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The Influence of Income Tax Rules on Insurance Reserves

David F. Bradford and Kyle D. Logue

One of the most important components of the balance sheet of a property-casualty insurance company is the *loss reserve*. In spite of what the term may suggest, a loss reserve is not a pot of funds set aside for the uncertain future. It is an accounting entry, a liability on the balance sheet. More precisely termed the *unpaid-losses account*, the loss reserve expresses the amount the company expects to pay out in the future to cover indemnity payments that will come due on policies already written for losses that have already been incurred and to cover the costs of dealing with the associated claims. The latter category of costs, which includes, for example, the litigation costs associated with settling claims, is called *loss-adjustment expenses*.¹

If loss reserves were determined solely on the basis of pure insurance-accounting theory, they would reflect only those factors that affect the size, frequency, and pattern of future claim payments and loss-adjustment expenses. Such factors would include changes in patterns of actual claim payments; changes in inflation rates, weather patterns, and technology; and, particularly

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1. Our discussion of insurance accounting and solvency regulation draws primarily from Mooney and Cohen (1991), Salzmann (1974), Peterson (1981), and Troxel and Bouchie (1990).

significant in the context of liability insurance, trends in tort doctrines and jury awards. In practice, however, loss reserves are influenced by other considerations as well, considerations such as how the reported reserves will affect the likelihood of regulatory scrutiny, the perceptions of investors, and the firm's income tax liability. In this paper, we begin to examine the effects of income tax rules on property-casualty reserving practices.

Although insurers can choose from a number of different approaches to calculating their loss reserves, all these approaches share some common characteristics. The insurer generally begins by collecting information about its own loss experience as well as information about the rest of the industry's loss experience. With respect to the latter, industrywide data are collected and distributed to insurers through rating bureaus such as the Insurance Services Organization. These data include information about the severity, frequency, and timing of past claim payments and claim-expense payments as well as information about changes in trends and patterns of payments.

Once these data have been collected, the insurer's actuarial department applies various statistical techniques designed to generate predictions about the insurer's future loss claim payments and loss expenses. Typically, the actuarial department will recommend a range of loss reserves. Then, from within this range, someone in management (e.g., the chief financial officer) will choose the actual number that will be reported on the insurer's books. In any event, the choice of the reported loss reserve inevitably rests with management, and it is undisputed that management has some measure of discretion in setting those reserves (Peterson 1981).

In thinking about the role played by reserves as liabilities in the financial, regulatory, and tax accounting of the insurance company, it is useful to keep in mind the generic connection between a balance sheet and an income statement. In general terms, *income*, a flow concept, equals the sum of the increase in an associated stock concept, which is *net worth*, and amounts distributed to the company's owners during a given period. And net worth is the excess of a company's total assets over its total liabilities at a given time. For reporting purposes, the flow concept (income) is recorded on the income statement, and the stock concept (net worth) is recorded on the balance sheet. Thus, in theory, a company's reported income for a given period is simply the increase in the company's net worth during the period. (If there is a distribution to owners during the period, this statement is modified in an obvious way.) As for the specialized case of insurance accounting, the concept of net worth is called *surplus*, and it is reported on the insurer's year-end balance sheet as the difference between total assets and total liabilities. Likewise, net changes in surplus are reflected on the insurer's income statement as an operating gain or loss.

This is where an insurer's loss reserves come into the picture. Loss reserves are typically the largest single liability on an insurer's balance sheet. Therefore, owing to their sheer magnitude, even relatively small percentage changes in

loss reserves can significantly affect an insurer's surplus (i.e., the company's stock picture) and its operating results or income (i.e., the company's flow picture).

State insurance regulators specify the accounting conventions that insurance companies must use in the reports that they file for purposes of regulatory oversight. Collectively, these conventions are known as *annual statement* or *statutory accounting*. Statutory accounting has traditionally required—and, in most states, still requires—that loss reserves be reported on an undiscounted basis, both on the balance sheet and on the income statement. That is, despite the fact that an insurer's loss reserves represent the insurer's expected future claim payments and loss expenses, which one might expect to be discounted to a present-value equivalent, statutory accounting requires the insurer to calculate the balance-sheet entry using the simple sum of those future outlays.

In addition, until 1986, insurers were required to use statutory accounting—including undiscounted loss-reserve calculations—for the purpose of calculating their federal income tax liability. As part of the Tax Reform Act of 1986 (TRA86), however, insurers were required to discount their loss reserves for federal tax purposes. The details and the importance of this change are discussed below.

In the modern view of the firm, managers are modeled as making managerial decisions that serve their own interests. These interests will coincide with the interests of the firm's owners if the managers are appropriately socialized or if appropriately structured compensation schemes are in place (Fama 1980; Jensen and Meckling 1976). The management of an insurance company has an interest in the results reported on the company's balance sheet and income statement. Additionally, with respect to some elements of the balance sheet and income statement, management has considerable discretion. That is, for such accounting elements, the information that is available to management regarding the company's performance and financial position does not translate automatically into accounting data that can be reported. For these elements, the exercise of managerial judgment is not only feasible but necessary. The insurer's loss reserve is one such accounting variable, the setting of which can be understood as a managerial decision.

In addition to playing an essential role in determining the insurer's annual financial and tax-accounting income, loss reserves are used in measuring an insurer's overall financial strength. All else equal, including a fixed and positive relation between reported loss reserves and a "best estimate" of future payment liabilities, a larger loss reserve is associated with an increased risk of the insurer's insolvency. If this risk becomes sufficiently large, state insurance regulators may increase their level of surveillance or intervene in some way. State regulators monitor specifically the insurer's ratio of surplus to premiums written. If this ratio falls below a given threshold, the regulator will require that steps be taken by the company to improve its financial position. In the extreme case, if the insurer is on the brink of insolvency, the regulator may take over

the company and run it. For obvious reasons, the financial condition of the insurer is also important to investors and to policyholders. In fact, from the point of view of insurance-company management, perhaps the most important consumer for the company's accounting data is the commercial rating agencies, such as A. M. Best and Standard & Poor's, whose ratings regarding a company's financial condition can be critical to the company's future prospects.

In sum, because loss reserves play an important role in determining insurers' reported income and surplus, one would expect management's reserving discretion to be affected by all the external factors mentioned above.

The exercise of discretion in reporting reserves has been studied by a number of previous researchers. Within this literature, perhaps the most commonly tested question is the extent to which insurers deliberately manipulate loss reserves to "smooth" (i.e., to reduce the variability in) earnings over time (see, e.g., Forbes 1970; Balcarek 1975; Ansley 1979, and Harrington 1988). This question was studied, for example, by Smith (1980) and Weiss (1985) in the context of automobile-liability lines of insurance. Both concluded that their findings were consistent with the smoothing hypothesis; both also suggested other possible causes of the reserving errors observed in their data, for example, unanticipated inflation. Grace (1990) carried out a similar study of loss-reserving errors. Grace hypothesized that management would choose loss reserves that maximize the company's discounted after-tax cash flow subject to smoothing constraints and uncertainty. Looking at automobile-liability lines from the period between 1966 and 1979, Grace, too, concluded that the results of her study were largely consistent with her hypothesis. More recently, Petroni (1992) explored the hypothesis that the incentive to underestimate loss reserves is a decreasing function of the financial strength of the insurer. The results of this study suggest that insurance companies that are close to receiving regulatory scrutiny tend to understate their reserves by a larger amount than other insurance companies.

Our interest in loss-reserving practices began with our realization that major changes in the federal income tax laws enacted in 1986 altered dramatically (although temporarily) the loss-reserving incentives of property-casualty insurers. Specifically, TRA86 changed the tax treatment of property-casualty insurance companies in ways that greatly increased the tax advantage of "conservative" loss reserving during the transition period from the pre-TRA86 world to the post-TRA86 world. (Conservative loss reserving is the reporting of loss reserves that fall systematically on the high end of the distribution of possible outcomes.) Thus, we were interested in exploring empirically how responsive insurers' loss-reserving discretion is to tax incentives.

Our study of the effect of taxes on loss reserving can be located within two established lines of inquiry. First, in the accounting literature, several researchers have attempted to determine the extent to which external incentives affect management's use of its accounting discretion in reporting earnings. For example, important contributions to the study of income management include

White (1970), Dascher and Malcolm (1970), Koch (1981), Lambert (1984), Moses (1987), McNichols and Wilson (1988), and Scholes, Wilson, and Wolfson (1990). Second, our research contributes to the study of the effect of tax law and tax-law changes on business decisions more generally. For a sampling of the enormous literature on this subject, see Slemrod (1992), which includes a collection of empirical studies of the effects of TRA86 on various types of business decisions.

