A NOTE ON MODEL YEAR RATING

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This paper will discuss the validity of model year rating for private passenger automobile coverages other than physical damage. While the techniques employed will be elementary, the result is of interest to providers as well as purchasers of automobile insurance.

Background

Model Year Rating was introduced in the mid-1970's, the end result of an effort to find an inflation-sensitive exposure base or rating variable for automobile physical damage coverages. The beauty and power of this idea is its simplicity - under the "age rating" system which model year rating supplanted, premiums for a given model year would fall automatically as that year aged. This was in recognition that as a vehicle aged, the maximum amount payable (total loss) decreases as the car depreciates. However, this logic gave no consideration to the fact that the overwhelming percentage of losses were partial losses, which were subject to the full impact of inflation. As a result, companies had to constantly seek rate relief to keep pace with the impact of inflation.

Under the new system, premiums for a model year remain fixed until a general rate level change is implemented. Premium levels between successive model years vary among companies, with 5% being a typical increment. The impact of this revision to the rating system was dramatic. In addition to allocating costs appropriately, rate level indications for physical damage coverages were reduced to recognize that model year rating acts as an automatic premium escalator on these coverages. This eliminated the "roller coaster" effect on the rates paid by the customers under the superseded system, under which annually rates were automatically decreased, only to be raised via subsequent rate filings. An ancillary effect was to reduce pressure on regulators, as the size of rate increases diminished in recognition of the additional revenue generated by MYR.

Is Model Year Rating Valid for Other Coverages?

Intuitively, one is not surprised by the fact that there is a connection between model year and premium level for physical damage coverages. At a minimum, one would expect that physical damage severities are positively correlated with model year. However, a review of auto collision data indicates severities

alone do not explain the entire rate difference indicated from model year to model year. In fact, frequency explains the majority of the rate differences and exhibits a better fit.

Private Passenger Automobile Collision Insurance
Frequency and Severity Data by Model Year

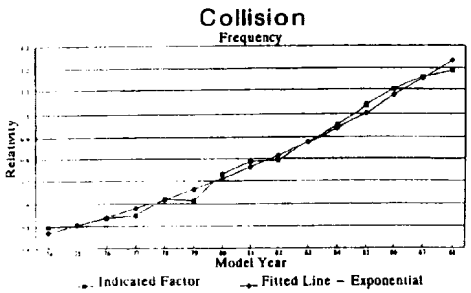
Model Year	Frequency Amount	Frequency Index	Severity Amount	Severity Index
1974	0.0303	0.4976	1151	0.6970
1975	0.0308	0.5057	1005	0.6088
1976	0.0327	0.5355	1005	0.6090
1977	0.0333	0.5459	948	0.5742
1978	0.0379	0.6219	962	0.5829
1979	0.0375	0.6151	1072	0.6494
1980	0.0445	0.7298	1083	0.6563
1981	0.0481	0.7881	1148	0.6956
1982	0.0484	0.7930	1264	0.7656
1983	0.0536	0.8788	1404	0.8505
1984	0.0579	0.9490	1501	0.9094
1985	0.0632	1.0363	1647	0.9974
1986	0.0673	1.1036	1741	1.0546
1987	0.0706	1.1582	1846	1.1184
1988	0.0724	1.1875	1942	1.1765
Total	0.0610	1.0000	1651	1.0000

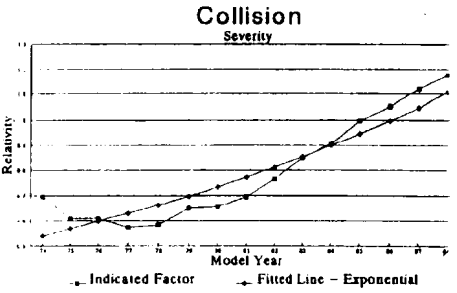
Results of Regression

Indicated Year-to-Year Change -	7.15%	5.23%
R Squared -	95.2 %	58.6%

Experience Period - 1/1/88 - 12/31/91

See figure 1 for chart of Collision Model Year frequency and severity relativities.





If frequencies explain the majority of the rate difference between model year for collision, it is reasonable to hypothesize that model year should be a legitimate rating criterion for the liability coverages as well, as the frequency is driven by accident involvement.

