

Fog and Folly: The Net Discount Rate "Controversy"

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The series of articles in litigation journals since the early 1990s seems to be generating more heat than light on discounting a future loss to present value. This note tries to put in perspective some of the alternative methods and to refocus measurement efforts to what is important.

So many of the methods personal injury analysts are advocating boil down to using historical averages. Both economic theory and mounting statistical evidence suggest historical averages are junk science, which becomes important to personal injury analysts with the Daubert ruling.

This note outlines and provides an economic and statistical critique of several alternative methods of estimating the present value of a future loss. This type of perspective and critique is apparently required given the comments in recent articles.

Constant Net Discount Method

Some personal injury analysts use a historical average net discount rate, which assumes the net discount rate has a long-run mean value to which the series returns after a shock. Gamber and Sorensen (1994) and Peláez (1995) along with Garcia and Perron (1996), Fama (1982), Rose (1988) conclude that the interest rate and the net discount rate do not have stationary means. The conclusion in Garcia and Perron is that the interest rate is characterized by regime shifts. They find that interest rates are nonstationary across regimes but are stationary within a regime. This would imply that calculating a historical average using data from a different regime will not be a reasonable forecast of the future interest rate.

While it is true that regime shifts are difficult for even professional forecasters to predict, they are impossible to predict using historical averages, which is akin to driving while looking in the rear view mirror. Pflaum, Duncan and Frye (1997) present a comparison of estimated loss using professional forecasts and historical averages. They show that the percent error using historical averages is substantial compared to professional forecasts.

Gilbert (1996) defended historical average net discount rate by making three arguments. The first is that the statistical tests of stationarity are somehow flawed since they do not

consider the underlying economics which determine the level of the variable (pp 7, 8, 9, and 10). His second argument is that a particular result in Peláez (1995) justifies the use of historical average net discount rate (pp 10, 13). His third argument is that theoretical growth models yield the result that net discount rates are constant in the long run (p 13).

The argument that the tests for stationarity are not valid since they do not consider the underlying economics is misplaced. As economists, we expect that the interest rate, for example, is driven by underlying economics. The test of the stationarity of the interest rate is merely an attempt to ascertain whether the economic fundamentals are such that the interest rate is driven back to a long run mean or not.¹ Given that the interest rate is nonstationary, the economist is left with the conclusion that forecasts of interest using economic fundamentals are superior to using historical averages of the interest rate which are unreliable and arbitrary.

Gilbert's argument is not only wrong but it points out an interesting inconsistency in the logic behind using historical averages. Gilbert's argument against relying on stationarity tests is that one needs to understand the economics driving the level of the variable and yet by relying on historical average net discount rates, an analyst ignores all economic drivers of the net discount rate.

Gilbert's second point in the defense of a constant net discount rate is based on the Peláez (1995) finding that the simple ratio of earnings growth to interest rate, g_t/r_t , is stationary. Consider the basic discounting problem where W_0 is the earnings in the base year, g_t is the earnings growth rate and r_t is the interest rate in year t .

$$(1) \quad PV = W_0 \sum_{t=1}^N [(1+g_t)/(1+r_t)]^t$$

The ratio $(1+g_t)/(1+r_t)-1$ is the net discount rate for year t . Gilbert makes a basic mathematical error by arguing that g_t/r_t equals $(1+g_t)/(1+r_t)$. These two ratios are not equal and do not need to have the same properties.²

¹Using Gilbert's example, suppose one were to argue that a simple average of past quantities is a good forecast of future quantity. A unit root test could be used to identify whether quantity is in fact stationary and, therefore, whether the mean quantity is stable over time. Failing to reject the null hypothesis that it is a unit root process means one must rely on the economic fundamentals and not simple historical averages to predict future quantity.

²See Peláez (1997) for other problems with Gilbert's arguments.

Gilbert's third argument is that the theoretical growth model of Rowe (1991) confirms that the net discount rate is constant in the long run. The Rowe work is an interesting mathematical exercise but it can not be used to conclude that there is a constant net discount rate in the absence of any empirical support.

Rowe's theoretical finding results from assuming Harrod-neutral technological progress and that the following factors never change: the elasticity of output with respect to labor, the growth in technological progress, the growth in the labor pool, and the rate of time preference.³ History is opposite these assumptions. With all of these factors changing over the past 40 years, it is not valid to argue from Row's model that the U.S. economy was in long-run equilibrium over the past 40 years and that the net discount rate has, therefore, been constant.