Section 7.1 describes the relevant tax-law history and sketches out some of our hypotheses concerning reserving behavior. Section 7.2 gives some descriptive statistics on the industry. Section 7.3 develops a quantitative measure of the tax incentives bearing on the reserving decision. Section 7.4 looks at the time-series evidence in industrywide data. There is a brief concluding section.

7.1 Income Tax Treatment of Property-Casualty Insurance Companies

The tax treatment of property-casualty insurance companies is governed by a special set of rules that are found in subchapter L of the Internal Revenue Code. Under these rules, property-casualty insurers are required to calculate their taxable income using essentially the same accounting conventions required by state insurance regulators, referred to, as we have noted, as *statutory* or *annual statement accounting*. The statutory approach requires an insurer to calculate its annual income by taking into account both its net underwriting profit (or loss) and its net investment income (or loss) for the year. To determine its underwriting profit or loss, the insurer starts with the premiums accruing during the year and then takes a number of deductions, the largest of which is typically the increase in the insurer's incurred losses account, which, in turn, includes any increases in unpaid loss reserves. Note also that annual statement accounting requires insurers to treat loss-reserve *increases* and loss-reserve *decreases* symmetrically. Thus, if an insurer has a net decrease in its loss reserves during the course of the year, the insurer must include the amount of that decrease in its underwriting profits for the year. (An increase in the estimated total of losses incurred and loss-adjustment expenses for policies that were written before the current reporting year is known as a *reserve strengthening*. A downward adjustment in those estimates is known as a *reserve weakening* or *release*.)

Given the availability of the loss-reserve deduction for federal income tax purposes, an insurer will often have a tax incentive to overstate its loss reserves. This is because overstating the reserve will increase the deduction and reduce the insurer's taxable income for the year. To be sure, that reduction comes at the cost of an equal increase in a future year's taxable income; nevertheless, in the meantime, the insurer will have benefited from the time value of the excess deduction. (As we explain below, owing to the transition provisions of TRA86, there was an extra advantage for reserves in 1986 and 1987 and possibly for reserves in earlier years as well.) Of course, tax effects are not the only source

of incentives operating on the reserving decision. In some years, for example, management may have an interest in understating the insurer's loss reserves so as to boost reported financial earnings. In addition, any tendency to overstate reserves will be constrained to some extent by the threat of increased scrutiny by state regulators or by the Internal Revenue Service. (If a loss-reserve deduction is unreasonably large, the unreasonable amount of the deduction can be disallowed by the IRS [Treas. Reg. sec. 1.832-4(b)].)

TRA86 contained at least three provisions that should have significantly affected management's incentives with respect to loss reserving: First, TRA86 enacted the largest reduction in corporate income tax rates ever. Under the act, the corporate rate was scheduled to decline from 46 percent in 1986, to 40 percent in 1987, and, finally, to 34 percent in 1988. Second, TRA86 introduced the requirement that, in calculating loss-reserve deductions and inclusions for federal income tax purposes, insurers must discount loss reserves to present value.² Third, TRA86 included a special "fresh-start" transitional rule that applied to pre-1987 loss reserves, under which insurers were permitted to write down their end-of-1986 reserves to the discounted amount. Reserve increases due to *strengthening* in 1986 of *pre-1986* reserves were, however, not eligible for the fresh start.

The opportunities that were created by the tax rate changes to reduce effective tax burdens are straightforward. Overstating loss reserves (i.e., reporting "conservative" reserves) is a method of postponing taxable income. Thus, any dollar of taxable income that was postponed from 1986 to 1987 or from 1987 to 1988 would have generated \$.06 in tax savings (not including the usual benefit of deferral).

The fresh-start rule enacted in conjunction with the discounting requirement also created possibilities for reducing taxes by adjusting reserves. Under the fresh-start provisions, insurers could take loss-reserve deductions in pre-1987 tax years at their undiscounted value, while the corresponding *inclusions* in income in post-1987 tax years were on a *discounted* basis. The net effect was to provide a second deduction (deferred in time to a degree depending on the length of the payout tail on the line in question) for the difference between the discounted and the undiscounted total of reserves carried into the new regime on 1 January 1987. (The length of the tail of an insurance policy is the span of time from issue until all payments have been made.) Congress recognized that the fresh-start provision would give insurers an incentive to exercise their loss-reserving discretion so as to increase the amount of their loss reserves eligible for the fresh start. That is why the law expressly disallowed the application of

2. The discount rate and loss-payment pattern that insurers must use in discounting their reserves are promulgated by the Treasury Department. Under certain circumstances, an insurer may elect to use its own historical loss-payment pattern. TRA86 also contained several other changes that specifically altered the tax treatment of property-casualty insurers. For a discussion of some of these changes and an investigation of their effects on insurers' investment strategies, see Cummins and Grace (1992).

the fresh-start rule to reserve strengthening that occurred in the 1986 tax and reporting year. (For most insurers, the concepts *tax year* and *reporting year* coincide.) Under this rule, to the extent that an insurer increased its loss reserves in the 1986 tax year in a way that was deemed to be a reserve strengthening by the IRS, the insurer would in effect be required to treat that reserve strengthening as if it had been made in 1987, under the new discounting rules. To be more precise, the insurer would be permitted to deduct the undiscounted value of the reserve strengthening in the 1986 tax year, but it would also be required to return the amount of the discount into income in the 1987 tax year (Treas. Reg. 1.846-3[e]). Thus, insurers could increase the amount qualifying for the fresh-start advantage by increasing reported reserves on new policies written in 1986 and by increasing reserves on all other policies in 1985 or earlier. For example, if an insurer overstated its loss reserves in the 1986 tax year for policies written in 1986 and corrected the overstatement in some post-1986 reporting year, the initial loss-reserve deduction would have been taken at the larger, undiscounted value, and the later loss-reserve inclusion (resulting from the corresponding weakening of the overstated reserve) would have occurred at the smaller, discounted value. The fresh-start rule implied a similar incentive to overstate loss reserves in pre-1986 tax years, to the extent that companies anticipated the enactment of the discounting requirement.³

7.2 The Industry: Descriptive Statistics

The lines of insurance that are offered by property-casualty insurance companies can be described in a number of different ways. For the purposes of this paper, we use the five lines set out in table 7.1, which are the categories that were used by the industry before 1989.

3. The requirement that property-casualty loss reserves be discounted for federal income tax purposes was first proposed in June 1983 in a hearing before the Senate Finance Committee. The proposal was put forward both by the Treasury Department (see Chapoton 1983) and by the General Accounting Office (see Mavens 1983). Comments on the proposal were received at the same hearing from members of the insurance industry, including representatives of the American Insurance Association, the National Association of Independent Insurers, and the Alliance of American Insurers and representatives of a number of large insurance companies. The discounting requirement appeared then in 1984 as part of the Treasury Department's report to the president ("Treasury I"; see U.S. Treasury Department 1984). Subsequently, in President Reagan's 1985 tax-reform proposal ("Treasury II"; see U.S. Treasury Department 1985), a proposal was included that would have had the same effect as the discounting requirement proposed by the Treasury Department and by the General Accounting Office. Earlier in 1985, the GAO had published its report calling for, among other changes, the introduction of the discounting requirement (see U.S. General Accounting Office 1985). Finally, a provision quite similar to the Treasury Department and GAO proposals was enacted as part of TRA86. The proposal to reduce the top marginal corporate income tax rate from 46 percent ultimately to 33 percent also appeared in both Treasury I and Treasury II.

In related research, Logue (1996) examines the extent to which, in the period leading up to TRA86, the news of these two tax-reform proposals—the discounting requirement and the reduction in corporate tax rates—may have affected insurers' loss-reserving decisions and, in turn, the pricing and availability of some lines of insurance. This period roughly corresponded in time with the so-called liability-insurance crisis of the mid-1980s.