The following basic limits loss ratio data for liability coverages suggests that this is indeed the case. Of course, since liability coverages are not presently rated by model year, an increasing trend to loss ratios arranged by model year suggests that a differential between successive model years should, in fact, exist in the rating system.

Private Passenger Automobile Liability Insurance
Loss Ratios by Model Year

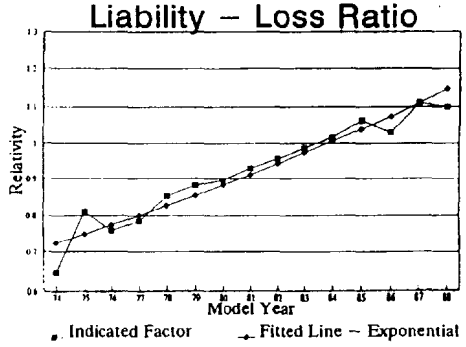
Model Year	Amount	Index
1974	40.5%	0.6445
1975	50.9	0.8103
1976	47.6	0.7588
1977	49.2	0.7837
1978	53.5	0.8521
1979	55.3	0.8814
1980	56.3	0.8960
1981	58.3	0.9292
1982	60.0	0.9558
1983	62.0	0.9867
1984	63.8	1.0165
1985	66.7	1.0629
1986	64.7	1.0300
1987	69.8	1.1109
1988	69.0	1.0995
Total	62.8%	1.0000

Results of Regression

Indicated Year-to-Year Change - 3.34%
R Squared - 91.6%

Experience Period - 1/1/88 - 12/31/91

See figure 2 for chart of liability loss ratio relativities by Model Year



While this analysis is elementary, it does control for existing rating variables to the extent that the rating differentials for those variables have been set correctly.

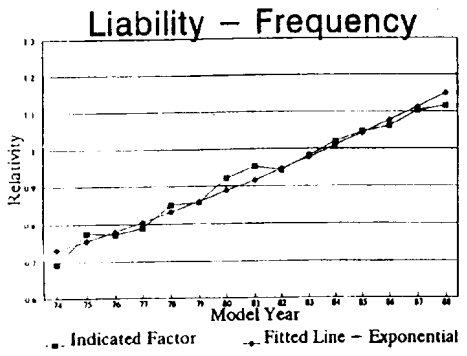
What Drives the Results?

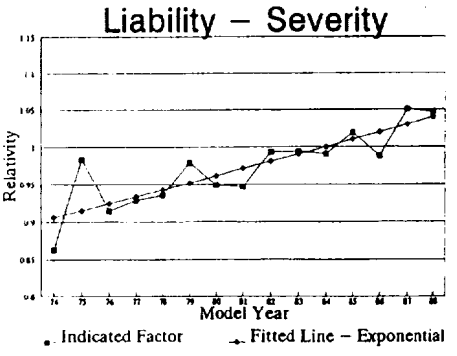
Although the concept of causality applied in the context of insurance pricing is an ambiguous one, regulators and insurance company management are nevertheless given to asking why a rating variable "works". In the case at hand, there is an at least partially satisfying response.

One can begin to understand the behavior of the loss ratios above by splitting the pure premium by model year into frequency and severity components. As the following data show, claim frequency is once again the driver.

Private Passenger Automobile Liability Insurance
Frequency and Severity Data by Model Year

Model Year	Frequency		Severity	
	Amount	Index	Amount	Index
1974	0.0465	0.6908	2848	0.8629
1975	0.0521	0.7750	3244	0.9829
1976	0.0519	0.7717	3017	0.9143
1977	0.0531	0.7892	3062	0.9280
1978	0.0572	0.8498	3086	0.9352
1979	0.0576	0.8555	3230	0.9787
1980	0.0621	0.9229	3130	0.9485
1981	0.0641	0.9525	3125	0.9469
1982	0.0635	0.9432	3278	0.9932
1983	0.0661	0.9821	3279	0.9936
1984	0.0686	1.0201	3269	0.9907
1985	0.0704	1.0462	3264	1.0194
1986	0.0714	1.0610	3260	0.9879
1987	0.0742	1.1022	3468	1.0509
1988	0.0750	1.1151	3455	1.0469
Total	0.0673	1.0000	3300	1.0000





Results of Regression

Indicated Year-to-Year Change -	3.28%	0.99%
R Squared -	96.9%	71.1%

Experience Period - 1/1/88 - 12/31/91

See figure 3 for chart of Liability Model Year frequency and severity relativities.

