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THE INFLUENCE OF INCOME TAX RULES ON INSURANCE RESERVES

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This is a revision of a paper presented at the NBER Conference on Risk Management, Palm Beach, FL, November 20-23, 1996 and has benefited from the discussant's comments there by James Hines. This paper is a part of the project on the Economics of the Property and Casualty Insurance Industry within the National Bureau of Economic Research, Cambridge, MA, with the support of the Insurance Information Institute. Bradford's work on the project benefited greatly from a visit at the Center of Economic Studies (CES) at the University of Munich and from helpful discussions there with Michel Reiter, Christian Thiman and Richard Arnott. Logue's work on this project greatly benefited from numerous conversations with his colleagues at the University of Michigan Law School. He gives special thanks to Jeffrey Lehman who has provided both useful substantive suggestions and wise counsel throughout this project. He also thanks Stuart Thiel for several helpful discussions. In addition, helpful comments and suggestions were received from Sean Mooney, David Cummins, Ralph Winter and Mark Wolfson. James Bohn was enormously helpful on matters of aggregation. Ryan Edwards and Ning Zhang provided extremely able research assistance. The usual caveats apply. This paper is part of NBER's research program in Public Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

Federal income tax rules, and especially changes in those rules, combine with financial market circumstances (interest rates) to create incentives bearing on property-casualty insurers' decisions regarding the level of loss reserves to report. These incentives have varied substantially over the period since 1980. In particular, transition effects due to the Tax Reform Act of 1986 created unusually large incentives to overstate reserves in reporting years 1985-1987. Because they amount to forecasts of quite variable quantities, reserves are inevitably subject to correction over time, making inferences from the time series evidence difficult. Furthermore, taxes are not the only sources of biasing incentives that may vary from time to time. Still, the picture in aggregate industry data presented in the paper is broadly consistent with the tax-motivated reserving hypothesis.

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The Influence of Income Tax Rules on Insurance Reserves

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I. Introduction

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]

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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 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 article 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 of 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, industry-wide 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 (for example, 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.[2]

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 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 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 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 will be 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.[3] 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, it is 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 relationship 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 take 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 are the commercial rating agencies such as A.M. Best's 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 of the above-mentioned external factors.

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" (that is, to reduce the variability in) earnings over time.[4] This question was studied, for example, by Smith (1980) and Weiss (1985) in the context of auto 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 auto 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 (though temporarily) the loss-reserving incentives of property-casualty insurers. Specifically, the 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 (1986), 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 the TRA86 on various types of business decisions.

Section II describes the relevant tax law history and sketches out some of our hypotheses concerning reserving behavior. Section III gives some descriptive statistics on the industry. Section IV develops a quantitative measure of the tax incentives bearing on the reserving decision. Section V looks at the time-series evidence in industry-wide data. There is a brief concluding Section VI.

II. 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 the TRA8, 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.[5])

The TRA86 contained at least three provisions that should have significantly affected management's incentives with respect to loss-reserving:

- First, the TRA86 enacted the largest reduction in corporate income tax rates ever. Under the Act, the corporate rate was scheduled to decline from 46% in 1986, to 40% in 1987, and finally to 34% in 1988.
- Second, the 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.[6]
- Third, the TRA86 included a special "fresh start" transitional rule that applied to pre-87 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 (that is, 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 undiscounted total of reserves carried into the new regime on January 1, 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 the fresh start rule to reserve strengthening that occurred in the 1986 tax and reporting year. (For most insurers, the concepts of tax year and reporting year coincide.) Under this rule, to the extent 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 would also be required to return the amount of the discount into income in the

1987 tax year.[7] 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 an example, if an insurer overstated its loss reserves in the 1986 tax year for policies written in 1986 and corrected the overstatement in some reporting year post 1986, 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.[8]

III. 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 below in Table 1, which are the categories that were used by the industry before 1989.

Table 1. Line Abbreviations[9]

MI	"Miscellaneous": Farmowners, Homeowners, and Commercial Multiple Peril, Ocean Marine, Aircraft (All Perils), and Boiler and Machinery
AL	Auto Liability
WC	Workers' Compensation
OL	Other Liability
MM	Medical Malpractice

The lines are arranged in order of length of tail. Thus, the shortest-tailed line is the Miscellaneous category, and the longest-tailed line is Medical Malpractice. We have used these line designations to organize the descriptive statistics in Table 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. (The abbreviations "RY" and "AY" refer to reporting year and accident year, respectively.)

