AN ILLUSTRATION OF THE IMPACT OF INFLATION ON INSURANCE COMPANY OPERATIONS

Stephen P. D'Arcy

Discussion by James P. Streff

It can hardly be disputed that inflation has become one of the biggest concerns and worries of the American public. Nor is it a secret that inflation rates in recent years have risen, become more erratic and, more often than not, defied control. The chance of returning to the inflation rates of the 1950's and 1960's appear slim, as economic forecasters are projecting an inflation rate of 6 to 7% for the next several years. These rates would be about twice the average rate of the 1950's and 1960's.

The calculation of the total return due on insurance company and underwriting profit margins cannot be treated independently from the underlying inflation rate and Stephen D'Arcy in his paper, "An Illustration of the Impact of Inflation on Insurance Company Operation" shows why this is true in theory. It is a well written paper in which he takes the reader through his logic in an uncomplicated manner.

My comments will be divided into three areas: editorial, technical and applications of results.

Editorial: In writing a paper such as Mr. D'Arcy's one is faced with a choice of keeping the model simple so that the true purpose won't be lost and making the model more complicated so that the results can be most accurately applied to the real world. Mr. D'Arcy chose the former route and I think he made the right choice, although it leaves him open to criticism that the model is oversimplistic.

One thing I would recommend he do differently is to very specifically highlight the purpose of the study and all the assumptions and contraints

right before he discusses the three examples. If he did, it might have read as follows:

PURPOSE: Study the relationship between various rates of inflation and underwriting profit margins which result in equivalent "returns on equity" and constant premium to surplus ratios.

ASSUMPTIONS:

1. All assets will be invested in short term government securities, which earn an interest rate of 2 percentage points more than the inflation rate.
2. All profits are fully taxable at 48%.
3. Equity in unearned premium will be omitted from surplus in calculating return on equity.
4. All earnings will be retained by the company to finance future growth.
5. Inflation affects interest rates and insurance rates the same.

CONTRAINTS:

1. The "growth rate" of the benchmark (0% inflation) model will be maintained in subsequent models.
2. The premium surplus ratio will stay constant at a predetermined ratio.

Technical: Mr. D'Arcy's model is simple to understand and seems to be so logical that it is difficult to do anything but agree. However, there are a couple of areas that I feel need comments and clarification.

First, the model is a point estimate model and doesn't deal with variance or risk. As mentioned earlier, this is both good and bad. It's good because it's easy to follow, but it's bad because the reader feels uncomfortable with applying the results. For example, the article contains a set of returns on equity and corresponding inflation rates which are equivalent.

Inflation Rate	0%	6%	12%
Return on Equity			
Exhibit I (1976)	8.03%	14.51%	20.99%
Exhibit II (1970)	6.81%	13.22%	19.63%
Exhibit III (1960)	5.00%	11.30%	17.60%

If the above combinations of inflation rate and return on equity are truly equivalent, then the reader should be indifferent to any of the three combinations within Exhibits I, II or III. An 8.03% return on equity and a 0% inflation rate, should be the same as a 20.99% return on equity and a 12% inflation rate in Exhibit I, as an example.

They are equivalent in their ability to provide capacity for growth by keeping the premium to surplus ratio constant. They may not be equivalent combinations to the investor who is subject to the variability of the investment market as well as the insurance operation itself. The investor would always take the highest rate of return with the smallest risk and presumably this would be the combination with the 0% inflation rate. I am not criticizing the author for leaving the measure of risk out of his model, but I'm hesitant to see his underwriting profit margins without this qualification.

A second criticism relates to the formula in the Appendix for obtaining the underwriting profit margin.

$$U = .05(1+I) + \frac{1 \cdot I \cdot S}{(1-T)EP} - (1-M) \cdot I \cdot \frac{A}{EP} \qquad (1)$$

Where:

S = Surplus
I = Inflation Rate
T = Tax Rate
A = Investable Assets
M = Real Interest Rate
EP = Earned Premium
U = Underwriting Profit Margin

Mr. D'Arcy makes four statements regarding this formula as follows:

> The underwriting profit margin equivalent to a 5% margin with no inflation:
>
> 1. Increases as the ratio of surplus to earned premiums increases.
> 2. Increases as the tax rate increases.
> 3. Decreases as the ratio of assets to earned premiums increases.
> 4. Increases as the real interest rate increases.

The first and the third statements appear to be true by virtue of Equation (1). The term containing $\frac{S}{EP}$ is positive and the term containing $\frac{A}{EP}$ is negative. Upon substituting some other values for A, S and EP into the equation, it soon occurred to me that anytime you had a set of values where A increased, S increased and EP remained constant, the first and third statements would have the underwriting profit margin, (U), going in opposite directions. In fact, if A goes up twice as much as S with EP being constant, U is unchanged. This 2 to 1 relationship is due mostly to the tax rate being 48%.