Table 7.1 Line Abbreviations

MI	“Miscellaneous”: farmowner’s, homeowner’s, and commercial multiple peril, ocean marine, aircraft (all perils), and boiler and machinery
AL	Automobile liability
WC	Workers’ compensation
OL	Other liability
MM	Medical malpractice

Note: In the pre-1989 statements, data for these lines were reported in the following parts of Schedule P: 1A (automobile liability), 1B (other liability), 1C (medical malpractice), 1D (workers’ compensation), and 1E (farmowner’s multiple peril, homeowner’s multiple peril, commercial multiple peril, ocean marine, aircraft [all perils], and boiler and machinery) (our “miscellaneous” line). After 1988, the same lines were reported as follows: 1A (homeowner’s/farmowner’s), 1B (private passenger automobile liability/medical), 1C (commercial automobile/truck liability/medical), 1D (workers’ compensation), 1E (commercial multiple peril), 1F (medical malpractice), 1G (special liability [ocean marine, aircraft (all perils), boiler and machinery]), 1H (other liability). To put the later data in the same categories as the earlier data, lines 1B (private passenger automobile liability/medical) and 1C (commercial automobile/truck liability/medical) of the 1989 form were added together to match the pre-1989 line 1A (automobile liability). Lines 1A (homeowner’s/farmowner’s), 1E (commercial multiple peril), and 1G (special liability [ocean marine, aircraft (all perils), and boiler and machinery]) from 1989 were added together to match the pre-1989 line 1E (farmowner’s multiple peril, homeowner’s multiple peril, commercial multiple peril, ocean marine, aircraft [all perils], and boiler and machinery). The remaining lines of insurance (workers’ compensation, medical malpractice, and other liability) were the same for both years, differing only by part designation within the schedule. Before 1989, the part designations were 1B (other liability), 1C (medical malpractice), and 1D (workers’ compensation). In 1989, the designations were 1D (workers’ compensation), 1F (medical malpractice), and 1H (other liability).

The lines are arranged in order of length of tail. Thus, the shortest-tailed line is the category *miscellaneous*, and the longest-tailed line is the category *medical malpractice*. We have used these line designations to organize the descriptive statistics in table 7.2, which is meant to provide a general picture of the total property-casualty market, specifically, of how much of the overall market is represented by each line of insurance.

Another way of illustrating the differing tail lengths, and the actual pattern of loss payments, for various lines is to use loss profiles. In table 7.3, we provide the standard loss profiles, for all five lines, that have been promulgated by the Treasury Department to be used in computing discounted loss reserves, as required by TRA86. The columns show, for each line, the assumed percentage of the incurred losses (and loss expenses) that have been paid by the end of the year specified in the row, relative to the accident year. The figures in boldface type indicate the years in which the year-to-year change in paid losses exceeds 4 percent of the total. Thus, table 7.3 displays clearly the different lengths of tails of the five lines. Table 7.4 shows the implied average time to payout for each line.

Table 7.5 shows the “loss ratios” for the industry, by line by accident year. The loss ratio is simply the ratio of incurred losses (including loss-adjustment expense) to earned premiums. Because of the deferral of payout under the long-tailed lines, one would expect their equilibrium loss ratios to be higher

Table 7.2 **Property and Casualty Insurance, Aggregate Statistics for 1993 (amounts reported in thousands)**

Line	Premiums Earned (RY 1993)	% Distribution of Premiums	Total Losses and Loss Expenses Incurred (AY 1993 reported in 1993)	Ratio of Losses to Premiums	Unpaid Loss Reserves for All Accident Years	% Distribution of Reserves
MI	41,502,943	25	33,299,942	80	36,522,008	14
AL	69,735,926	43	62,136,202	89	83,733,227	32
WC	30,311,809	19	24,733,279	82	67,077,085	26
OL	17,018,772	10	14,104,169	83	53,819,285	21
MM	4,278,988	3	5,316,464	124	19,560,549	8
Total	162,848,438	100	139,590,056	86	260,712,154	100

Source: Authors' calculations based on *Best's Aggregates and Averages* (various years).

Note: RY = reporting year. AY = accident year.

Table 7.3 Treasury-Specified Loss Profiles, 1988, by Line

	MI	AU	WC	OL	MM
AY + 0	56	34	26	9	3
AY + 1	79	65	55	25	13
AY + 2	86	80	68	40	23
AY + 3	91	89	76	55	36
AY + 4	94	94	80	66	45
AY + 5	97	97	84	75	54
AY + 6	98	98	85	80	61
AY + 7	98	98	87	84	67
AY + 8	99	99	89	87	72
AY + 9	99	99	89	88	75
AY + 10	99	99	90	89	78
AY + 11	100	100	91	90	81
AY + 12	100	100	91	91	83
AY + 13	100	100	92	92	86
AY + 14	100	100	92	93	89
AY + 15	100	100	100	100	100

Source: Treasury Department regulations. Table extended beyond AY + 10 according to Treasury rule of thumb and truncated at AY + 15.

Note: Figures given in boldface type indicate the years in which the year-to-year change in paid losses exceeds 4 percent of the total. AY = accident year.

Table 7.4 Average Time to Payout, by Line

Line	Average Time to Payout (years)
MI	1.2
AU	1.6
WW	3.1
OL	4.4
MM	6.3

Source: Authors' calculations on data from *Best's Aggregates and Averages* (1988).

than those of the short-tailed lines.⁴ (The reference in the table to the "post-1988" lines relates to the way the statistics are presented in the annual reports; the aggregation of policies used in this table differs from the standard described in table 7.1 in that automobile liability is split into two lines, private passenger and commercial automobile.)

We should point out that there is an element of apples and oranges in table 7.5. For the earlier accident years and especially the shorter-tailed lines in those years, the loss ratios are effectively the final result. That is, the loss ratios can be understood to be no longer an estimate or prediction of future loss pay-

4. For an extended discussion of the determinants of equilibrium premiums, see Bradford and Logue (1998).

Table 7.5 Loss Ratios by Accident Year (using post-1988 lines of insurance)

Accident Year	Homeowner's/ Farmowner's (MI)	Private Passenger	Commercial Automobile	Workers' Compensation (WC)	Other Liability (OL)	Medical Malpractice (MM)
1980	.76	.78	.84	.72	.83	1.47
1981	.69	.83	.91	.73	.99	1.68
1982	.75	.85	.97	.82	1.21	1.70
1983	.76	.88	1.09	.93	1.45	1.71
1984	.74	.95	1.20	1.07	1.66	1.47
1985	.79	.97	1.04	1.04	1.22	1.21
1986	.67	.92	.79	.95	.64	.81
1987	.65	.91	.75	.91	.56	.72
1988	.68	.91	.79	.93	.62	.75
1989	.83	.93	.84	.94	.70	.82
1990	.78	.92	.81	.93	.75	.98
1991	.86	.87	.80	.89	.78	1.13
1992	1.24	.88	.80	.86	.80	1.21
1993	.83	.90	.83	.82	.83	1.24
1994	.89	.90	.84	.80	.84	1.23

Source: *Best's Aggregates and Averages* (various years).

outs over premiums earned but rather an accounting of past payouts over premiums earned. For the later accident years, however, especially the longer-tailed lines in those years, the loss ratios continue to have a substantial element of uncertainty; thus, those ratios continue to be, to a substantial extent, in the nature of forecasts.

7.3 Tax Incentives Bearing on Reserves

As discussed above, when an insurance company writes a policy, it acquires, in addition to a right to receive a premium payment or series of such payments, an obligation to make a stream of future loss payments (dependent on contingencies). For the purpose of computing its annual underwriting income, the insurer starts with premiums accrued during the year. From this amount is deducted the amount of accrued premiums not yet earned (because they are for coverage to be provided in the next year); these accrued premiums are added to the "unearned premium reserve account," and to this amount is added the amount of premiums accrued in the past but earned in the current year, which premiums are subtracted from the unearned-premium-reserve account. (The details of the treatment of the unearned-premium-reserve account in the derivation of taxable income were changed by TRA86. For a discussion, see Bradford and Logue [1998].) The net result is the "earned-premium" income. The second major step in determining underwriting income for a given reporting period is the deduction for "losses incurred" during the period. This deduction consists of two parts: a deduction for the losses that were actually paid during

the period and a deduction for the increase in the unpaid-losses account (i.e., the loss reserves). (Recall that the loss reserves are the losses that the company has reason to believe have been incurred but have not yet been paid.)

With the passage of time, that is, as the insurer moves from one reporting year to the next, the insurer accumulates information about the policies that it has written in each accident year. As indemnity payments are made under those policies, the insurer shifts losses from the “unpaid” to the “paid” accounts. In addition, the insurer updates its estimates of total losses incurred under those policies. These two changes are implemented in the accounts by a combination of a deduction for the losses paid during the year and a deduction for any increase in loss reserves during the year. The latter is simply the difference between the end-of-current-reporting-year reserve and the end-of-previous-reporting-year reserve.