Table 2

Property and Casualty Insurance, Aggregate Statistics for 1993
(000 omitted)

Line	Premiums Earned (RY 1993)	Percent 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	Percent 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 Bests Aggregates and Averages, various years.

Another way of illustrating the differing tail lengths, and of the actual pattern of loss payments, for various lines is to use loss profiles. In Table 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 the 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 bold-faced figures indicate the years in which the year-to-year change in paid losses exceeds four percent of the total.

Table 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 Dept. Regulations. Authors have extended table beyond AY +10 according to Treasury rule of thumb and have truncated it at AY +15.

Thus, Table 3 displays clearly the different lengths of tails of the five lines. Table 4 shows the implied average time to payout for each line.

Table 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.

Table 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 than those of the short-tailed lines.[10] (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 1 in that auto liability is split into two lines, private passenger and commercial auto.)

Table 5

Loss Ratios by Accident Year (Using post 1988 Lines of Insurance)

Accident Year	Homeowners / Farmowners (MI)	Private Passenger	Commercial Auto	Workers' Compensation (WC)	Other Liability (OL)	Medical Malpractice (MM)
1980	0.76	0.78	0.84	0.72	0.83	1.47
1981	0.69	0.83	0.91	0.73	0.99	1.68
1982	0.75	0.85	0.97	0.82	1.21	1.70
1983	0.76	0.88	1.09	0.93	1.45	1.71
1984	0.74	0.95	1.20	1.07	1.66	1.47
1985	0.79	0.97	1.04	1.04	1.22	1.21
1986	0.67	0.92	0.79	0.95	0.64	0.81
1987	0.65	0.91	0.75	0.91	0.56	0.72
1988	0.68	0.91	0.79	0.93	0.62	0.75
1989	0.83	0.93	0.84	0.94	0.70	0.82
1990	0.78	0.92	0.81	0.93	0.75	0.98
1991	0.86	0.87	0.80	0.89	0.78	1.13
1992	1.24	0.88	0.80	0.86	0.80	1.21
1993	0.83	0.90	0.83	0.82	0.83	1.24
1994	0.89	0.90	0.84	0.80	0.84	1.23

Source: Best's Aggregates and Averages, Various Years.

We should point out that there is an element of apples-and-oranges in Table 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 payouts over premiums earned, but rather can be seen

as 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.

IV. 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), which 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 the TRA86. For a discussion, see Bradford and Logue, 1996.) 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 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 (that is, 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. And the flipside 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 the losses incurred for a given accident year in a given line shows 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 lossess 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, an overstatement of total incurred losses, whether intentional or not, 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.[11] 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 upon the company's anticipation of future tax rates. The rate applicable to a given company will 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 upon 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 6 sets out the tax rates used in our calculations for each year.[12]

Table 6

Anticipated Federal Income Tax Rates			
		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
Anticipated in	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, Standard Federal Tax Reporter Vol.1, ¶3265.0129-.0139 (1996)

To calculate the net benefit from deferral we require a discount rate. In Table 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).

Table 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	0.48	0.48	5.88	3.06	0.47	0.01
1977	1.00	0.48	0.48	6.09	3.17	0.47	0.01
1978	1.00	0.48	0.46	8.34	4.50	0.44	0.04
1979	1.00	0.46	0.46	10.65	5.75	0.43	0.03
1980	1.00	0.46	0.46	12.00	6.48	0.43	0.03
1981	1.00	0.46	0.46	14.80	7.99	0.43	0.03
1982	1.00	0.46	0.46	12.28	6.63	0.43	0.03
1983	1.00	0.46	0.46	9.58	5.17	0.44	0.02
1984	1.00	0.46	0.46	10.91	5.89	0.43	0.03
1985	1.00	0.46	0.46	8.42	4.55	0.44	0.02
1986	1.00	0.46	0.40	6.46	3.87	0.39	0.07
1987	0.80	0.32	0.27	6.77	4.47	0.26	0.06
1988	0.80	0.27	0.27	7.65	5.05	0.26	0.01
1989	0.80	0.27	0.27	8.53	5.63	0.26	0.01
1990	0.80	0.27	0.27	7.89	5.21	0.26	0.01
1991	0.80	0.27	0.27	5.86	3.87	0.26	0.01
1992	0.80	0.27	0.27	3.89	2.57	0.27	0.01
1993	0.80	0.28	0.28	3.41	2.22	0.27	0.01
1994	0.80	0.28	0.28			0.28	0.00

