

Negative Net Discount Rates: When Are They Appropriate, And How to Ensure Consistency When Derived from Current Market Yields and Less-Current Earnings Growth Forecasts

Joseph I. Rosenberg

Abstract

Today's current bond market yields remain very low by historical standards. This has caused many damage award experts to either use negative net discount rates (NDR) or consider when to use them when calculating awards. The purpose of this paper is fourfold: (1) Review the literature on key issues and historical trends involving NDRs; (2) rather than viewing NDR as an input to calculating an award, argue instead that NDR should be considered an effective result when calculating an award using current market yields and forecasted earnings growth; (3) compare alternatively-derived NDRs to see under what conditions a negative NDR should result; and (4) offer a way to resolve the timing mismatch in calculating a damage award and its implied NDR based on current market yields and a "stale-dated" forecast of earnings growth.

Introduction and Literature Review

There is an extensive literature on the concept of a net discount rate (NDR) and how accurate it is when used to calculate the present value of damage awards. This literature goes back to at least 1989 (e.g., Nelson, 1989; Dulaney, 1989). In essence, the NDR is often used as a shortcut factor to discount lost future earnings by combining an assumed future growth rate in the numerator and an assumed discount rate in the denominator. Among the various algorithmic notations used to express the NDR, the one used here is as follows, where g is the single future earnings growth rate, and r is the single discount rate (allowing some users to substitute the time-varying g_t and r_t in which both values are geometric means equal to their respective periodic rates):

Joseph I. Rosenberg, MBA, MA, CFA
Joseph I. Rosenberg, CFA, LLC
9821 La Duke Drive
Kensington, MD 20895
Tel: 301-802-0617
jrosenberg123@gmail.com

$$LostWages = \frac{w_0(1+g)}{(r-g)} \left[1 - \left(\frac{1+g}{1+r} \right)^T \right]$$

$$LostWages = \frac{w_0}{NDR} \left[1 - \left(\frac{1}{1+NDR} \right)^T \right] = w_0 \frac{1 - (1+NDR)^{-T}}{NDR}$$

$$NDR = \frac{(r-g)}{(1+g)} \text{ and if estimated from historical data } = \frac{1}{N} \sum_{i=1}^N \left(\frac{r_i - g_i}{1+g_i} \right)$$

NDR is often shortened to $r_i - g_i$

The literature is replete with arguments over NDR-related issues. A sampling of issues and related articles include:

- Whether NDRs should vary with level of earnings (Franz, 1993; Levy and Murnane, 1992);
- Whether the total offset method (NDR = 0) is reasonable, as described by one author giving a result that “... for a large number of industries and diverse worklives, total offset awards are not significantly different from a fair award” (quote from Pelaez, 1989, p. 59; Schwartz, 1997; Martin 2012, Sec. 1201);
- How similar the NDR method is to the use of a below market discount rate, and whether the latter is appropriate¹ (Pelaez, 1995, 1997, and 1999; Gilbert, 1996; Schwartz, 1997);
- How stable or stationary has the NDR (or the NDR ratio²) been over time (Haydon and Webb, 1992; Johnson and Gelles, 1996; Horvath and Sattler, 1997; Gamber and Sorenson, 1993 and 1994; Payne, et al., 1999a and 1999b; Hays, et al., 2000; Sen, et al., 2000; Brush, 2003, 2004, and 2011; Clark et al., 2008; Braun et al., 2008; Albrecht and Krueger, 2014); and
- Which discounting method (or methods), including NDR as one type of historically-based measure, provides the most accurate damage award valuation when analyzed after the fact (Schilling 1985; Dulaney, 1987; Brush, 2003, 2004, 2011; Cushing and Rosenbaum, 2006, 2008, and 2010; Rosenberg and Gaskins, 2012).

There is obviously a close relationship between the NDR and a below market interest rate, as both measures require use of a single discount rate in which future inflation expectations are purportedly netted out. One difference between the two measures is how explicit one needs to be on earnings growth. For example, if users of a below market interest rate feel it appropriate to include future productivity gains above inflation, this is likely to be obvious if not explicit in any forecasted future earnings

growth. By contrast, in theory at least, NDR users would need only to implicitly incorporate any future productivity growth above inflation within the assumed NDR.

The Pfeifer court (*Jones and Laughlin v. Pfeifer*, 1983) suggested that a trial court would be unlikely to be reversed if it adopted a below market interest rate of between 1 and 3%. It is perhaps not coincidental that in the first survey of damages experts specifically asking what NDR they would use if required to do so (Brookshire and Slesnick, 1999), the median NDR was exactly 2%.