To see how this works, consider the case in which, in the current reporting year, there is no change in the estimate of the total losses incurred for a given past accident year—call it “accident year *X*.” In such a case, the unpaid loss account (loss reserves) will be reduced by the amount of loss expense paid during the year. Therefore, the deduction for losses paid during the current reporting year with respect to accident year *X* will be exactly offset by a *negative* deduction for the change in reserves. Because the end-of-current-reporting-year reserve for accident year *X* will be lower than the end-of-previous-reporting-year reserve for that accident year *by exactly the amount of losses paid during the year*, accident year *X* will have no underwriting-income consequences for the current reporting year.

Now consider the case in which, in the current reporting year, there is a change in the estimated total loss incurred with respect to a past accident year—again, call it accident year *X*. Such a change will result in a *further* change in the end-of-current-reporting-year loss reserve for that accident year, that is, a change in addition to the normal reduction in that reserve to account for paid losses. The point can be put more generally. If, in the current reporting year, an insurer increases its estimate of total incurred losses for a given accident year (i.e., the insurer strengthens that accident-year reserve), there will be a corresponding deduction from income in that reporting year in precisely the amount of the strengthening, holding all else constant. The flip side is also true. If the insurer reduces its estimate of total incurred losses for a given accident year (a reserve weakening), there will be a corresponding inclusion in income for that reporting year.

Thus, the sequence of deductions and inclusions in income that must be made by an insurer with respect to the loss side of any insurance policy is identical to the sequence of adjustments to the losses-incurred account for that policy—which, recall, represents the estimated total loss (paid and unpaid) with respect to that policy. Of course, the first time that the losses incurred for a given accident year in a given line show up in the insurer’s accounts is at the end of the accident year. That would be the only year in which the accident

year and the reporting year overlap. After that, any net deduction or inclusion in a given reporting year with respect to a given accident year would be the result of a revision in the total incurred losses for that accident year. If there is a fixed point in this sequence of adjustments, it would be when enough time has passed so that all liabilities with respect to an accident line and year are finally settled and the final losses-incurred number is known. Working back from that point, any variation in the incurred-loss estimate at the end of the previous reporting year results in offsetting changes in the income in the two adjoining reporting years.

So, whether intentional or not, an overstatement of total incurred losses at the end of the next-to-last reporting year results in a deduction from that year's income that is balanced by an equal extra inclusion in income in the last reporting year. This is the mechanical result of the income calculation: deduction of the sum of losses paid during the year and the excess of the end-of-year loss reserve (zero in the last year) over the end-of-previous-year loss reserve. The same reasoning applies as one works back from year to year. A decision to overstate loss reserves by one dollar in one year implies—other things, including future loss reserves, equal—a reduction in this year's income by a dollar and the addition of a dollar to the following year's income.

To this point in the analysis, we have assumed that loss reserves are not discounted to present value. In the case of discounted reserves, the analysis is slightly different. In this case, a one-dollar overstatement of reserves in one reporting year produces an extra deduction of less than a dollar in that year, namely, the discounted value of the future payment implied by the addition to total estimated payouts.⁵ Consequently, adding a dollar to the total incurred-loss estimate in a year results in a deduction from income in that year of some amount less than a dollar. As in the undiscounted case, however, a reduction in this year's income by a dollar implies—other things, including future loss reserves, equal—the addition of a dollar to the following year's income. The deferral effect of overstatement is the same, but the deferral per dollar of overstatement is reduced, relative to the undiscounted case.

The tax and accounting-income consequences of the choice of stated reserves in a given reporting year can thus be fully summarized by the implications for the income calculations in that year and in the next year. To determine the tax incentive to add a dollar to the incurred-loss estimate in a year, we therefore need to know the tax rate applicable in the adjacent years as well as an estimate of the discount rate applied by companies to variation in the cash flow due to changes in the tax liabilities in the adjacent years.

The incentive bearing on the reserving decision depends on the company's anticipation of future tax rates. The rate applicable to a given company will

5. The factor by which undiscounted reserves are multiplied to get discounted reserves depends on the profile of remaining payments to be made under a policy. It will tend to be larger the later in the life of a policy. However, if the payment profile is "humped," the factor applicable to a given line and accident year could actually decline from one year to the next.

Table 7.6 Anticipated Federal Income Tax Rates

Anticipated in	Tax Rates in	
	Current Year	Next Year
1976	.48	.48
1977	.48	.48
1978	.48	.46
1979	.46	.46
1980	.46	.46
1981	.46	.46
1982	.46	.46
1983	.46	.46
1984	.46	.46
1985	.46	.46
1986	.46	.40
1987	.40	.34
1988	.34	.34
1989	.34	.34
1990	.34	.34
1991	.34	.34
1992	.34	.34
1993	.35	.35
1994	.35	.35

Source: Commerce Clearing House (1996, vol. 1, sec. 3265.0129–.0139).

depend on its particular circumstances as well as the tax law. For the case of a company that is continually subject to tax at the full tax rate, the variation in taxes depends on the statute. Statutory corporate tax rates have changed from time to time. Sometimes tax legislation specifies the future course of tax rates. For purposes of this exercise, we assume that companies know the tax rate applicable in the current reporting year and for future years believe the tax rates specified in legislation as of the end of the current reporting year. Table 7.6 sets out the tax rates used in our calculations for each year.⁶

To calculate the net benefit from deferral, we require a discount rate. In table 7.7, we have used the yield, after taxes, on one-year Treasury bonds to determine the addition to the after-tax bottom line in a given year of adding a dollar to loss reserves (holding future reserves constant). Thus, the tax payoff to insurers of overstating reserves has generally been a function of prevailing interest rates and of anticipated reductions in tax rates. The overstatement payoffs in 1986 and 1987, for example, were notably high by historical standards (\$0.07 and \$0.06 per dollar, respectively) owing to the anticipated reduction in corporate tax rates.

Given the assumptions about insurers' expectations regarding tax rates and

6. Logue (1996) explores the possibility that tax-rate changes may have been anticipated by insurers before 1986 and so influenced their behavior at an earlier point.

Table 7.7 Tax Deferral Gain Due to One Extra Reserve Dollar

Reporting Year	Discount Factor	Tax Saving This Year	Extra Tax Next Year	Before-Tax Interest Rate	After-Tax Interest Rate	Current Value of Next Year's Extra Tax	Present-Value Payoff per Extra Dollar of Reserves
1976	1.00	.48	.48	5.88	3.06	.47	.01
1977	1.00	.48	.48	6.09	3.17	.47	.01
1978	1.00	.48	.46	8.34	4.50	.44	.04
1979	1.00	.46	.46	10.65	5.75	.43	.03
1980	1.00	.46	.46	12.00	6.48	.43	.03
1981	1.00	.46	.46	14.80	7.99	.43	.03
1982	1.00	.46	.46	12.28	6.63	.43	.03
1983	1.00	.46	.46	9.58	5.17	.44	.02
1984	1.00	.46	.46	10.91	5.89	.43	.03
1985	1.00	.46	.46	8.42	4.55	.44	.02
1986	1.00	.46	.40	6.46	3.87	.39	.07
1987	.80	.32	.27	6.77	4.47	.26	.06
1988	.80	.27	.27	7.65	5.05	.26	.01
1989	.80	.27	.27	8.53	5.63	.26	.01
1990	.80	.27	.27	7.89	5.21	.26	.01
1991	.80	.27	.27	5.86	3.87	.26	.01
1992	.80	.27	.27	3.89	2.57	.27	.01
1993	.80	.28	.28	3.41	2.22	.27	.01
1994	.80	.28	.28			.28	.00

Source: Interest rates, Federal Reserve Board data, [gopher://gopher.town.hall.org/other/fed/h_15](http://gopher.town.hall.org/other/fed/h_15); discount factors as described in Bradford and Logue (1998).

Note: One-year interest rates are the simple arithmetic means of one-year Treasury bond yields during the year. The 1986 row refers to strengthening of past years. The factor for 1985 ignores the fresh-start rule (see the text). The discount factors after 1986 are the simple average of the 1987 factors for AY + 0 to AY + 10. (AY = accident year.)

interest rates in table 7.6, the overstatement payoff described in table 7.7 would apply to any reserving decisions *except those affected by the fresh-start rule*. The fresh start changes the story. For those reserves to which the fresh start was expected by insurers to apply, the reserve-overstatement payoff was increased beyond the amounts described in table 7.7. To what reserves might insurers have plausibly expected the fresh start to apply? TRA86 specifically provides that the fresh start applies to all property-casualty reserves outstanding as of the end of 1986, with the following exception: it does not apply to any reserve strengthening reported in 1986. Thus, for any reserve strengthening made in 1986, the analysis in table 7.7 would apply. But the analysis is different for any new policies written in 1986 and (to the extent that companies anticipated TRA86's introduction of discounted reserves and of the fresh-start rule) any new policies written in (or strengthening reported in) 1985 or earlier.