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

Source: Interest rates, Federal Reserve Board data, gopher://gopher.town.hall.org/other/fed/h_1 discount factors as described in Bradford and Logue, 1996.

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 interest rates in Table 6, the overstatement payoff described in Table 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. To what reserves might insurers have plausibly expected the fresh start to apply? The 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 would apply. But for any new policies written in 1986, and--to the extent companies anticipated the TRA86's introduction of discounted reserves and of the fresh start rule--any new policies written in (or strengthenings reported in) 1985 or earlier, the analysis is different.

Under the fresh start rule, for example, the present value of one dollar of reserve overstatement in the1986 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 8 spells out the details. The fresh start rule substantially increase 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 an 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 the1985 reporting year, to the extent 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* impact on the incentive to add to reserves (for all accident years) at the end of 1985, to the extent the new tax policy was anticipated. In this case, the extraordinary tax benefit was the result of carrying the higher reserves into 1987.

Table 8

Gain from an Extra Dollar of Reserves on New Policies in 1986: The Impact 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	0.89	.46	0.36	6.46	3.87	0.34	0.12
AL	0.89	.46	0.36	6.46	3.87	0.34	0.12
WC	0.81	.46	0.32	6.46	3.87	0.31	0.15
OL	0.77	.46	0.31	6.46	3.87	0.30	0.16
MM	0.69	.46	0.28	6.46	3.87	0.27	0.19

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

Sources: Interest rates, Federal Reserve Board data, gopher://gopher.town.hall.org/other/fed/h_15; Discount

Table 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 the fresh start rule on premiums, assuming no variation in any tax-induced bias in reported loss reserves, see Bradford and Logue, 1996.)

Table 9. Losses Incurred in 1986 and Fresh Start

Loss Reserves for Accident Year 1986, Reported in 1986
(000 omitted)

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) x col (4)) (5)	Estimated Saving from 10% Increase in Incurred Loss Estimate (10% of (3) x (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.

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 non-tax consequences of variation in the reported loss reserves.

V. Reserving Seen in Industry Data

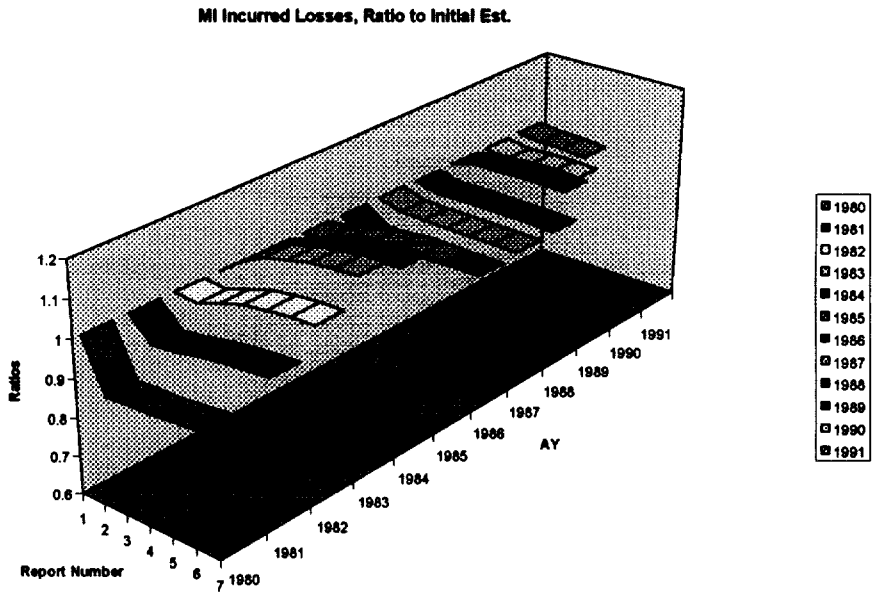
Industry aggregate data are suggestive of behavior consistent with tax-influenced reserving. Figure 1 to Figure 5 attempt to capture the pattern of reserve strengthening that occurred in the various lines (running from short- to long-tailed). The graphs show the ratio of (a) the incurred loss estimate at the end of each year after the accident year to (b) the estimate at the end of the accident year (that is, the first reported figure). All the curves start at 1. 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 accident years, rising links corresponding to reporting years 1985 and later. For the 1986 and 1987 accident years, and for 1985 to the extent the restriction on the fresh start rule was anticipated, one would expect 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 figures 4 and 5), there is a substantial shift in the downward direction in the curves--suggesting overstatement of the initial 1986 reserves