I think what Mr. D'Arcy implied in each of these statements was "all other things being equal. . ." If this preface is added to each statement, they are all true. However, I think the three variables (assets, surplus and earned premium) would be best treated together to avoid practical inconsistencies. The other variables can logically be handled individually.

The second and fourth statements can be seen as true by referring to Equation (1). However, Equation (1) can be differentiated with respect to T and M to see not only the direction, but also the rate of change.

$$\frac{dU}{dT} = \frac{1}{(1-T)^2} \frac{I \cdot S}{EP} \qquad (2)$$

$$\frac{dU}{dM} = I \cdot \frac{A}{EP} \tag{3}$$

One more observation should be added. Equation (1) can be differentiated with respect to I producing:

$$\frac{dU}{dI} = .05 + \frac{1}{(1-T)} \frac{S}{EP} - (1-M) \frac{A}{EP} \tag{4}$$

When T = .08 and M = .02:

$$\frac{dU}{dI} = .05 + 1.92 \frac{S}{EP} - .98 \frac{A}{EP} \tag{5}$$

Because the tax rate is 48%, the underwriting profit margin will be unaffected by a change in the inflation rate when assets are very close to twice surplus. Actually, Exhibit III comes close to showing this. In this model, if assets had started at 201 instead of 211, there would have been no decrease in the underwriting profit margin as the inflation rate increased. When assets fall lower than twice surplus, the underwriting profit margin would go up as inflation rates increased, although this isn't very likely to happen.

Application of Results:

The best possible result of a paper of this nature would be to arrive at a precise formula for adjusting the return on equity for the insurance industry to account for economic conditions on a year-by-year basis. One could then evaluate return on equity on an "inflation free" basis. This would be a very ambitious undertaking beyond what Mr. D'Arcy intended. However, his model does show quite clearly that adjustments are necessary.

This is somehwat intuitive in trying to arrive at equivalent real rates of return.

A couple of other interesting scenarios to Mr. D'Arcy's model might be possible.

1. What if the model used return on equity-inflation rate equivalents as seen through the eyes of investors rather than equivalents which resulted in comparable growth while holding the premium to surplus ratio constant?
2. What if the model were run under the assumption that all investment income from assets excluding surplus, were returned to the policyholder?

In the first scenario, the predetermined equivalents might be as follows for Exhibit I (Industry 1976).

Inflation Rate	0%	6%	12%
Return on equity from investor viewpoint	8.03%	16.51%	24.99%

The returns on equity would include some compensation (two points of return in equity for each 6 points of inflation) for greater risk which would accompany a higher and presumably more unstable inflation rate. These are not meant to be precise figures.

With these sets of returns on equity-inflation rate equivalents, the model in Exhibit I can be worked from the bottom up to obtain underwriting profit margins. All other initial conditions in Exhibit I remain unchanged.

The underwriting profit margin for the three inflation rates would be:

Inflation Rate	0%	6%	]2%
Underwriting profit margin	5.00%	3.14%	1.27%
Return on equity	8.03%	16.51%	24.99%

By adding the extra 2 percentage points of return on equity for each 6 points of inflation, the swing in the underwriting profit margin was more than cut in half, from 8.04 to 3.73. I'm not suggesting that what I did was completely precise, but rather that some compensation for greater risk associated with higher inflation rates would have a big impact on the model.

The second scenario, perhaps helps to illustrate the effect of investment income from policyholders supplied funds in the model. I changed the author's model so that <u>all</u> investment gain from assets excluding surplus goes back to the policyholder, not through underwriting losses, but rather through dividends. Otherwise I'll follow the same logic and same assumptions. This scenario would change the formula for the underwriting profit margin to be:

$$U = .05(1-T) + \frac{(M+T - M\cdot T)}{(1-T)} \frac{I\cdot S}{EP} \qquad (6)$$

The term containing total assets drops out and when T = .48 and M = .02 the equation becomes:

$$U = .05(1+T) + .943 \frac{I\cdot S}{EP} \qquad (7)$$

Applying this equation to all three industry time periods, the summary of results are:

Inflation Rate	0%	6%	12%
Exhibit I (1976)			
Underwriting profit margin	5.00%	8.48%	11.66%
Return on Equity	5.67%	12.00%	18.35%
Exhibit II (1970)			
Underwriting profit margin	5.00%	9.00%	12.70%
Return on equity	5.02%	11.51%	17.82%
Exhibit III (1960)			
Underwriting profit margin	5.00%	10.54%	15.78%
Return on equity	3.85%	10.08%	16.31%

This illustrates what would happen to the underwriting profit margins if the investment income from non-surplus assets were not available to impact upon the underwriting profit margin.

In summary, I enjoyed Mr. D'Arcy's paper and would recommend to anyone who wants a good illustration of the relationship between inflation and underwriting profit. I hope nobody uses the results directly to adjust the return on equity of various years to an inflation-free basis, because the problem is more complicated than that. He points this out in his paper and his intent of exploring the relationship between inflation and underwriting profit margins is quite clear and well presented.