Under the fresh-start rule, for example, the present value of one dollar of reserve overstatement in the 1986 tax year for the 1986 accident year depends on the line of insurance. This is because the effect of the rule is to offset a deduction of a dollar in 1986 with an inclusion of the discount factor in 1987. The discount factor is larger the longer the tail of the insurance in question (because the payments are more distant in the future). Therefore, the tax-reducing value of an extra dollar of reserves is larger for the longer-tailed lines. Table 7.8 spells out the details. The fresh-start rule substantially increased the incentive to overstate reserves in 1986 (for policies covering 1986), compared with the incentives resulting from the declining tax-rate effect taken by itself. For medical malpractice, for example, an extra dollar of reserves on a new policy, holding constant the end-of-1987 reserves, was worth the equivalent of \$0.19 in after-tax income in 1986. A comparable incentive applied to reserves for accident years 1985 and earlier at the end of the 1985 reporting year, to the extent that the fresh-start rule was anticipated then.

It is easy to become confused about the various tax incentives. To review, the incentive effect of the change in tax rates applied to all reserves at the end of 1986 and 1987. Strictly speaking, the rate reductions for 1987 and 1988 did not imply any extra incentive to add to reserves in 1985 since the same benefit could be obtained by strengthening reserves in 1986. (If strengthening reserves is itself costly, for example, if it attracts extra regulatory scrutiny, then the extra payoff to reserves at the end of 1986 would have an *indirect* incentive effect on reserving in 1985 or even earlier.) The incentive effect owing to the fresh-start rule (combined with the rate-change effect) applied to new reserves established during 1986 (i.e., to reserves for policies covering accident year 1986). The fresh-start effect also had a *direct* effect on the incentive to add to reserves (for all accident years) at the end of 1985 to the extent that the new tax policy was anticipated. In this case, the extraordinary tax benefit was the result of carrying the higher reserves into 1987.

Table 7.9 gives an idea of the magnitudes involved in the fresh-start rule as it affected losses incurred in 1986. (For a discussion of the predicted effect of

Table 7.8 Gain from an Extra Dollar of Reserves of New Policies in 1986: The Effect of the Fresh-Start Rule

Line	Discount Factor	Tax Saving This Year	Extra Tax Next Year	Before-Tax Interest Rate	After-Tax Interest Rate	Current Value of Next Year's Extra Tax	Payoff per Extra Dollar of Reserves
MI	.89	.46	.36	6.46	3.87	.34	.12
AL	.89	.46	.36	6.46	3.87	.34	.12
WC	.81	.46	.32	6.46	3.87	.31	.15
OL	.77	.46	.31	6.46	3.87	.30	.16
MM	.69	.46	.28	6.46	3.87	.27	.19

Sources: Interest rates, Federal Reserve Board data, gopher://gopher.town.hall.org/other/fed/h_15; discount factors as described in Bradford and Logue (1998).

Note: One-year interest rates are the simple arithmetic means of one-year Treasury bond yields. The discount factors are the simple average of the 1987 factors for AY + 0 to AY + 10. (AY = accident year.)

Table 7.9 Losses Incurred in 1986 and Fresh Start (loss reserves for accident year 1986, reported in 1986, amount reported in thousands)

Line	Reserves for AY 1986 at Year-End 1986 (1)	Premiums Earned for AY 1986 (2)	Loss Incurred in AY 1986 Reported in 1986 (3)	Payoff to Extra Dollar of Reserves (%) (4)	Estimated Saving Due to Fresh-Start Rule (col. 1 × col. 4) (5)	Estimated Saving from 10% Increase in Incurred-Loss Estimate (10% of col. 3 × col. 4) (6)
MI	9,705,812	32,284,313	19,206,091	12	1,144,212	226,419
AL	23,500,447	41,133,219	33,550,013	12	2,740,056	391,179
WC	12,019,927	19,039,001	15,376,597	15	1,779,845	227,688
OL	11,841,432	16,188,897	12,262,955	16	1,946,029	201,530
MM	3,450,089	3,509,158	3,500,588	19	671,926	68,176
Total	60,517,707	112,154,588	83,896,244		8,282,068	1,114,993

Source: Authors' calculations based on *Best's Aggregates and Averages* (various years).

Note: AY = accident year.

the fresh-start rule on premiums, assuming no variation in any tax-induced bias in reported loss reserves, see Bradford and Logue [1998].)

An implication of this analysis of the tax incentives bearing on the reserving decision is that, apart from 1986 and possibly for strengthening in 1985, the marginal payoff to an extra dollar of reserves is the same for all lines and accident years. That is, with the exception of the fresh-start effect, any difference in tax-motivated reserving behavior from line to line or accident year to accident year must be related to the differences in the regulatory, financial, and other nontax consequences of variation in the reported loss reserves.

7.4 Reserving Seen in Industry Data

Industry aggregate data are suggestive of behavior consistent with tax-influenced reserving. Figures 7.1–7.5 attempt to capture the pattern of reserve strengthening that occurred in the various lines (running from short to long tailed). The graphs show the ratio of (a) the incurred loss estimate at the end of each year after the accident year to (b) the estimate at the end of the accident year (i.e., the first reported figure). All the curves start at one. A rising link in a curve indicates that the reserve for the given accident year was strengthened in the reporting year in question. In that sense, it means that the accident-year reserve was understated in the prior year. A falling link in a curve indicates reserve weakening for that accident year in the reporting year in question. In that sense, it means that the accident-year reserve was overstated in the prior year. The augmented tax incentive to bias reserves would imply, for pre-1985

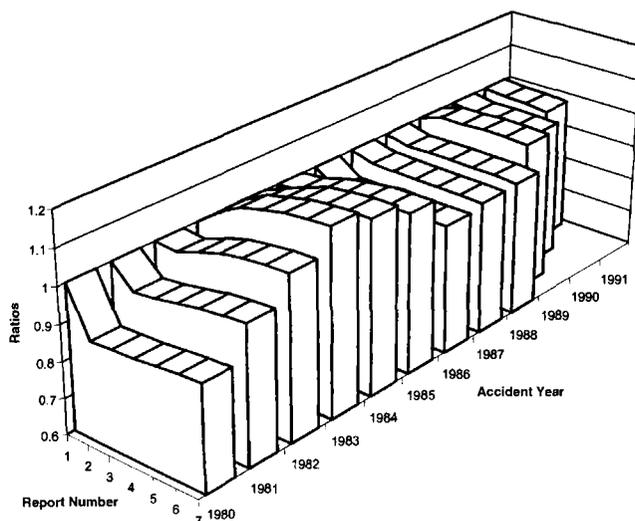


Fig. 7.1 Incurred-loss estimates by years since accident year: MI

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

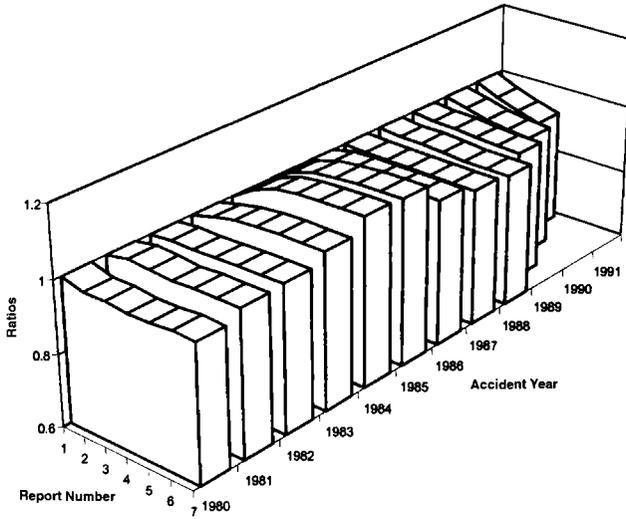


Fig. 7.2 Incurred-loss estimates by years since accident year: AL
 Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