Upon reflection, the reduced dependence of severity on model year is not surprising. The mix of automobiles (and their operators) which any vehicle faces clearly does not depend upon the model year of that vehicle. What explains the frequency result? It seems far-fetched to suppose that frequency variation by model year can be explained by territory or operator characteristics. Moreover, these variables are controlled for in the loss ratio analysis above.

We offer the following hypothesis - The model year of a vehicle serves as a partial surrogate to annual miles driven. The reader will note that while "miles driven" is currently incorporated into most rating plans, because of rate integrity problems it is done so on a very incomplete basis. Most companies use a single break point, such as 7,500 miles annually, to segregate vehicles by miles driven. This is an incomplete measure at best.

Evidence in Support of the Hypothesis

It is reasonable to surmise that a newer car is likely to be used more than one which is older. Certainly, this is consistent with the natural predisposition to drive newer vehicles more, simply because they are newer. It is also likely true that older vehicles are under repair and thus removed from exposure more days of the year than newer vehicles. Moreover, both factors, if valid, are likely to operate more strongly in multi-car households than in single-car households. In fact, the data below show a modest but definitely greater indicated model year factor in the multi-car case.

Private Passenger Automobile Liability Insurance
Model Year Loss Ratio - Single vs. Multi Car

Model	Single Car		Multi Car	
Year	Amount	Index	Amount	Index
1974	57.5%	0.9357	35.6%	0.5621
1975	49.3	0.8033	51.4	0.8115
1976	46.5	0.7565	48.0	0.7585
1977	45.8	0.7448	50.3	0.7948
1978	53.8	0.8754	53.4	0.8439
1979	51.9	0.8445	56.4	0.8910
1980	59.7	0.9712	55.2	0.8719
1981	55.4	0.9016	59.3	0.9365
1982	61.6	1.0026	59.5	0.9399
1983	60.1	0.9790	62.6	0.9886

Private Passenger Automobile Liability Insurance
Model Year Loss Ratio - Single vs. Multi Car

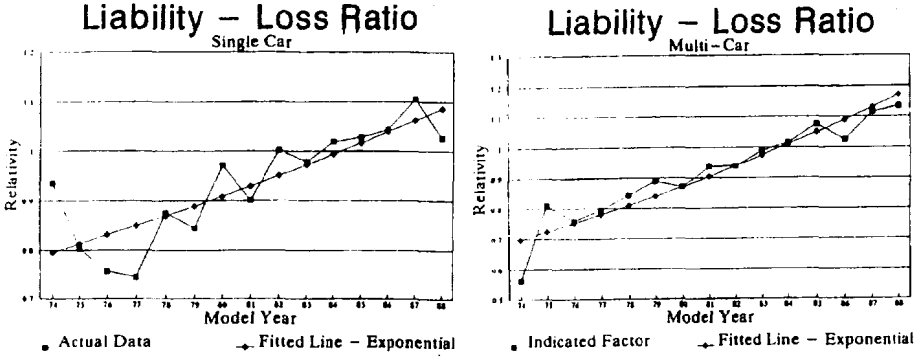
Model Year	Single Car Amount	Single Car Index	Multi Car Amount	Multi Car Index
1984	62.6	1.0197	64.3	1.0150
1985	63.2	1.0283	68.1	1.0764
1986	64.1	1.0434	64.9	1.0255
1987	68.0	1.1061	70.6	1.1145
1988	63.1	1.0271	71.7	1.1324
Total	61.4%	1.0000	63.3%	1.0000

Results of Regression

Indicated Year-to-Year Change -	2.26%	3.77%
R Squared -	66.8%	84.1%

Experience Period - 1/1/88 - 12/31/91

See figure 4 for chart of Liability Model Year loss ratios for single and multi car policies.



Model Year versus Age Rating

If the reason for the difference between various model years is decreased mileage and, as a result, low frequency, the question becomes: "Why not set the rates for the age of the vehicle and decrease the rates as the vehicle ages?"

The answer is simply that model year rating is more appropriate than age rating for the same reason it replaced Age Rating in the mid 1970's ... i.e., age rating ignores the impact of inflation on overall loss costs.