As a key issue, noted above, the stability or stationarity of the NDR is critical in providing confidence to its adherents that it will produce reasonably accurate and consistent damage awards over time. In Clark, et al., 2008, a review of many studies on this topic showed mixed results as to whether the NDR is really stationary (implying that shocks are transitory, with eventual mean reversion) or whether the NDR has exhibited structural breaks over time that do not result in mean reversion. The answer to this question is important since if the NDR ratio is non-stationary, then past observations have questionable predictive value and the best predictor of next period's NDR is that of the current period. Of the eight sets of authors (whose 10 studies were reviewed by Clark, et al.), six qualified their findings of stationarity by acknowledging at least one structural break in the time series data, implying that non-stationarity applies over longer time periods. In the study cited that was the least convinced on mean reversion, NDR was found to be "...nonstationary even after accounting for two structural breaks" (Braun, et al., 2005, cited in Clark, et al., 2008, p. 234). In their own analysis, Clark et al. proposed their own method of modeling the net discount ratio as a "fractionally integrated process". They observed that economy-wide and sector net discount ratios are "long memory processes that are mean-reverting," i.e., that "[I]f shocked away from its historical average, a mean-reverting but non-stationary NDR [sic] will eventually revisit this level." (Clark, et al., 2008, p. 242).

NDRs are measured over a wide range of historical time periods. When damages experts use historically-based NDRs to derive a damage award rather than forecasting a future NDR, the utility of any historically-averaged NDR cannot be separated from the broader issue of whether historical average discount rates of any type are more accurate relative to the use of current market yield discount rates. The results of this ongoing debate have also been mixed, as noted in the above-referenced articles by Dulaney, Cushing and Rosenbaum, Brush, and Rosenberg and Gaskins. Concluding that stationarity was inherently uncertain, Cushing and Rosenbaum devised what they argue was an optimal NDR estimator containing both current and historical average NDRs, and for practicality proposed an even split between the two measures (Cushing and Rosenbaum, 2006).

It should be noted that regardless of how NDRs are obtained by damage award experts, there has clearly been a downward trend in the median values and ranges being used. In the four surveys of damages experts published in the JFE from 1999 through 2012, the median NDR declined from 2.0 to 1.5, with the latest survey having an interquartile range of 1.0% to 2.04% (Slesnick, et al., 2013, p. 72). It isn't clear whether this downward trend in NDRs mainly resulted from the prolonged period of declining real

interest rates, or whether survey respondents were simply assuming that wage growth will generally at least keep up with inflation even if short and intermediate-term interest rates do not.

Historical Net Discount Rates

There are several somewhat arbitrary choices in measuring what the NDR has been historically. Among the most important choices are:

- (1) What measure of earnings should be used, e.g., wage and salary earnings only vs. total compensation including benefits; full time workers vs. all workers; hourly vs. weekly wages (or hourly vs. weekly total compensation); earnings excluding or including self-employment net earnings, i.e., proprietor's income; etc.;
- (2) What bond instrument and yield(s) to maturity(ies) should be used, e.g., U.S. Treasury 1, 3, 5, 7, 10, 20, or 30-year maturity yield or some combination, such as a bond ladder; and
- (3) What measure of periodicity for earnings growth and bond yields should be used (e.g., observations using a single base year, three-year base period/moving average, or longer moving average period, e. g., 15 or 20 years, etc.).

Regarding choice (1), there have been a variety of earnings measures used: For example, Pelaez (1989) and Rosenberg and Gaskins (2012) used the Bureau of Labor Statistics average weekly earnings for production and non-supervisory workers (BLS, monthly data series); Haydon and Webb (1992) and Clark, et al. (2008) used the BLS average hourly earnings for production and non-supervisory workers; and both Dulaney (1987) and Brush (2004) used the BLS total hourly compensation in the U.S. business sector. Although not often cited in published articles, a separate earnings measure by the Trustees of the Social Security Administration trust funds (OASDI/SSA, 2013) is also sometimes used by damage award experts, and it includes self-employment net earnings. Regarding choices (2) and (3), many different individual bond maturities or mixes of maturities have been used, as well as different periodicities of observations, too numerous to enumerate here.

Regardless of whatever complex models might be used to explain whether NDRs should be considered statistically “stationary”, graphical evidence that jury members might be presented most likely would make this a difficult assertion for them to accept. Figure 1 (p. 48) presents the Net Discount Rate based on single-year observations, i.e., single year averages for earnings growth rates over the prior year (from BLS’ weekly average earnings for production and non-supervisory workers obtained via its “Household Survey”) netted against market yields averaged during the same single year. The results are shown for five different Treasury maturities. As would be obvious to any jury, NDRs measured this way have varied greatly. They have varied from very low and even negative NDRs for certain bond maturities during the 1970s and again in the 2000s, to very high NDRs during the early to mid-1980s, exceeding 7% at least once for each of

the maturities considered, and even above 8% for some maturities. Clearly, actual inflation, inflationary expectations, and the lag observed when bond market yields began skyrocketing around 1980, which then began declining at a slower pace than nominal wages over much of the decade, all have contributed to the extreme volatility observed in annual NDRs.