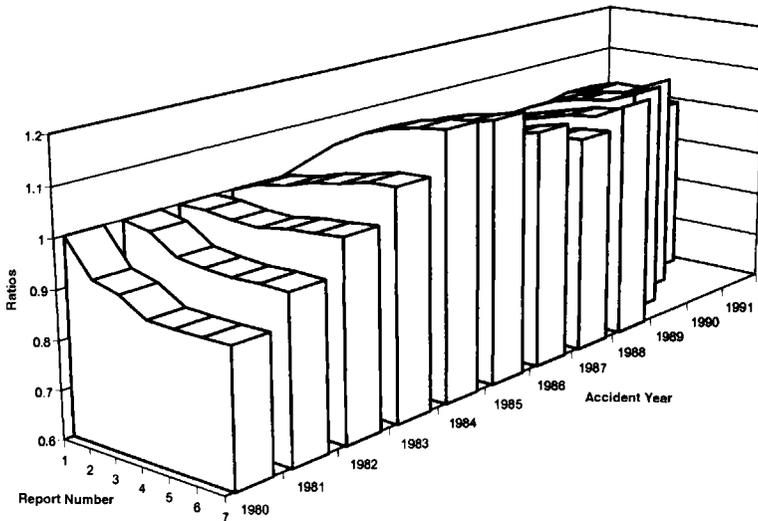


Fig. 7.3 Incurred-loss estimates by years since accident year: WC
 Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

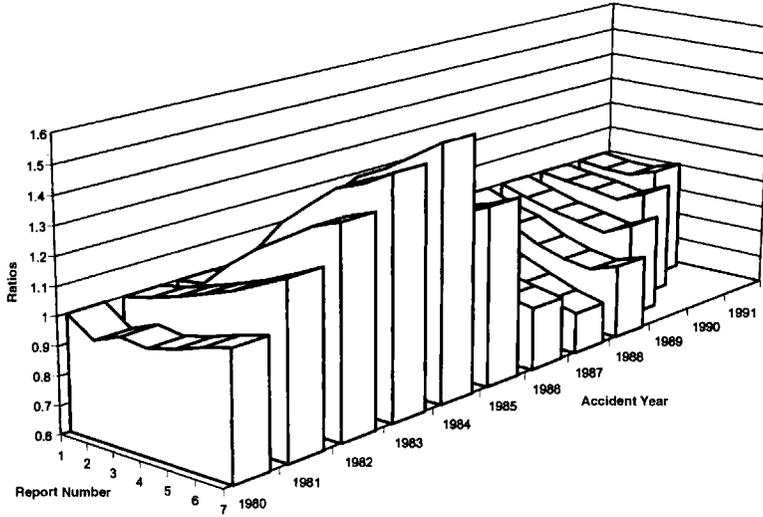


Fig. 7.4 Incurred-loss estimates by years since accident year: OL

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

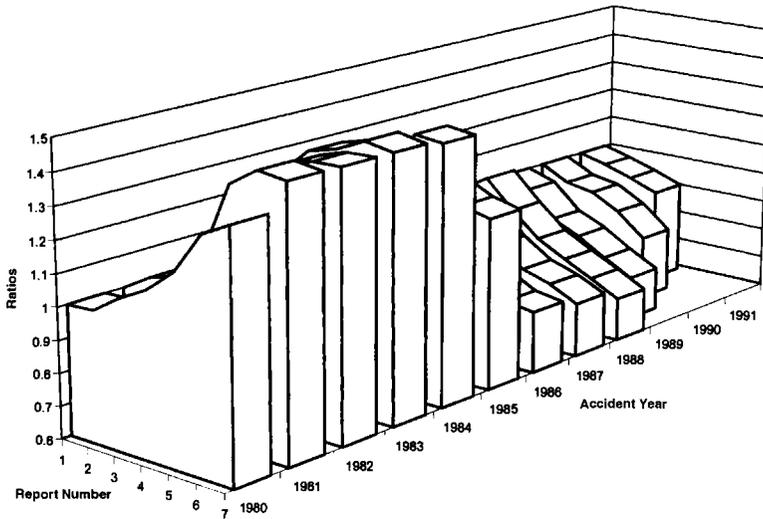


Fig. 7.5 Incurred-loss estimates by years since accident year: MM

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

accident years, rising links corresponding to reporting years 1985 and later. For the 1986 and 1987 accident years, and for 1985 to the extent that the restriction on the fresh-start rule was anticipated, one would expect that a tax-induced overstatement of initial reported losses incurred, followed by subsequent reserve weakening (downward links) as the policies matured toward their ultimate payout. For accident years 1988 and later, one might expect a reversion to something like the pattern of earlier years.

Since the incurred losses are subject to considerable uncertainty, it is not possible to draw conclusions from the industry data with great confidence. The pictures, however, appear broadly consistent with the description just given. In the 1986 accident year, especially in the long-tailed lines (see figs. 7.4 and 7.5), there is a substantial shift in the downward direction in the curves—suggesting overstatement of the initial 1986 reserves that subsequently required weakening. Note also the 1985 accident year for the long-tailed lines. That is the first accident year to show a substantial change in reserving direction; that is, although the 1985 reserves ultimately had to be strengthened, they had to be strengthened by considerably less than the 1984 accident-year reserves. Until 1985, the degree of strengthening in the long-tailed lines had been increasing for several years.

The picture after 1987 is less obviously consistent with our hypothesis. We would have expected the reserves in those years, when the tax incentive was no longer so strong, to return to the pre-1986 patterns. But that did not happen. The post-1987 accident-year reserves were, like the 1986 reserve, initially overstated (thus the downward character in the curves). There is no obvious tax-related explanation for this trend. For some reason, over the course of one or two years, the property-casualty insurance industry became more conservative in its reserving decisions, and, what is difficult to explain (at least from a tax-avoidance perspective), the change in this tendency stuck. One possible explanation is that, putting aside the temporary tax incentive to overstate reserves created by the fresh-start rule, there was generally a greater incentive to overstate reserves after TRA86 than before simply because, after the act, property-casualty insurers had more taxable income. That is, before the act, because of the undiscounted reserving, among other things, the insurance industry in the aggregate had relatively little taxable income anyway, whereas, after the act, the industry had considerably more income that was potentially taxable.⁷ Another possibility, of course, is that—for reasons unrelated to taxes—insurers became more conservative in their estimates of loss reserves.

Table 7.10 attempts to capture the extent of conservatism in the initial incurred-loss report in the form of the ratio of the report five years later to the initial report. So, for example, according to the table, the incurred loss figure for automobile liability for accident year 1985 was up by 7 percent at the end of 1990, relative to the initially announced level. Relatively high numbers mean

7. For further discussion of this possibility, see Logue (1996).

Table 7.10 Incurred-Loss Estimates Five Years Out (summary: ratio of losses, report 5 to report 1)

Accident Year	MI	AL	WC	OL	MM
1980	.88	.98	.88	.99	1.18
1981	.97	1.01	.94	1.12	1.39
1982	1.05	1.01	1.00	1.24	1.40
1983	1.11	1.04	1.06	1.36	1.41
1984	1.08	1.07	1.14	1.38	1.27
1985	1.05	1.07	1.13	1.16	1.21
1986	.96	1.02	1.07	.87	.86
1987	.98	.99	1.04	.81	.85
1988	.98	.98	1.07	.85	.83
1989	1.03	.98	1.08	.90	.79
1990	.99	.95	1.09	1.00	.81

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

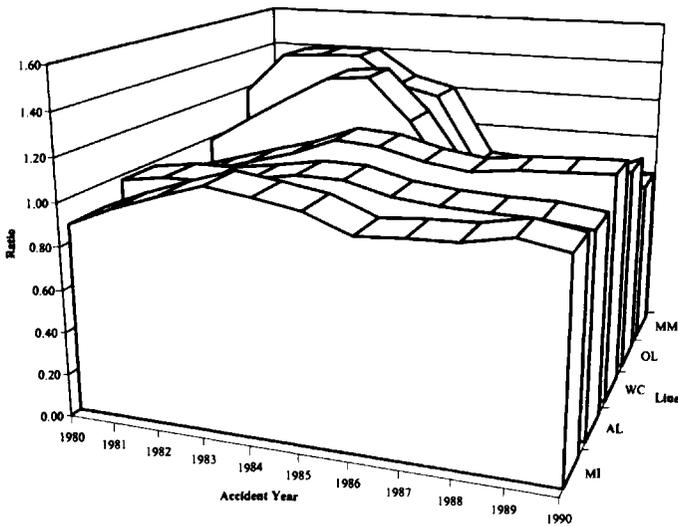


Fig. 7.6 Loss estimates five years out: ratio to initial estimates

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

relatively low initial reserves. Particularly for the long-tailed lines, there appears to be a break at 1986. Figure 7.6 displays the same information graphically.