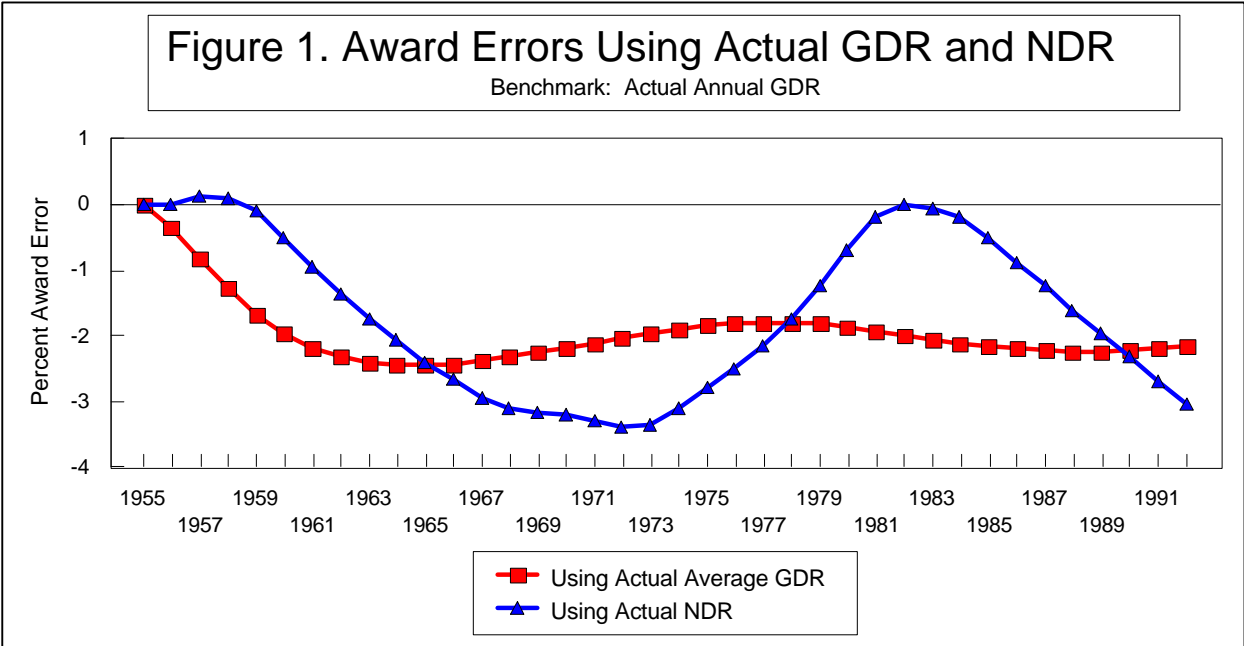
Constant Growth-Discount Rate Method

Peláez (1991) discusses the growth-discount rate (GDR) method of calculating the present value. The only difference between the basic discounting formula presented in equation (1) above and the GDR method is that the geometric average of the interest rates in the years preceding year t (call it R_t) are substituted for r_t and the geometric average of the earnings growth rates in the years preceding year t (call it G_t) are substituted for g_t . Though it is theoretically correct to use the annual geometric averages instead of the annual interest and growth rates, the percent error in awards introduced by simply using the annual net discount rate is quite small. Figure 1 contains the percent award errors using the constant GDR for 1955-92 and using the annual net discount rates for the period 1955-92. Just as in Peláez (1995), the analyst is endowed with perfect foresight with respect to actual future interest and growth rates. The benchmark loss is calculated using the actual annual GDRs.⁴ Peláez uses the 1955-92 time period to demonstrate how well using a constant GDR performs over the historical period from which it was calculated. It is clear from Figure 1 that using the annual net discount rates provides much the same percent award errors as using a constant GDR.

Peláez addressed the challenge of predicting the constant GDR when applying the technique to future losses. He states that since it is impractical to forecast the constant

³Rowe also uses a Cobb-Douglas production function which imposes restrictive assumptions regarding input substitution.

⁴Peláez (1995) presumably intended to use the annual GDRs as the benchmark in his paper, but his Tables 4, 5 and 6 all use the standard annual net discount rate as the benchmark. The percent award errors using the annual GDR as the benchmark are reflected in our Figure 1.



GDR, he examines forecasts of the “present value factor” (PVF), which is simply the annual net discount rate. Peláez develops an econometric model consistent with those models of interest rate determination in Spiro (1989) to explain past levels

of the net discount rate. Having explained past changes in the net discount rate with the model, Peláez hypothesizes about how possible future changes in the explanatory variables will affect the future net discount rate.

