TOTAL RETURN PRICING IN PROPERTY-CASUALTY INSURANCE
THE MASSACHUSETTS SYSTEM
By Jeffrey Brown

Discussion by Holmes Gwynn

DISCUSSION

Modern financial theory has been brought into the realm of
the casualty actuary by its use in ratemaking. Today that use is
confined to Massachusetts where it is used to develop a profit
provision for Auto and Workers Compensation - the two lines for
which rates are established by the Commissioner.

When Dr. Stone, an acknowledged expert in modern financial
theory, came into that office in 1975, he decided it was about
time that financial theory and ratemaking were blended. This
stemmed from the premise that the insurance industry did not
really understand the role of investment income in ratemaking.
This premise was proven to Dr. Stone when his first negative
profit provision was labelled "outrageous" by the industry. We
actuaries have, to date, had difficulty in attempting to counter
these theories because they have been developed outside our area
of expertise. Indeed, Dr. Stone has dismissed most all actuarial
testimony at rate hearings because the actuary testifying did not
have modern financial theory credentials.

Emerging from our ashes, Jeff Brown has made an attempt to
counter some of the work done by Dr. Fairley. My comments will
be critical of both.

Dr. Fairley has written essentially two papers on profit
provisions for auto ratemaking in Massachusetts. Both are well
written and well thought-out. Where he feels his arguments are
weak he attempts to support them by approaching from a different

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direction reaching a similar conclusion. It is, therefore,
extremely difficult to effectively criticize such a work -
even if you don't believe the answer it produces.

Given the purpose of Mr. Brown's paper is to provide a
basis for discussion at the spring meeting of the C.A.S., he
has provided us with a wealth of material.

The first part of Brown's paper paraphrases Fairley's
most current paper. Having read this subsequent to reading
Fairley was an enormous help toward understanding Fairley's
work.

The second part of Brown's paper is what he sees to be
the flaws in Fairley's methods - identifying them into two
broad categories - theoretical and parameter selection.

The main theoretical problem cited by Brown is Fairley's
treatment of taxes in relation to the rate of return on assets.
Brown carries this through resulting in the following formula
for the profit provision:

$$p = \frac{1}{(1-t)}[-kr_f + B_p\ (r_m - r_f)] \quad (12\text{ in Brown})$$

(See Brown's or Fairley's paper for identification of parameters.)

This formula says that the profit provision should be the
rate of return produced by the CAPM before taxes and then loaded
so as to produce an after tax profit return. While in theory
this may sound good, in reality if the sum in the brackets is
negative (i.e. a negative profit), then the higher the tax rate
the lower the resulting profit need be.

Fairley's formula, on the other hand, treats taxes by adding
the term, $[t/(1-t)s]r_f$, to the quantity in the brackets above.

This gives p the property of increasing as t increases, regardless of p being positive or negative. While on the topic of Fairley's 'tax' expression I would comment that this is the only part of his formula for p that that has no intuitive basis. While it moves in the proper direction one cannot provide - at least in its present form - a verbal translation of the expression as one can do with the other parts of the formula.

Having implied Brown is wrong I'll say that may not be the case. Brown may be on the right track but just didn't go far enough. Specifically, I wonder if there is not a relationship between t and B_p.

Brown further criticizes Fairley's theory for lack of a uniform time horizon. He does not develop this argument so I will reserve comment until this can be developed at the meeting.

Brown next turns his attention to the data problem, recognizing that parameter valuation can be used to produce large swings in the final answer.

He first discusses beta (B) coefficients which is an intriguing concept for actuaries. The B's are the heart of the Capital Asset Pricing Model (CAPM) which is the specific application of modern financial theory used by Fairley. What makes this intriguing is the way Fairley has brought this theory from one used in portfolio analysis to one used in ratemaking.

Historically the CAPM is an outgrowth of other methods used in portfolio analysis. Its main property is its simplicity and reduced number of variables from earlier models.

Having been used since the early 1970's all the model savs is that the rate of return should be the risk-free rate of return plus an additional return for systematic risk. Systematic risk is that risk beyond that of "risk free" or the difference in the market return versus a risk-free return. This has intuitive appeal because the greater the risk the greater the rate of return. The measure of how much a portfolio goes beyond being risk free is B and is defined as the quotient of the covariance of stock market movement and portfolio movement to the variance of stock market movement.

This has the property that if $B = 1$ the portfolio and market move identically and, therefore, the rate of return will be the market rate of return. If $B = 0$ there is no relationship with the market and the rate of return should be the risk-free return.

One can easily understand how Stone and Fairley were enamored to this when considering its application to profit provisions. All the elements were there to evaluate the insurance industry in relation to the economy as a whole which the Hope decision on profit regulation said was necessary to make.

The CAPM, similarly to predecessor models, may now be falling out of favor with economists. This is because of the quantification of B. It appears that B's tend to vary within an industry from year to year. This fluctuation has made it a difficult tool to use.