Table 7.11 presents data on the extent of reserve strengthening (relating to past accident years) in reporting years 1983–94. Each cell reports, for that reporting year, the average over the five most recent accident years of the ratio of

Table 7.11 **Average Year-to-Year Increase in Incurred-Loss Reports, Reporting Years 1983–94**

Line	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
MI	.02	.12	.13	.09	.08	.04	.04	.00	.00	.00	-.01	-.05
AL	-.01	.00	.05	.01	.02	.01	.01	.00	-.01	-.04	-.04	-.05
WC	-.05	.00	.01	.04	.04	.06	.03	.04	.06	.05	.00	.05
OL	.01	.08	.11	.10	.09	.04	.03	.00	-.03	-.05	-.04	.08
MM	.03	.06	.26	.08	.02	.02	.08	-.08	-.08	-.05	-.08	-.09
Average	.00	.05	.11	.06	.05	.03	.04	-.01	-.01	-.02	-.03	-.01

Source: Authors' calculations based on data from *Best's Aggregates and Averages* (various years).

Note: Cells show average for the five most recent accident years of the fractional increase in the sum of paid and unpaid losses. (For 1983, three accident years are included and, for 1984, four accident years.)

the increase in the total incurred loss estimate (i.e., the sum of paid and unpaid losses) to its previous level. (Because the data extend back only to 1980, for 1983 three past years are accounted for, and for 1984 four past years are accounted for.) Finally, we have noted that the incentive to *strengthen* reserves on past accident years was strongest in 1985 to the extent that the fresh-start rule was anticipated. Otherwise, the incentive effects of the tax-rate changes from 1985 to 1986 and from 1986 to 1987 reflected in table 7.7 above apply. The bottom line of the table presents the simple averages of the averages. Here, one sees a pattern generally consistent with the influence of the tax incentives, including something of a reversion to roughly zero strengthening in the more recent years.

7.5 Concluding Comments

In this paper, we have explained how the federal income tax rules, and especially changes in those rules, have combined with financial market circumstances (interest rates) to create incentives bearing on property-casualty insurers' decisions regarding the level of loss reserves to report. We find that these incentives have varied substantially over time. In particular, transition effects due to the Tax Reform Act of 1986 created unusually large incentives to overstate reserves in reporting years 1985–87. We would emphasize that, because they amount to forecasts of quite variable quantities, reserves are inevitably subject to correction over time. Furthermore, taxes are not the only sources of biasing incentives that may vary from time to time. Still, the picture in aggregate industry data that we have assembled is broadly consistent with the tax-motivated reserving hypothesis. In work in progress, we hope to tease additional insights about reserving from the quantitative record.

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Comment Ross J. Davidson Jr.

When Ken Froot asked me to discuss this paper, I was quick to remind him that I am neither a reserving actuary nor a tax expert. He was either desperate for another discussant or thought that my involvement in capital management, financial exposure management, and insurance regulatory capital issues over the past few years could add a unique perspective to this topic.

But I must admit to an agenda in agreeing to discuss this paper. I am currently coordinating the Technical Advisory Group to the National Association of Insurance Commissioners (NAIC) Catastrophe Reserve Subgroup. This group is composed of approximately forty individuals who represent insurers, insurance brokers, catastrophe-modeling firms, investment banks, accounting, legal, and actuarial firms, and federal government agencies. They are a collection of very talented people, with broadly ranging expertise in actuarial science, tax, accounting, economics, capital markets, and state and federal regulatory affairs. We are charged with advising a group of state regulatory officials who represent the NAIC on the rationale, appropriate design, economic effects, and implementation of a reserve for future catastrophes. Annual additions to this reserve would be deductible for federal tax purposes, and draw-downs against the reserve would flow into taxable income, allowing smoothing of insurer results. Since this reserve is intended to provide insurers with incentives to write catastrophe coverage in hazard-prone areas while improving the financial strength of such insurers, I have more than a casual interest in any study that seeks to gauge the effect of changes in tax law on insurance reserving practices. The question is, Will the desired market and capital retention behavior be induced by tax incentives? Alternatively, if a reserve is mandated, can it be designed to be an efficient mechanism?

In fact, before I read Bradford and Logue's paper, I expected that it might be an answer to my prayers. The fundamental premise that income tax rules could influence reserving practices is closely related to the premise that reserving requirements that include tax incentives could influence an insurer's decisions to write hazard insurance. In fact, the very techniques by which Bradford

and Logue sought to ferret out past behaviors induced by tax-law changes could form the basis of predictive behavior models that could help shape and direct the debate on reserving practices that include tax incentives. What's more, maybe after our discussion more of you will want to develop a method to predict the influences on market behavior and financial strength of tax-deductible catastrophe reserves. As we have seen, Howard Kunreuther and the Wharton school are beginning to build some of the infrastructure models for such a project.

Now, more to the topic of the paper, I will not seek to comment on the elegance of the formulas or the correctness of the statistical analysis or even the authors' attempts to deal with imperfections in or paucity of the data, but I will attempt to address the relevance of the paper and its conclusions to insurance management and regulation and will point out some dimensions of the paper that, if broadened, might be useful to practitioners.

Occasionally, I look at the last page of a book before I begin reading it. This has the risk of being like eating dessert first. It can stimulate the taste buds, but the rest of the meal may seem somewhat pedestrian. But I must say that, when I read the conclusion of this paper first, I did not have that experience. In fact, I found the reading of the paper, the main course if you will, to be far more satisfying than the conclusion (the hoped-for dessert). Remember the feeling you get when you're engrossed in an intense television program (maybe your favorite soap or "Star Trek" mutant) that seems to be approaching the climatic scene, only to see *to be continued* appear on the screen. I relived that feeling as I read the conclusion of this paper. To paraphrase, while from an industrywide perspective some tax-induced reserving behavior can be detected, other influences may in fact be causing the observed behavior. Moreover, the jury is still out on how to adequately measure the tax-incentive-influenced behavior of industry sectors or individual insurers with different tax characteristics. Admittedly, this is a very complicated subject that must be simplified. However, any tax-motivated behavior must be evaluated in balance with other important non-tax factors that influence management decisions. As the authors continue their exploration, I encourage them to evaluate the influence and correlation of some of the following factors on past and future reserving behavior.

Effect of Alternative Minimum Tax (AMT)

This change in the tax law had a profound effect on property and casualty insurers and may even have modulated any reserving behavior influenced by tax incentives. Before AMT, varying the mix of taxable and tax-exempt investment income was a dominant tax-minimization strategy. After AMT, property and casualty insurers could no longer use investment mix as a dominant tool to minimize taxable income. With the AMT, many property-casualty insurers became taxpayers for the first time, and, having their options limited, they may have looked more carefully at reserving practices to modulate their taxable income.

The Uncertainty Factor

As I collected comments on the paper from USAA's reserving actuary, she reminded me that her job is not all science. A significant amount of uncertainty is involved in reserve estimation, especially for the long tail lines that seem to have demonstrated some evidence of change in the target period. New developments in cost and litigation can often dramatically change perceptions and give the impression that someone may have been cooking the books when in fact more information had led to a different expectation of loss development.

Changes in development of claims on other liability, especially environmental and asbestos claims during the 1980s, are a good example. Around the same time as the 1986 tax act, there were dramatic changes in the perception of insurers writing these coverages as to the development of claims. Many insurers were adding massive amounts to their reserves as the specter of increased costs of litigation and recovery loomed. Another example is the effect on medical malpractice claims of recent lower health care costs and a trend to a less litigious environment.

The Effect of the Competitive Cycle and Interest Rates and Inflation on Underwriting

The early to mid-1980s were years of dramatic change in interest rates and inflation, both of which greatly affect profitability. The transition out of high inflation and interest rates to lower rates caused many insurers to reevaluate the role of underwriting results in the profitability equation. If insurers were prone to use the underwriting component to smooth earnings, they would have found the mid-1980s to be an especially tempting time to do so.

The Limited Opportunity for Undetected Reserve Manipulation in Short-Tail Lines like Automobile Liability, Homeowner's, and Marine

Because of their relatively short development life cycle, these lines may not have allowed for enough flexibility for undetected tax-incentive-influenced reserving variations. Longer tail lines do, owing to the sheer larger number of years that it takes you or others to know if you were wrong.