Figure 2 (p. 49) presents the same NDR data except replacing single-year observations with the three-year geometric means of weekly earnings and market yields (interest returns but not capital gains or losses) on each remaining maturity bond. The intent in producing this figure was to see how much effect the smoothing of annual data has on the inherent annual volatility in these measures and the incidence of negative NDRs. The answer is that there was some reduction in extreme observations, but all maturities still exhibited high volatility and at least some three-year-periods of negative NDRs remained.

Finally, Figure 3 (p. 50) presents an alternative earnings measure to assess the impact of a broader measure of earnings, that of covered earnings as reported by the Social Security Administration. Covered earnings is calculated as "... the ratio of the sum of total U.S. wage and salary disbursements and net proprietor's income to the sum of total U.S. civilian employment and armed forces." (OASDI/SSA, 2013, p. 97). Clearly, the single-year average of covered earnings as tracked by SSA and embedded within the NDRs shown in Figure 3 is more expansive and volatile than average earnings of production and non-supervisory workers in private industry, as tracked by the BLS and embedded within the NDRs shown in Figure 1 (p. 48). One obvious explanation for the greater volatility of OASDI/SSA covered earnings is its inclusion of proprietors' net earnings, which should be more directly correlated with macroeconomic factors than the average earnings of production and non-supervisory workers in private industry.

NDR as an Historically-Based Input to a Damage Award vs. NDR as an Effective Result Based on Current Yields and Forecasted Earnings Growth

The issue of how best to derive an NDR leads to an important question directly involving the topic of this paper. Although NDRs are typically thought of as a historically-based input to calculating a damage award, there is no reason why an NDR should not be the effective result from calculating a damage award based on non-historical factors, such as current bond market yields for discounting and forecasted future earnings growth rates. While few damages experts might calculate an historical average NDR over a long period and observe an average negative value, there is no reason why an effective NDR based on current market yields, especially a current yield ladder, and a reasonably contemporaneous forecast of future earnings growth rates cannot produce a negative value.

Selecting any single NDR may be considered arbitrary and unrelated to current conditions in both the bond market and the labor market. The rate of past inflation and especially the deviation of actual from expected inflation have affected trends in realized NDR over time. This was demonstrated in Figures 1-3 (pp. 48-50). The current and

implied rate of future inflation obtained from the bond market, as well as contemporaneously projected earnings growth rates, together offer an alternative way to obtain NDRs. Many damage award experts use current market yields for discounting, and many such experts (not always the same ones) use recent earnings growth forecasts. When used together, NDR can be derived as an effective result from a calculated damage award. Such a resulting NDR may in fact have a negative value under certain conditions.

Two popular governmental forecasts for future earnings growth are (1) one by the Trustees of Social Security Trust Funds (the Federal Old-Age And Survivors Insurance And Federal Disability Insurance Trust Funds, usually referred to collectively as “OASDI”, 2013), and (2) another by the Congressional Budget Office (CBO, 2014). Forecasts of future earnings growth from each of these sources are explicitly accompanied by forecasts of future inflation. Therefore, in both forecasts, each year’s future earnings projection embeds an underlying rate of real earnings growth above inflation, typically attributable to labor’s assumed share of future productivity gains.

A key problem arises when using either of these forecasts of future earnings growth in a damage award calculation along with current market yields for discounting. The problem is that inflation rates embedded within nominal earnings growth forecasts can become stale rather quickly, while current market yields reflecting the most recent expectations of inflation are updated daily. This may not be much of a problem when bond market yields exhibit only limited fluctuations. However, when bond market volatility is high, creating a major change in inflationary expectations, the timing mismatch between current market yields and a now-dated nominal earnings growth rate forecast can create inconsistencies that render suspect any result based on their combined usage. Before addressing how to resolve this potential problem, however, it is worth reviewing the past history of these two alternative measures of earnings growth, as well as two additional sources of past earnings growth data that inform the debate on how best to create a credible damage award calculation.

Comparison of Compound Real Annual Earnings Growth Rates

Four sets of governmental time series data are compared to see what we can learn about historical earnings growth rates measured in different ways. All four are compared for various historical time periods and, for the two mentioned above (OASDI/SSA and ECI/CBO), forecasts also are available and compared. These are shown in Table 1 (p. 51) and include the following:

- **Covered Wages and Self-Employment Net Earnings:** Historical and projected series data are provided by the Social Security Administration in its annual OASDI report (referred to as **OASDI/SSA**). By including the sum of covered wages and self-employment/ proprietors’ net earnings as described above, this is a broader measure than weekly or hourly earnings provided by the

BLS for non-supervisory workers in private industry. It is the source of earnings growth used to derive NDR in Figure 3 (p. 50);