which 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.

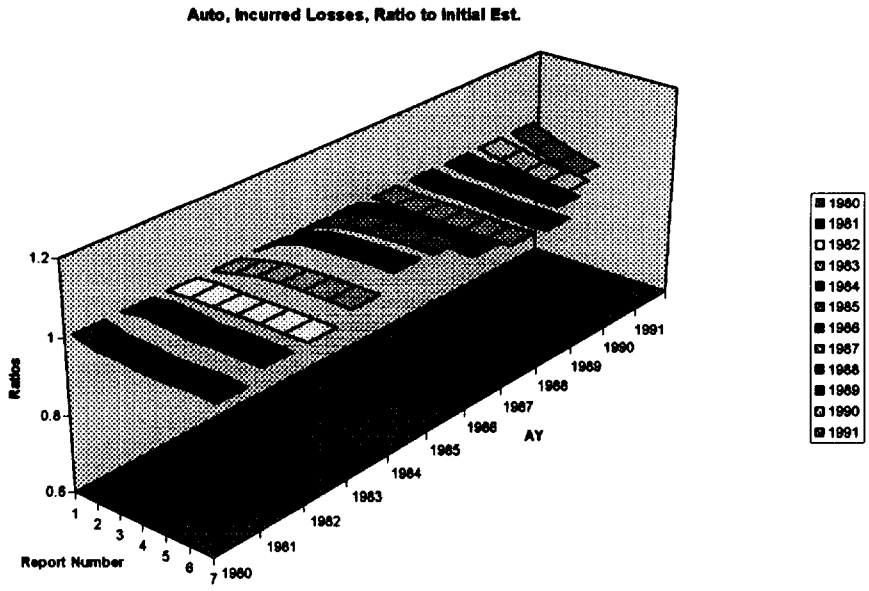
The picture after 1987 is less obviously consistent with our hypothesis. We would have expected the reserves in those years, when the tax incentive was no longer so strong, to return to the pre-86 patterns. But that did not happen. The post-87 accident-year reserves were, like the '86 reserve, initially 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 become more conservative in their 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 the 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.[13] Another possibility, of course, is that insurers--for reasons unrelated to taxes--became more conservative in their estimates of loss reserves.

Figure 1. Incurred Loss Estimates by Years Since Accident Year: MI



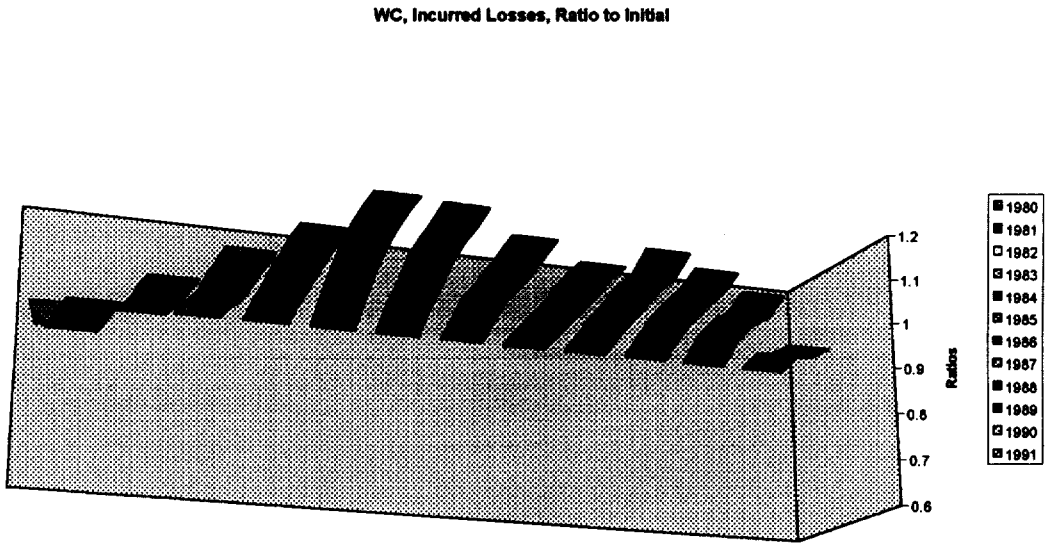
Source: Authors' calculations, based on data from Best's Aggregates and Averages, various years.