The Complex and Dynamic Regulatory Scene

Regulators use many more tools than the premium-to-surplus ratio to determine the financial health of their regulated companies. In fact, they look carefully at the development of reserves, believing that most insurers are habitually underreserved. The fact that an insurer strengthened reserves may play more heavily on a regulator's view of the financial strength of an insurer than is credited by the authors. The NAIC has a couple of sets of ratios, some of which more directly go to the point of reserve adequacy. Financial hazardous condition laws use the so-called ratios to provide regulators with the authority

to intervene in a company's management if negative trends develop in income, surplus, liabilities, etc.

More recently, the advent of risk-based capital has become more important than the surplus liquidity ratio, although its effect may be relatively similar to the premium-to-surplus ratio.

Rating Agency and Stock Analysts' Perceptions Are Not Exclusively Based on Earnings

Like regulators, rating agencies and stock analysts are just as interested and were maybe uniformly more sophisticated in the 1980s in assessing the adequacy of reserves in the capital sufficiency equation.

While the authors note in their conclusion that the measures they explored and the data set that they used did not lend themselves well to effective in-sector analysis, nonetheless there are fairly significant differences in how segments of the property-casualty industry might behave. Some of those include the following:

Stock and Nonstock Insurers. Insurers organized as stockholder-held entities are driven by different motives. They seek to please Wall Street, are more inclined to shorter-term tactical decisions, and may view reported earnings with a higher priority than nonstocks. Having worked for both types of organizations in my career, I can testify to the vast difference.

Capital Rich and Capital Poor Insurers. This can be a major motivator since those insurers that may be perceived as having too much capital will tend to try to reserve robustly and be less sensitive to tax-law changes.

Large and Small Insurers. Some insurers write only in one state and as a result are not affected as much by national insurance regulatory schemes such as the NAIC.

Another effect to be considered is *the dominance of one or a few* insurers in the data. In industry studies, we have found that State Farm and several other insurers dominate the outcome of any industry trends. Techniques to normalize for size of insurers seem to yield vastly different results.

Back to "As the World Turns"

I believe that the exploration done here may form the basis of very important research as the national debate on catastrophe management begins to consider tax-incentive-influenced reserving for catastrophes. The foundation of that effort is that tax incentives will produce behavior on the part of insurers and other capital providers that will help deal with solvency and availability issues in the hazard-insurance market.

Several points may give us perspective on this issue. While catastrophe risk

can be managed in a number of ways, the bottom line is that the capital to cover these risks must come from somewhere—ultimately either current or future policyholders (the primary risk takers) or current or future taxpayers. Tax policy can either support or work against appropriate accumulation and allocation of that capital. The current taxation of profits or losses from catastrophe coverage works against the optimal allocation of capital. Even the carry-back and carryforward rules intended to allow for temporal variation of results are inadequate to deal with the time frames that we encounter in managing exposures to megacatastrophes. Catastrophe reserves must fit into the overall framework of capital for catastrophe-management tools. A good balance must be struck with other capital resources.

One implication of these points is that tax policy must be used very carefully when attempting to modify capital accumulation and allocation behavior.

If the techniques explored in this paper for ferreting out tax-motivated historical behavior can be refined and applied prospectively to predict future tax-incentive-influenced behavior, the nation will have been well served in the upcoming debate on tax-deductible catastrophe reserves. I hope that the script of the next episode in this to-be-continued development will address these issues. I also hope that many of you will be similarly inspired to explore this new and exciting frontier. It may help us practitioners carry the catastrophe-management ball a little farther down the field.

Comment James R. Hines Jr.

This paper offers a very readable description of the U.S. tax treatment of insurance loss reserves, which is a significant accomplishment, and goes on to analyze the industry's reactions to the incentives introduced by the Tax Reform Act of 1986. The evidence is consistent with an important effect of tax incentives on loss-reserve accounting, although the available data are so limited that it is difficult to measure precisely the magnitude of the effect. Nevertheless, the notion that insurers adjust their loss reserves in response to changes in tax incentives is consistent with other well-documented aspects of firm behavior and is of sufficient importance to be worthy of careful investigation.

The nature of the insurance industry makes income measurement particularly challenging, which in turn makes the taxation of its income a very difficult exercise. The arcane and somewhat arbitrary tax rules that Bradford and Logue describe are required in order to implement a system that attempts to tax the annual flow of income in a line of business in which one year's activities

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generate a stream of future liabilities the present value of which is highly uncertain. Since the 1977 publication of *Blueprints for Basic Tax Reform*, David Bradford has been a leading proponent of replacing the income tax with a consumption tax, maintaining that the consumption tax is not only more efficient than an income tax but also easier to administer. Bradford's recent work includes careful descriptions of various complex parts of the Internal Revenue Code that are always to the point but that also always subtly remind the reader of the tangled web that an income tax represents (see, e.g., Bradford 1986; and Ault and Bradford 1990). This paper falls squarely in that tradition.

It is instructive to consider the incentives facing those in the insurance industry who select loss-reserve levels for their firms. Firms generally have tax incentives to overstate their loss reserves even in the absence of legislative transitions such as those introduced by the 1986 act. Increasing reserves reduces present taxable income by the same amount that it increases future taxable income. This is a profitable exercise as long as there is a positive time value to money. The uniformly positive numbers that appear in the rightmost column of Bradford and Logue's table 7.7 in part reflect this incentive. In an extreme case, a firm with carte blanche to select its loss reserve level can, by increasing the loss reserve sufficiently each year, reduce to zero its tax liability in every period.

What prevents taxable firms from greatly increasing their loss-reserve levels and enjoying the accompanying tax benefits? It is probably the case that several considerations conspire to prevent them from doing so. The first of these is oversight by the Internal Revenue Service, which can disallow unwarranted deductions and which can make life unpleasant for taxpayers deemed to have taken unwarranted deductions. The second is oversight by shareholders and bondholders, who may have difficulty distinguishing tax-motivated reserve increases from those that reflect true economic risks to the firm. As a result, share values, bond ratings, and managerial compensation may fall in reaction to announcements of higher loss-reserve levels. The third is oversight by state regulators, who are concerned about the relative magnitudes of assets and liabilities and who may also interpret higher loss-reserve levels as reflecting greater liabilities. The fourth consideration is professional custom and other human habits that prevent firms from optimizing on all margins all the time.

Consequently, the responsiveness of reserve levels to tax changes appears against a background in which firms do not fully optimize against the tax system owing to one or more nontax frictions. The inability or unwillingness of insurers to adjust their reserve levels to minimize tax liabilities is analogous to widely observed behavior in which firms fail to take full advantage of their opportunities to overstate their expenses or understate their incomes in order to reduce tax liabilities. One example is the choice of inventory-accounting method. In the presence of any amount of inflation, firms reduce their tax liabilities by substituting last-in, first-out for first-in, first-out inventory accounting. In spite of this incentive, a significant number of firms persist in using

first-in, first-out accounting. A second example concerns the choice of depreciation method for tax purposes. Accelerated depreciation schedules, when available, generally enhance the present value of depreciation allowances—but, in spite of this advantage, they are not universally employed. The case of depreciation allowances is all the more thought provoking in that there is no requirement (as there is in the case of inventory accounting and loss-reserve accounting) that the same methods must be used for both tax calculations and financial statements.

In spite of the likely presence of nontax frictions, the loss-reserve behavior documented by Bradford and Logue is broadly consistent with the tax incentives introduced by the 1986 act. Loss reserves rise at the same time that incentives to overstate them rise, doing so most visibly in the long-tailed lines of business in which one would expect to see the strongest reaction. It is, however, impossible to draw any strong statistical inferences from the behavior of a sample of just five lines of business around one event date (1986). Furthermore, the changing legal environment of the mid-1980s that was responsible for rising liability awards may itself have encouraged insurers to expand their loss reserves in a way that could appear to have been tax motivated. While the evidence is highly suggestive of tax-motivated behavior, it simultaneously reflects all other secular changes that influence insurance reserves.

Part of the attraction of studying the industry's reaction to events around 1986 is that doing so affords insight into the extent to which tax and nontax considerations influence reserve levels during unspectacular periods. A finding that reserve levels respond dramatically to tax changes in turn suggests that reserves are significantly overstated on a chronic basis owing to the tax incentive that arises from discounting. Since the paper in fact reports evidence that reserves react significantly to tax transitions, it follows that reserves in normal years typically overstate expected future liabilities. This inference in turn carries any number of implications for tax and regulatory policy as well as implications for the way in which financial markets should react to announcements of changes in loss reserves. So there is quite a bit of interesting work to be done in addition to this very useful analysis of reactions to the Tax Reform Act of 1986.

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