The rates charged are, of course, a function of the pure premium and are, therefore, responsive to both changes in frequency and severity over time. Liability severities continue to feel upward pressure, even in the current low inflation economy.

Model Year versus Symbol

For the completion of the record, it should be noted that the appropriateness of using "symbol" relativities for liability was tested as well.

The attached exhibit compares the results of a straight-forward joint analysis of symbol and model year. As expected, there was little correlation of loss ratio with symbol. Within symbol, results by model year displayed an increasing trend.

Concluding Remarks

A model year rating factor of 3% between successive model years appears to be justified for liability coverages for companies currently employing mileage as a rating criterion. The factors should be higher for companies not using the mileage rating system. Not only does model year meet most of the requirements for inclusion for a rating system, it also has an element of social acceptability, in that purchasers of newer automobiles are likely to be more able to afford higher premiums than owners of older vehicles.

Model year rating on liability could also play a role in smoothing out the underwriting cycle for the private passenger automobile line. This is due to the role of model year rating as an automatic premium escalator.

It is also true that this rating variable stands in as a zero-cost alternative to cumbersome and expensive "pay at the pump" proposals, which attempt to address the mileage issue in a direct but administratively inefficient manner. In the same vein, in recent years legislation has been passed in a few states -- and their number is likely to increase -- requiring that many traditional rating variables be discarded or given lesser weight than actuarially justified. Model Year Rating appears to pass muster under these new laws.

Finally, the industry's private passenger liability premium currently stands in excess of $50 billion. If model year rating for liability were to be implemented industrywide, aggregate annual rate level filings would be reduced by $1.5 billion.

LIABILITY LOSS RATIOS

TOTAL – ACCIDENT YEARS 88–90

MODEL YEAR		Symbol										
		5	6	7	8	J	K	M	N	P		
	Number of Exposures	25503	74115	117855	110508	84007	55470	36696	23725	15282	Slope	R^2
76	9231	82.3%	48.6%	41.3%	22.0%	67.2%	104.2%	15.4%	105.8%	34.2%	−0.0266	0.0116
77	14316	66.4%	89.6%	61.3%	104.2%	57.0%	31.6%	46.5%	137.7%	41.8%	−0.0023	0.0002
78	19410	83.4%	99.9%	51.4%	31.6%	94.9%	49.6%	5.0%	79.7%	51.9%	−0.0130	0.0015
79	24482	87.1%	77.5%	85.0%	49.6%	88.5%	107.2%	81.5%	369.2%	76.1%	0.0318	0.0250
80	21636	81.0%	85.1%	100.9%	107.2%	100.4%	71.6%	95.1%	24.4%	58.9%	−0.0095	0.0032
81	23816	78.9%	98.2%	91.7%	71.6%	97.6%	93.1%	114.3%	74.0%	63.8%	−0.0010	0.0002
82	25975	88.0%	99.4%	84.8%	93.1%	92.6%	89.9%	88.8%	101.5%	135.3%	0.0067	0.0170
83	32696	96.6%	100.1%	91.4%	89.9%	75.7%	100.3%	100.2%	91.9%	91.9%	−0.0013	0.0017
84	50015	90.0%	94.8%	100.5%	100.3%	98.3%	80.7%	105.8%	95.7%	74.5%	−0.0015	0.0014
85	57723	98.3%	99.0%	96.5%	80.7%	98.0%	99.3%	113.7%	87.9%	87.6%	−0.0010	0.0008
86	64895	105.6%	87.2%	100.8%	99.3%	101.0%	94.2%	95.6%	96.9%	90.2%	−0.0021	0.0095
87	70381	81.7%	89.6%	110.4%	94.2%	105.4%	102.4%	94.4%	92.2%	85.2%	0.0021	0.0035
88	69679	102.6%	93.2%	94.8%	102.4%	109.8%	102.5%	87.1%	108.2%	84.1%	−0.0013	0.0015
89	58907	82.9%	86.7%	88.8%	102.5%	92.6%	102.8%	94.2%	104.3%	79.4%	0.0035	0.0095
											Mean −0.0011	0.0062
	Slope	0.0165	0.0186	0.0504	0.0749	0.0284	0.0433	0.1291	−0.0084	0.0579	0.0456	
	R^2	0.3246	0.1736	0.5419	0.4042	0.4182	0.2712	0.3574	0.0040	0.4704	0.3295	