Figure 2. Incurred Loss Estimates by Years Since Accident Year: AL



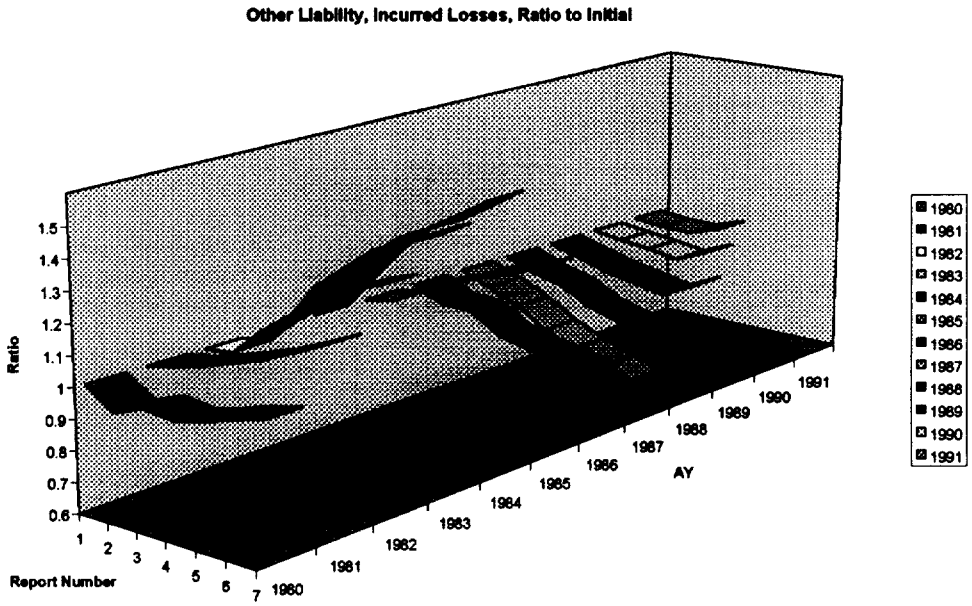
Source: Authors' calculations, based on data from Best's Aggregates and Averages, various years.

Figure 3. Incurred Loss Estimates by Years Since Accident Year: WC



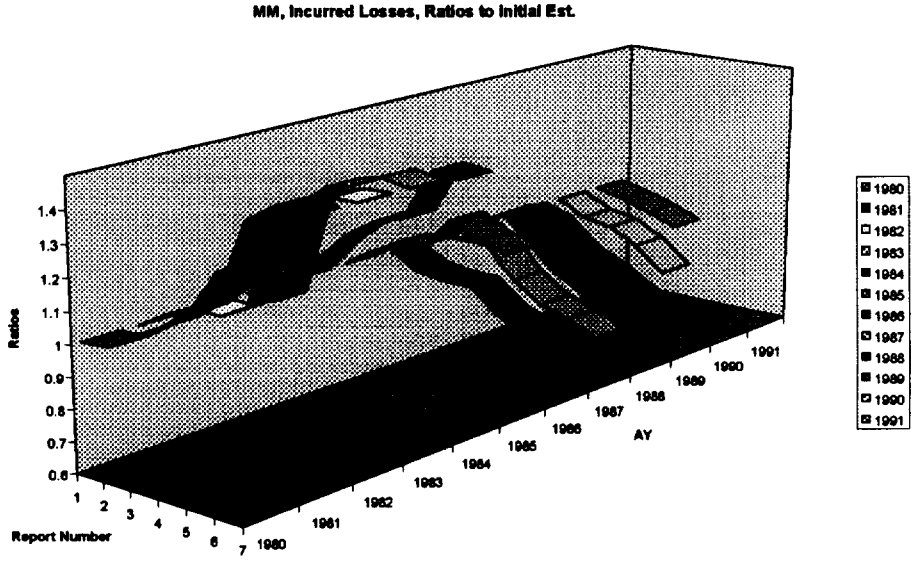
Source: Authors' calculations, based on data from Best's Aggregates and Averages, various years.