- **Employment Cost Index:** For this index, historical data series are obtained and produced by the Bureau of Labor Statistics via its National Compensation Survey (NCS) of business establishments; projected data series are produced by the Congressional Budget Office. Depending on what is being referred to, it may be referenced as **ECI/BLS** or **ECI/CBO**. The ECI has a separate component for wages and salaries excluding benefits. The wage and salary component of ECI is the straight-time wage or salary rate of earnings before payroll deductions, which includes production bonuses, incentive earnings, commission payments, and cost-of-living adjustments, but excludes overtime pay, shift differentials and non-production (e.g., annual) bonuses (BLS, 2001);
- **Average weekly earnings of production and non-supervisory workers in private industry:** This self-explanatory measure of earnings provides the longest set of time series earnings data available from the BLS. Its source is the BLS' Current Employment Statistics (CES) survey of business establishments, but this measure is not forecasted. It is the source of earnings growth used to derive the NDR in Figures 1 and 2 (pp. 48-49).
- **Mean Earnings for Full-Time Year-Round (FTYR) workers:** This measure is produced by the Census Bureau via its Current Population Survey (**Census/CPS**), conducted with the BLS. Two important features of the CPS that are not available in the other earnings series are: (1) the segregation of full-time year-round workers' earnings from part-time or seasonal workers' earnings; and (2) a further breakdown of earnings by level of educational attainment, including by the age bracket of respondents. In this paper, all FTYR workers 18 and over are combined into two groupings: those with a BA degree or higher and those with less than a BA degree.

Table 1 (p. 51) displays the compound real annual growth rates for earnings, or wages and salaries, net of inflation for different historical periods. Also shown is the corresponding number of recessions that occurred during each period, reflecting the impact of this key macroeconomic factor on earnings. In addition to the real earnings growth rates from each data source by time period, with the Census/CPS data we are also able to show the educational breakout for those with and without a BA degree or higher. This significant source of differential earnings growth is important to isolate, given the impact of educational attainment on lifetime earnings.

It is also important to net out the underlying different historical inflation rates used among the four earnings data series in Table 1 (p. 51) in order to measure real earnings growth rates in a consistent way. The Census/CPS data series uses the CPI-U-RS, or the Consumer Price Index for all urban consumers, research series. Using this index, Census presents different years' FTYR earnings in constant dollars, allowing the measurement of real earnings growth over time.

The ordinary CPI-U is the most commonly referenced source of general inflation in the U.S. However, over time important changes in the CPI-U have been introduced to

improve accuracy in measuring what things cost, such as the rental equivalent for housing costs and the growing use of generic drugs. Since the BLS never restates past measures in its published CPI-U data, using a long time series of CPI-U can create distortions. The CPI-U-RS was created specifically to incorporate these changes to past CPI-U indices in order to have a more consistent set of time series data.³ Of the four data sources in Table 1 (p. 51), only Census/CPS explicitly used the CPI-U-RS inflation measure when presenting its FTYR earnings in constant dollars. For consistency, it was necessary to ignore the real earnings growth data published with the OASDI/SSA series since they were derived using the CPI-W, and instead effectively replace the inflation measure upon which they were calculated with the CPI-U-RS. This allowed for consistent real earnings or wage and salary growth statistics over each historical period from all sources.⁴ For the OASDI/SSA, its own forecast of real wage growth is displayed directly in Table 1, since it is unclear how different the SSA Trustees' forecast of CPI-W would be from what it might have forecast for the CPI-U, much less the CPI-U-RS. For the ECI/CBO forecast, no real earnings growth rates are published. Thus, since no CPI-U-RS forecast is available, the ECI/CBO real growth rate forecast is derived from its nominal earnings forecast by netting out the CBO projection of CPI-U inflation.

In Table 1 (p. 51), all historical time periods shown end with the year 2012. This cutoff was to ensure comparability among the data sources, since the Census/CPS series was not updated for 2013 as of the writing of this article.

Several important observations can be made from Table 1 (p. 51):

- With the exception of the last decade that included only one recession, the so-called “Great Recession” that began in December of 2007, the number of recessions included in each time period has had a negative impact on real earnings/ wage and salary growth rates (i.e., more recessions, lower real growth rates) among all four data sources;
- Also except for the last decade with the single, dominant Great Recession, real average earnings growth rates in all other periods were relatively similar among three sources: BLS' average worker's wages and salary (ECI/BLS, column 6); BLS average earnings for production and non-supervisory workers in private industry (BLS, column 7); and FTYR workers with less than a BA degree (Census/CPS, column 9). In each period except the last decade, real earnings growth rates among these three data series were much lower than real growth rates of covered wages and self-employment net earnings (OASDI/SSA, column 5) or FTYR workers with a BA degree or higher (Census/CPS, column 10).
- Covered wages and self-employment net earnings (OASDI/SSA) grew more than twice as fast as the employment cost index (ECI/BLS) over every comparable historical period of time. Among the plausible reasons for this phenomenon may be the rising component of proprietors' net income which includes profit as compared with wage and salary income as measured by the ECI.
- Comparing the only two published government forecasts of real growth rates in earnings or wages and salaries, the OASDI/SSA exceeds the ECI/CBO for the period 2014-2023 in their most recent respective forecasts as of June 2014.⁵

While both forecasts for the year 2024 are close, only the OASDI/SSA forecast projects earnings growth afterwards at a constant rate, whereas 2024 is the last year of the CBO forecast.