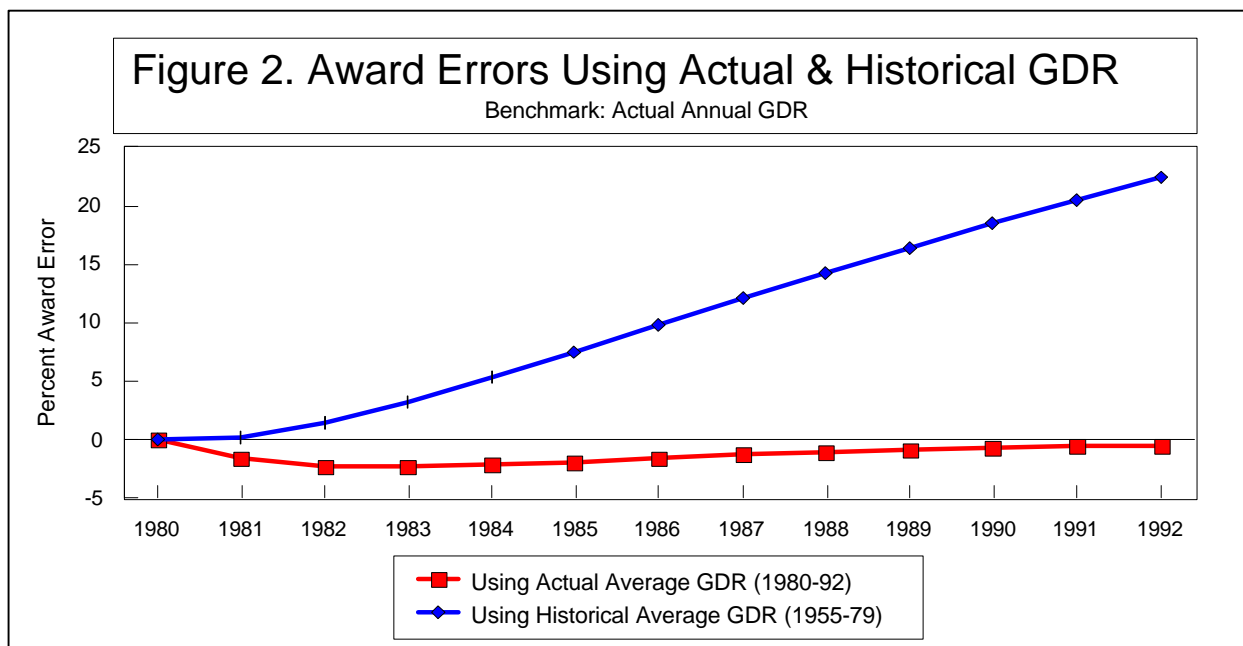
Arguing that forecasting a future constant value of GDR would be impractical, Peláez advises the reader on possible guidelines for selecting a historical period over which to estimate the average GDR.⁵ There is, however, a fundamental flaw in Peláez’ argument. The annual GDR are based on the annual net discount rates and the annual net discount rate is a random walk, making the annual GDR a random walk. (See the Appendix for a mathematical exposition.) Therefore, just as there is not a stable historical average net discount rate, there is not a stable historical average GDR.

In the numerous tests of stationarity Peláez (1995) conducted, he did not explicitly test the

⁵Predicting or explaining the historical average GDR is analogous to predicting or explaining the historical average net discount rate. It is irrelevant given that it is nonstationary. What is relevant is predicting or explaining the annual GDR and annual net discount rate, which is what professional economic forecasters do.

stationarity of the GDR.⁶ An explicit test of the stationarity of GDR conducted for this note reveals that GDR is nonstationary. The data and test statistics are presented in the Appendix. Since there is, then, no stable mean of GDR, selecting a different historical period can change the average GDR which means using a historical average GDR is unreliable and arbitrary for discounting future losses.

To demonstrate how sensitive the GDR is to the choice of historical period, consider a loss that begins in 1980 using data supplied in Peláez (1995). The benchmark present value of the loss is calculated using the annual GDRs. The percent award errors using the actual average GDR for the period 1980-1992 is compared to the errors using the historical average GDR for the period 1955-1979.⁷ This comparison is presented in Figure 2. It is clear that the awards are grossly overstated when the historical average GDR is used



instead of the actual GDR for the 1980-1992 period.

⁶Peláez (1991) did test the stationarity of what he calls the present value factor, PVF, which is simply the net discount rate using only 35 years of annual data (pp40-41). His results with respect to the net discount rate are not supported by his own analyses in his 1995 paper.

⁷Peláez' (1995) guidelines for selecting the appropriate length of historical period are without merit. If GDR were in fact a stationary series with a stable mean, then using a longer period of time would provide a superior estimate of the mean. Following Peláez' guidelines is tantamount to admitting the mean GDR shifts and is not stable.

