial Reinsurance: See Section 2.2.

Statutory Accounting Principles (*SAP*): Rules of accounting prescribed by state law or regulatory authorities for insurance companies. Since most insurance

accounting practices seek to assure solvency, SAP have concentrated on conservative valuation rules for balance sheet items. Generally, SAP adopt a liquidation view of the company.

Underwriting Income: The operating income of the insurance company.

Unearned Premiums (= advances from customers): Most policyholders pay for their insurance coverage in advance. Under both GAAP and SAP, premiums are not recognized as being earned when collected. Consistent with the concept of matching revenues against expenses, Unearned Premiums are recognized as Earned Premiums (revenue) over the coverage period; similarly, Losses Incurred (expenses) are also recognized over the coverage period (creating a liability account of Unpaid Loss Reserves). Unearned Premiums are presented net of reinsurance, i.e., net of ceded (reinsured) unearned premiums. This liability account typically constitutes one-quarter of the total liabilities of a property–liability insurer.

Unpaid Loss Reserves: Loss Reserves as of a certain date are those *nominal* (future) amounts that would pay for all incurred and unsettled claims against the insurer. Reserves are established for losses that have been reported to the insurance company but have not yet been paid, and for losses estimated to be incurred during the accounting period but not yet reported to the company. This account is presented net of reinsurance recoverables, i.e., net of the reinsurer's participation in future payments of losses. Discounting (present-value presentation) of loss reserves is prohibited. This liability account typically constitutes one-half of the total liabilities of a property-liability insurer.

References

Beatty, A., S.L. Chamberlain, and J. Magliolo, 1995, Managing financial reports of commercial banks: The influence of taxes, regulatory capital, and earnings, Journal of Accounting Research, forthcoming.

Berger, L.A., J.D. Cummins, and S. Tennyson, 1992, Reinsurance and the liability insurance crisis, Journal of Risk and Uncertainty, 253–272.

Best's key rating guide, Property–casualty edition, Annual (A.M. Best, Oldwick, NJ).

Best's review, Property & casualty edition, 1991, Financial reinsurance: Answering the critics, March (A.M. Best, Oldwick, NJ).

Business Insurance, 1990, NAIC wrestles with financial reinsurance, November 12.

Carey, M., 1994, Snacking and smoothing: Gains trading of investment account securities by commercial banks, Working paper (Federal Reserve Board, Washington, DC).

Casualty Actuarial Society, 1990, Foundations of casualty actuarial science (R&S Financial Printing).

Chen, P. and L. Daley, 1994, Capital adequacy regulation and managed loan loss accruals in the Canadian banking industry, Working paper (University of Alberta, Edmonton).

College of Insurance, 1980, Reinsurance (College of Insurance, New York, NY).

Collins, J.H., D.A. Shackelford, and J.M. Wahlen, 1995, Bank differences in the coordination of regulatory capital, earnings, and taxes, Journal of Accounting Research, forthcoming.

Committee on Energy and Commerce, 1990, Failed promises – Insurance company insolvencies (U.S. Government Printing Office, Washington, DC).

Cummins, J.D., S.E. Harrington, and R. Klein, 1994, Insolvency experience, risk-based capital, and prompt corrective action in property–liability insurance, Working paper (University of Pennsylvania, Philadelphia, PA).

FASB, 1992, Statement of financial accounting standards no. 113: Accounting and reporting for reinsurance of short-duration and long-duration contracts (FASB, Norwalk, CT).

Garven, J.R., 1991, The demand for reinsurance: Theory and empirical tests, Working paper (University of Texas, Austin, TX).

Grace, E.V., 1990, Property–liability insurer reserve errors: A theoretical and empirical analysis, Journal of Risk and Insurance 57, 28–46.

Hoerger, T.J., F.A. Sloan, and M. Hassan, 1990, Loss volatility, bankruptcy, and the demand for reinsurance, Journal of Risk and Uncertainty, 221–245.

Holthausen, R.W., D.F. Larcker, and R.G. Sloan, 1994, Annual bonus schemes and the manipulation of earnings, Working paper (University of Pennsylvania, Philadelphia, PA).

Joint Committee on Taxation, 1987, General explanation of the tax reform act of 1986 (Commerce Clearing House, Chicago, IL).

Judge, G. et al., 1988, Introduction to the theory and practice of econometrics (Wiley, New York, NY).

Mayers, D. and C.W. Smith, 1990, On the corporate demand for insurance: Evidence from the reinsurance market, Journal of Business 63, 19–40.

Moyer, S.E., 1990, Capital adequacy ratio regulations and accounting choices in commercial banks, Journal of Accounting and Economics 13, 123–154.

Petroni, K.R., 1992, Optimistic reporting in the property–casualty insurance industry, Journal of Accounting and Economics 15, 485–508.

Scholes, M.S., G.P. Wilson, and M.A. Wolfson, 1990, Tax planning, regulatory capital planning, and financial reporting strategy for commercial banks, Review of Financial Studies 3, 625–650.

Walker, R.A., 1991, Do taxes matter? The case of the property–casualty insurance industry, Ph.D. dissertation (University of Texas, Austin, TX).

Wall Street Journal, 1991, Insuranc regulators mounting attack on controversial financial technique, June 7.