- Educational attainment matters a lot. According to the Census/CPS survey data, FTYR workers with a BA degree or higher (column 10) saw their average earnings grow more than twice as fast as workers without a BA degree (column 10), again excepting the last decade as the period that included the Great Recession.

One interesting aspect in assessing the impact of education is that while both groups, those with and without a BA degree, saw their average earnings decrease by non-trivial fractions from 2002-2012, the entire set of Census-surveyed workers (column 8) saw their real earnings growth as essentially flat. This is explained by the fact that over this decade, the percentage of FTYR workers over 18 with at least a BA degree grew from 31.5% to 38.3% of the total. Therefore, while the average earnings within each educational grouping may have declined, this was more than offset in total by the considerably larger percentage of FTYR workers that managed to obtain a BA degree or higher, resulting in a significantly greater weighting of the more highly educated group by the end of the period.

What Do the Different Data Sources Imply About NDRs Based On Current Market Yields And Forecasted Earnings Growth?

Figure 4 (p. 52) displays four sets of hypothetical 30 year forecasts of earnings growth applied to a base earnings amount of \$43,000, roughly the average earnings observed by BLS for all workers in 2013 (BLS, Table B-3, 2014). This comparison illustrates the range of possible results based four forecasts from the three sources shown in Table 1 (p. 51): the direct forecasts from OASDI/SSA and ECI/CBO, and two separate forecasts from Census/CPS for FTYR workers, one for those with less than a BA degree, and one for those with a BA degree or higher.

For the Census/CPS forecasts, we utilized the yearly inflation assumptions of the CBO combined with two measures of average compound annual real earnings growth rates based on different levels of educational attainment observed from 1980-2012. The lower real annual growth rate of .16% was observed for FTYR workers with less than a BA degree, and the higher annual growth rate of .7% was observed for all FTYR workers but also closely represents those with a BA degree or higher.⁶

The current dollar values shown for the year 2043 (e.g., \$140,856 for OASDI/SSA) are the calculated results over 30 years for each growth forecast starting with \$43,000 in 2013. Each future earnings stream is then discounted to present value using a current yield bond ladder of U.S. Constant Maturity Treasuries (CMT), observed as of 6-18-2014 (allowing for interpolation between observable maturities).

At the bottom of Figure 4 (p. 52), we see four present values, ranging from a high of \$1,509,000 for OASDI to a low of \$1,159,000 for Census/CPS FTYR respondents having less than a BA degree (a 30% difference from lowest to highest). Interestingly, the OASDI/SSA is also 13% higher than the other government forecast, \$1,340,000 from ECI/CBO. There is about an 8% difference between the two Census/CPS forecasts that may be attributable to educational attainment level.

The “**No Disc./Growth**” number at the bottom right of Figure 4 (p. 52), **\$1,290,000**, represents the present value if one were to assume a zero Net Discount Rate. Since \$43,000 was the beginning earnings amount assumed in 2013, projecting this out for 30 years with a zero discount rate and a zero earnings growth rate is simply calculated as $\$43,000 \times 30$ years, or \$1,290,000. Thus any present value result that is more than the zero NDR value so derived can be said to have an effective **negative NDR**.

The main problem with comparing results as just derived is the one noted above: That all inflation assumptions used to produce the Figure 4 (p. 52) results are “stale-dated” in comparison with the current market yields in the CMT bond ladder used for discounting. Inflation expectations may not have actually changed much between the time each inflation forecast was made (May 2013 for OASDI, and February of 2014 for CBO, which was also used for both Census-based results). However, a useful methodology must account for, and offer a solution to, the possibility of a material change in inflation expectations from the time an earnings growth forecast is made and the date it is used with the most current market yields available. Such a solution is presented in the next section.