Figure 4. Incurred Loss Estimates by Years Since Accident Year: OL



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

Figure 5. Incurred Loss Estimates by Years Since Accident Year: MM



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

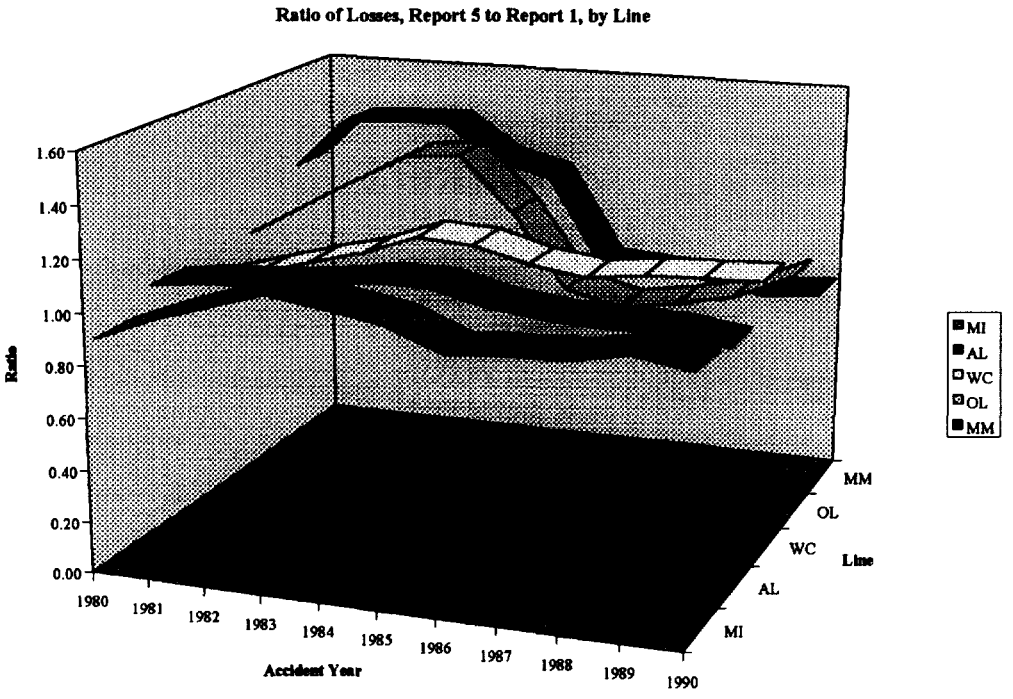
Table 10 attempts to capture the extent of conservatism in the initial incurred loss report in the form of the ratio of the report five years later to the initial report. So, for example, according to the table, the incurred loss figure for Auto Liability for accident year 1985 was up by seven percent at the end of 1990, relative to the initially announced level. Relatively high numbers mean relatively low initial reserves. Particularly for the long-tailed lines, there appears to be a break at 1986. Figure 6 displays the same information graphically.