Total Offset Method

For the total offset method to be a valid method, one must find two statistical properties of the net discount rate. The first property is that the series must be stationary and therefore have a stable long-run mean. The second property is that the long-run mean net discount rate must not be statistically different from zero. Numerous studies of the net discount rate find that the net discount rate is not stationary and, therefore, does not have a stable long-run mean. Since the mean net discount rate is not stable, it can not have a long-run mean equal to zero. Therefore, there is no statistical support for the total offset method.

Schwartz (1997), ignoring the mounting statistical evidence to the contrary, defends the total offset method. He cites a long-run correlation as a statistical defense but simple correlations do not refute the findings that there is no long-run stable mean net discount rate. In fact, as Peláez (1995) points out, the interest rate and earnings growth rates are integrated of different orders. This means that simple correlations, such as those on which Schwartz relies, are spurious.

Below-Market Method

The below-market method consists of growing earnings at a real earnings growth rate and discounting future real lost earnings by a real discount rate. Court rulings such as *Culver II* have attempted to give guidance to analysts by establishing bounds on the net discount rate within which the courts will not challenge the rate used. Peláez has interpreted the below-market method as allowing the analyst to arbitrarily select a net discount rate within the range established by the court. To the extent that the below-market method encourages arbitrary selection of the net discount rate, the method is clearly without foundation. It does seem, however, that an economist worth his or her salt would have an economic basis for selecting a net discount rate and would not treat the court rulings as a license to abandon economic reason. Since *Daubert* requires “scientific methods,” procedures under *Culver* fail since they are not accepted methods.

Case-By-Case Method

Peláez (1997) discusses another method by which present values can be calculated: the case-by-case method. With this method, one uses earnings growth appropriate for the particular case. A valid example may be one for which long-term union contracts are available. Peláez also advocates the use of Treasury Strips to yield the relevant net discount rates for discounting. When historical averages are avoided, this method is

entirely consistent with the basic method using forecasted data since market interest rates reflect a current consensus forecast of future rates.

Conclusions

Out of all the alternatives, discounting still comes down to just applying the relevant net discount rate. It is clear that total offset is unfounded and that historical average net discount rate is arbitrary and unreliable. The Gilbert contribution is hopelessly flawed mathematically. The below-market rate is unfounded if it promotes or justifies arbitrary net discount rates. In some cases, one is supplied with or can reasonably estimate the earnings growth so the case-by-case method is appropriate.

Peláez' average GDR method provides a good estimate of actual loss with perfect foresight. With perfect foresight, however, why use an approximation? His average GDR method falls prey to the same historical averaging problems as with the historical average net discount rate: there is no stable long-run mean, and selection of a historical period is arbitrary and unreliable.

One is left, then, with the conclusion that professional forecasts of interest rate, earnings growth rate and inflation provide the best, least arbitrary method of estimating future loss.

Appendix

GDR is a Random Walk

One can show that GDR is a random walk if the net discount rate is a random walk by considering the definition of GDR_t and of a random walk.

$$\begin{aligned} GDR_t &= \left[\prod_{i=1}^t (1+g_i) / \prod_{i=1}^t (1+r_i) \right]^{1/t} - 1 \\ &= \left[\prod_{i=1}^t (1+n_i) \right]^{1/t} - 1 \end{aligned}$$

where g_i is the earnings growth rate, r_i is the discount rate and n_i is the net discount rate for period i .

Since the net discount rate is a random walk, it can be written as

$$n_i = n_0 + \sum_{j=1}^i e_j$$

where n_0 is the net discount rate in the first period of the historical time period being considered and e_j is the random error in period j . Substituting in this characterization for n_i into the GDR_t equation yields

$$GDR_t = \left[\prod_{i=1}^t \left(1 + n_0 + \sum_{j=1}^i e_j \right) \right]^{1/t} - 1$$

From this equation, it is clear that GDR_t is determined by the random errors in the net discount rate and, therefore, GDR_t is itself a random walk with no stable mean.

Stationarity Test of GDR

Monthly data on 3-month Treasury Bills (auction rate) were collected from the Federal Reserve's on-line service (FRED) and were converted to quarterly data by taking the rate in the first month of each quarter as the quarterly rate. Average weekly earnings in

manufacturing were used to construct a quarterly series of earnings growth rates. Quarterly inflation rate is calculated from monthly CPI.

The growth-discount rate was calculated using 1955:1 as the first quarter of loss. It is assumed, as it was in Peláez' analyses, that earnings are paid at the beginning of the period, which is the quarter in this analysis. The Augmented Dickey-Fuller t-test was conducted with and without a trend and using AIC to determine lag length. The t-value calculated for this test without a trend is -2.23 while the critical value at the 10% level is -2.57. The t-value with a trend is -2.91 while the critical value at the 10% level is -3.13. Therefore, the null hypothesis of nonstationarity could not be rejected at even the 10% level of significance.

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