One Way to Resolve the Timing Mismatch in Calculating a Damage Award and its Implied NDR Based on Current Market Yields and a “Stale-Dated” Forecast of Earnings Growth

Future inflation is a key component of most earnings forecasts, often along with some additional real earnings growth. Both the OASDI/SSA and ECI/CBO provide inflation forecasts explicitly as a separate component of their earnings forecasts. However, OASDI/SSA is always available only as a single annual forecast, and while CBO usually does two forecasts per year, in 2013 it only produced one. Therefore, “staleness” of their forecasts, especially for the inflation component, is a constant risk until their next forecasts are published.⁷

There are no perfect ways to derive current market expectations for future inflation. An imperfect way, and probably the one most widely used by damages experts, is to take the difference between U.S. coupon bearing Treasuries and U.S. Treasury Inflation-Protected Securities or TIPS. Since the latter offers a real interest yield plus an inflation adjustment via a change in principal, the difference between TIPS and ordinary fixed coupon-bearing Treasuries can be deemed to be compensation for the uncertainty of future inflation, albeit with certain caveats (discussed below).

The Federal Reserve Board publishes research under its Finance and Discussion Series. Two papers in this series, which allow for daily updates in yields, provide the data needed to derive an imperfect future annual inflation compensation measure (Gurkaynak, et al., 2006; Gurkaynak, et al., 2008).

In their 2008 paper, Gurkaynak et al. provide “breakeven” par coupon yields for each remaining maturity from year 2 through 20 (labeled “BKEVEN”). For any given number of years of remaining maturity, these BKEVEN bond equivalent yields (BEYs⁸) equal the cumulative inflation compensation between nominal U.S. Treasury yields and TIPS yields as of that remaining number of future years. In both papers, par coupon yield curves were calculated for all remaining maturities via a common spline smoothing technique.

Algebraically, the published BKEVEN rates allow us to first derive cumulative inflation compensation through each future year, and then, based on the forward BKEVEN rates, we can derive annual inflation compensation by year, as follows:

$BKEVEN_t = \text{Nominal Tsy Yld}_t - \text{TIPS Yld}_t = \text{Cumulative Inflation Compensation}_t$

$$\text{Annual Inflation Compensation}_t = \left(1 + \frac{BKEVEN_t}{2}\right)^{t \times 2} / \left(1 + \frac{BKEVEN_{t-1}}{2}\right)^{(t-1) \times 2} - 1$$

Annual inflation compensation should be considered as the additional compensation implied by the market for holding a regular coupon-bearing Treasury security in lieu of holding a TIPS, each bond with one year more of maturity than those same bond types maturing in the prior year.

BKEVEN rates are provided via a data download to an Excel spreadsheet: <http://www.federalreserve.gov/Pubs/feds/2006/200628/200628abs.html>

In defining BKEVEN rates, the authors provide this caveat:

“Please note that rates of inflation compensation (“breakeven” rates) incorporate inflation risk premiums and the effects of the differential liquidity of TIPS and nominal securities. Consequently breakeven rates should not be interpreted as estimates of inflation expectations.”

Whether or not one views this caveat about using BKEVEN rates as perfunctory, in concept, many damages experts do consider the yield differential between regular coupon-bearing Treasuries and TIPS as the best estimate of future inflation. Moreover, there is really no seriously competing method to obtain the market’s impartial forecast of yearly inflation. Hence, it is an imperfect method with few competitors.

Using this method, Figure 5 (p. 53) displays modified results for the same earnings forecasts as in Figure 4 (p. 52) except substituting the rates of annual inflation compensation calculated as described above for the inflation rates that are embedded in

the four forecasts of Figure 4. In Figure 4, the OASDI/SSA inflation forecast (made in May 2013) ranged from 2.2% to 2.8%, the latter being its long run projection. The ECI/CBO inflation forecast (made in February 2014) ranged from 1.7% to 2.4%, the latter being its last year (2024) projection. The CBO inflation projection was also used in the two forecasts based on the Census/CPS data, since it was more recent than the one in OASDI/SSA.

By making the inflation component the same among the four forecasts as shown in Figure 5 (p. 53), the resulting range of present values narrowed from 30% before to 22% now (from a high of \$1,411,000 for OASDI to a low of \$1,156,000 for Census/CPS FTYR respondents having less than a BA degree). Also due to consistent inflation assumptions is the narrowing of present value differences between the two government forecasts. OASDI/SSA is now less than 5% above the ECI/CBO forecast (\$1,411,000 vs. 1,344,000), vs. 13% higher in Figure 4 (p. 52) when each was based on their own inflation forecasts that were published nine months apart.

Returning to the main question of this paper, both the OASDI/SSA and ECI/CBO forecast still result in effectively negative NDRs. We now have current estimates of future inflation incorporated within modified earnings growth forecasts alongside current market yields observed as of the same day used for discounting. This proposed method of including an imperfect but widely used measure of inflation expectations that can be observed as of the same day as current market yields resolves the potential timing mismatch issue on when future inflation is assumed.