Brown has pointed out that variation in B's will cause wide disparities between true profits versus theoretical profits. He goes on to point out that if B_E is permitted to vary by sub-line (Fairley has it constant), this will produce very different

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B_L's and B_p's. The effect of this is to make the BI provision a larger negative and the PD a larger positive.

What may be of more importance in the interpretation of the B's. If B_p is zero, it implies that underwriting profit is totally unaffected by movements in the stock market. If B_p is one, profits will rise directly with stock market prices and if B_p is minus one, profits will decline in direct relation to a rise in the stock market.

It is interesting to note that Fairley's $B_{p,BI} = .34$ and Brown's simple refinement results in a $B_{p,BI} = -.51$. Fairley says BI profits will tend to vary directly with the market while Brown, using Fairley's same starting B_A shows they will vary inversely.

Indeed, who knows how profits vary with the stock market? Certainly we can put numbers in a formula and show a relationship, but if there are no causal factors underlying that relationship, is there a relationship at all?

I do not suggest this as an argument that B_p equals zero, rather, I believe that it shows the use of the CAPM is of questionable value for determining a profit provision.

Brown further points out that the calculation of p is for a prospective profit provision. Because the risk-free rate, no matter how you measure it, will vary greatly even within a given year. How, therefore, can this be part of a formula to calculate a constant profit provision?

Fairley used past rates to guess at what a future average might be, which is certainly an actuarial sound principle. But

if that underlying data widely fluctuates, I am sure most actuaries would agree it has limited use in predicting the future.

In all fairness to Fairley, he used a risk-free rate of 6% for 1979 rates. This appears to be conservative. But again, Brown's point is that it will not come close to the true risk-free rate in 1979. So because r_f is speculative, it is controversial and therefore a weakness of the system.

On the same subject Brown implies r_f should vary by line because the cash flow of different length will extend over a wide variation of interest rate cycles.

Brown's next criticism is ironically a point Fairley uses in defense of his method. Fairley says that historically, the margins shown in his formula are what the industry actually has earned. Brown says this is evidence that traditional profit margins should be maintained.

Fairley says that is not true in Massachusetts because here we have perfect ratemaking. As a matter of fact, Dr. Fairley says overall we are excellent ratemakers, only the element of competition keeps profit provisions that are built into rates from being earned. Therefore where rate competition does not exist a true profit must be included in the rates. It is not easy to refute Fairley's contention while sparing our own ego.

One point I would like to make though is that if we have perfect ratemaking in Massachusetts, won't we be paying the full tax rate on profits, i.e. there will be no such thing as carry-overs to reduce the effective tax rate? Fairley's 20% tax rate is simply an observed countrywide insurance industry rate.

It seems to me in light of perfect ratemaking that rate should
be much closer to the 48% level that is contained in the profit
tax law.

Lastly, Brown says Stone does not meet the Hope criteria
because characteristics within the industry vary greatly, therefore
the parameters in Fairley's model will vary greatly if done on a
company-by-company basis, and therefore will not produce a proper
provision for any one company.

This criticism does not necessarily imply that profit provisions
should vary by company but implies the parameters defined in the
model are poor because they vary so greatly from company to company.
Basically this criticism is a wrap-up of the criticisms that have
already been stated, particularly in the calculation of B's. One
can put numbers in a formula, but what do they mean?

One additional problem I have with Fairley's parameters is
his quantification of k_N. At this point in time I am not prepared
to say Fairley is wrong. As a matter of fact, the values move in
the proper direction. I only question the magnitude. In his paper
Fairley does not build as strong an argument for his k_N's as he
does for other parameters. This may or may not be because he feels
he is more obviously correct in his calculation and therefore re-
quires less support. Regardless, I feel this is a weakness of his
paper not necessarily his method - but one that needs further
investigation.

Personally, I am not yet ready to state that "modern financial
theory" has no place in ratemaking. The Stone/Fairley application,
while interesting and innovative, is a poor model for evaluating
what a profit provision ought to be. While the starting assumption

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(Equation 2 in Brown) is valid, the subsequent development using
the CAPM runs into serious problems. While alternative procedures
have been presented to Commissioner Stone, he dismissed them
out-of-hand because they were not as rigorous as Fairley's.
Stone set the ground rules that profit ratemaking will be kept
within the framework of modern financial theory. If it is to be
kept within actuarial science, there must be a commitment on the
part of actuaries to deal with the theorists on the theorists'
own ground. Although Dr. Stone no longer is Commissioner in
Massachusetts, these theories remain and will continue to be
the basis for developing profit provisions in Massachusetts
until better theories come along.

Mr.' Brown has provided a great service by taking on the task
of criticizing the work done so far in Massachusetts. He has
brought out onto the table some weaknesses of a system - a system
in which we as actuaries need to become more deeply involved.