Table 10. Incurred Loss Estimates Five Years Out

Summary: Ratio of Losses, Report 5 to Report 1					
Accident Year	MI	AL	WC	OL	MM
1980	0.88	0.98	0.88	0.99	1.18
1981	0.97	1.01	0.94	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	0.96	1.02	1.07	0.87	0.86
1987	0.98	0.99	1.04	0.81	0.85
1988	0.98	0.98	1.07	0.85	0.83
1989	1.03	0.98	1.08	0.90	0.79
1990	0.99	0.95	1.09	1.00	0.81

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

Figure 6. Loss Estimates Five Years Out: Ratio to Initial Estimates



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

Table 11 presents data on the extent of reserve strengthening (relating to past accident years) in reporting years 1983-1994. Each cell reports, for that reporting year, the average over the most recent five past accident years of the ratio of 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 the fresh start rule was anticipated. Otherwise the incentive effects of the tax rate changes from 1985 to 1986 and 1986 to 1987 reflected in Table 7 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 a reversion to roughly zero strengthening in the more recent years.

Table 11. Average Year-to-Year Increase in Incurred Loss Reports Reporting Years 1983-1994

Line	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
MI	0.02	0.12	0.13	0.09	0.08	0.04	0.04	0.00	0.00	0.00	-0.01	-0.05
AL	-0.01	0.00	0.05	0.01	0.02	0.01	0.01	0.00	-0.01	-0.04	-0.04	-0.05
WC	-0.05	0.00	0.01	0.04	0.04	0.06	0.03	0.04	0.06	0.05	0.00	0.05
OL	0.01	0.08	0.11	0.10	0.09	0.04	0.03	0.00	-0.03	-0.05	-0.04	0.08
MM	0.03	0.06	0.26	0.08	0.02	0.02	0.08	-0.08	-0.08	-0.05	-0.08	-0.09
Average	0.00	0.05	0.11	0.06	0.05	0.03	0.04	-0.01	-0.01	-0.02	-0.03	-0.01

Cells show average for the most recent five past accident years of the fractional increase in the sum of paid and unpaid losses. (For 1983, three accident years are included; for 1984, four accident years.) Source: Authors' calculations based on data from Bests Aggregates and Averages, various years.

VI. 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 1985-1987. 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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Endnotes

[1]Our discussion of insurance accounting and solvency regulation draws primarily from Mooney and Cohen (1991); Salzmann (1974); Peterson (1981); Troxel and Bouchie (1990); and Advisory Commission on Intergovernmental Affairs (1992).

[2]Peterson (1981).

[3] Fama (1980); Jensen and Meckling (1976).

[4] See, for example, Forbes (1970); Balcarek (1975); and Ansley (1979).

[5] Treas. Reg. § 1.832-4(b).

[6] 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. The 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).

[7] Treas. Reg. 1.846-3(e).

[8]The requirement that property-casualty loss reserves be discounted for federal income tax purposes was first proposed in June of 1983 in a hearing before the Senate Finance Committee. The proposal was put forward both by the Treasury Department (see Statement of John E. Chapoton (1983)) and by the General Accounting Office (see Statement of Harry S. 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, 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 entitled "Tax Reform for Fairness, Simplicity, and Economic Growth" (November 1984) ["Treasury I"]. Subsequently, in President Reagan's 1985 tax reform proposal entitled "The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity" (May 1985) ["Treasury II"], a proposal was included that would have had the same effect as the discounting requirement proposed by the Treasury Department and by the GAO. Earlier in 1985, the GAO had published its report calling for, among other changes, the introduction of the discounting requirement. (GAO, "Congress Should Consider Changing Federal Income Taxation of the Property/Casualty Insurance Industry (GAO/GGD-85-10) (March 1985)). Finally, a provision quite similar to the Treasury Department and GAO proposals was enacted as part of the 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 the 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.

[9] In the pre-1989 statements, data for these lines were reported in the following parts of Schedule P: 1A (Auto Liability), 1B (Other Liability), 1C (Medical Malpractice), 1D (Workers' Compensation), and 1E (Farmowners Multiple Peril, Homeowners 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 (Homeowners/Farmowners), 1B (Private Passenger Auto Liability/Medical), 1C (Commercial Auto/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 auto Liability/Medical) and 1C (Commercial Auto/Truck Liability/Medical) of the 1989 form were added together to match the pre-1989 line 1A (Auto Liability). Lines 1A (Homeowners/Farmowners), 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 (Farmowners Multiple Peril, Homeowners 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).

[10] For an extended discussion of the determinants of equilibrium premiums, see Bradford and Logue (1996).

[11] 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.

[12] 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.

[13] For further discussion of this possibility, see Logue (1996).