It also is straightforward to solve directly for what the net discount rate is for each potential damage award. Table 2 (p. 54) shows how this is done. We first solve for the internal rate of return (IRR), which is the single discount rate that equates the present value of each forecasted earnings stream with the yearly forecasted cash flows. (Note: These are all very similar because each stream of future earnings is discounted at the same current Treasury yield ladder). We next solve for the single compound earnings growth rate associated with each earnings forecast. Finally, the NDR is solved as explained before: $(r-g)/(1+g)$. Based on the Figure 5 (p. 53) results utilized in Table 2, OASDI/SSA has an NDR of -.642%, and ECI/CBO has an NDR of -.474%. The other two forecasts based on Census/CPS survey, one utilizing inflation plus .70% and the other utilizing inflation plus .16%, both have positive NDRs: .007% and .530% (the first for FTYR workers with at least a BA degree and the second for those without, respectively). It also is easy to see how assuming a real growth rate above inflation just slightly higher than the .7% observed for all Census/CPS respondents from 1980-2012 (and about the same for the more educated ones) could also lead to the calculation of an effectively negative NDR.

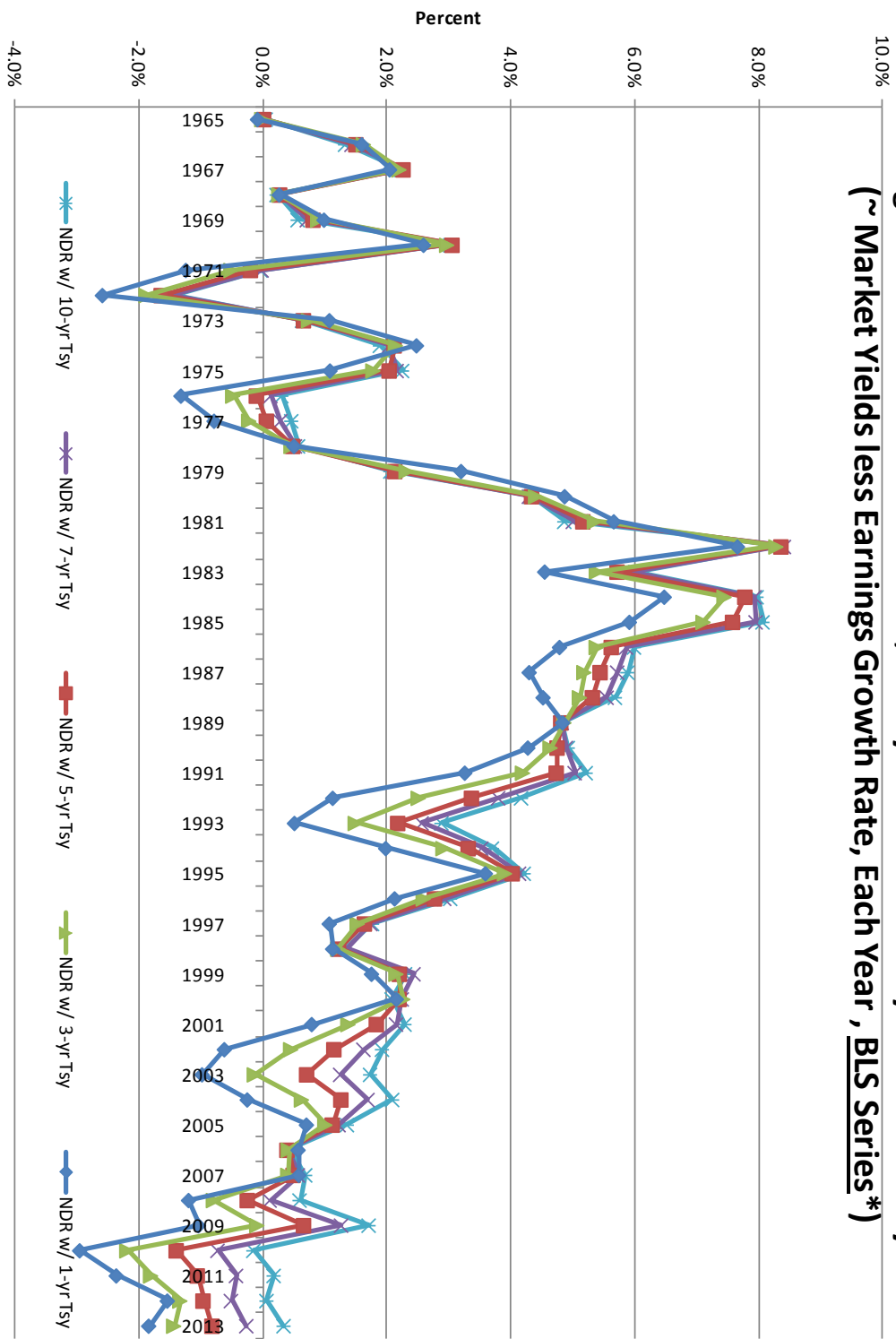
Conclusion

The net discount rate may be thought as an effective result in calculating a damage award, rather than its more common use as an input assumption in generating such awards. Today's low bond market yields, however much they are affected by deliberate

government policy, are a reality facing the parties to a lawsuit involving loss of earnings or earning capacity. Negative net discount rates, however rare historically, do not seem at all unreasonable today. This is particularly true for users of current market yields for discounting along with either the ECI/CBO or OASDI/SSA forecasts of future earnings growth.

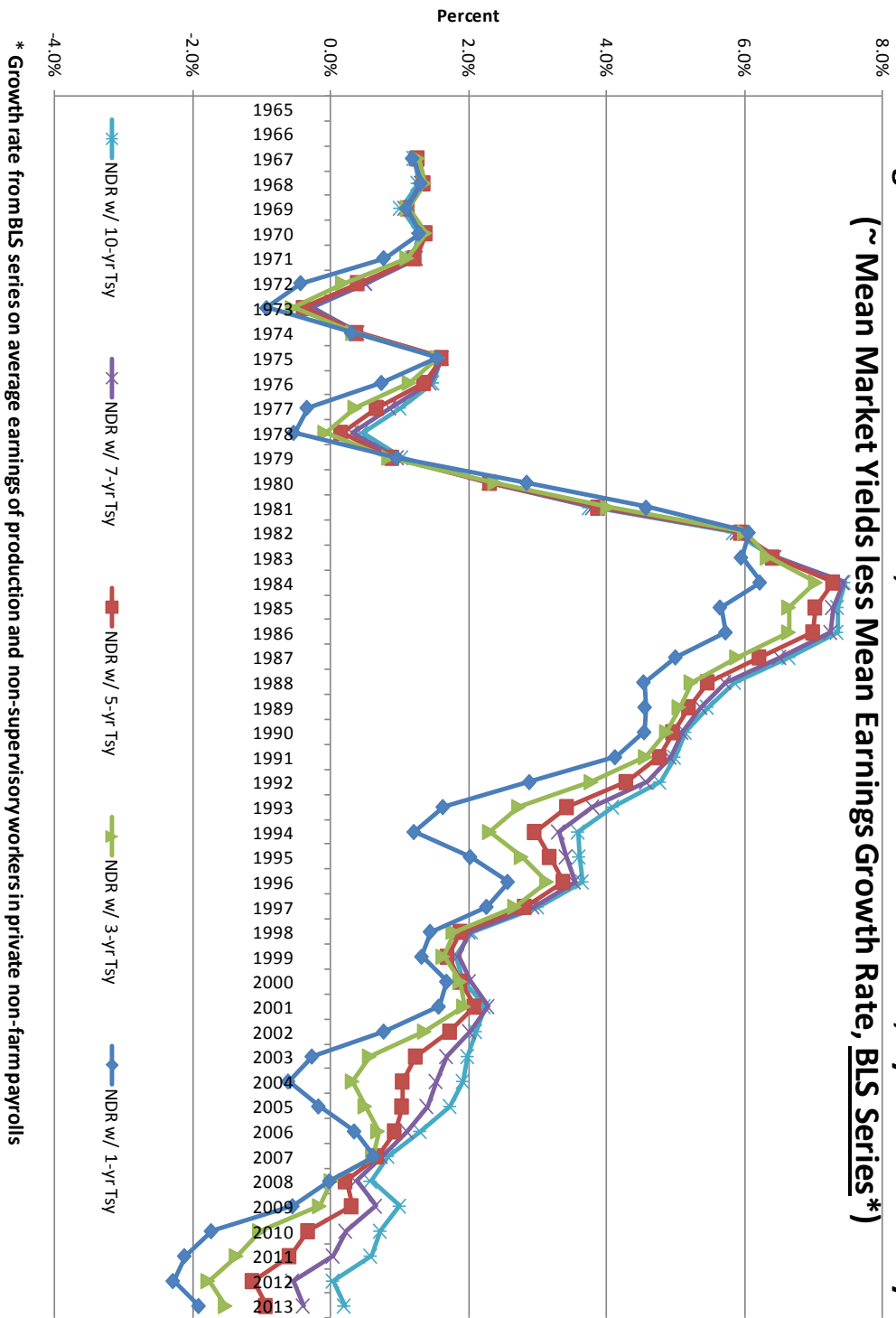
For damage award experts who use current market yields for discounting, however, the specter of using materially-dated inflation assumptions embedded within authoritative earnings growth forecasts can render the calculation theoretically inconsistent and subject to rejection. The methodology presented here offers a way to resolve this potential inconsistency. Even though inflationary expectations have been relatively stable for some time, damages experts know that sudden changes in inflation expectations and their impact on current market yields can occur in short order. When this occurs, the use of authoritative earnings forecasts even a few months old can become suspect. Moreover, the method presented here is also well suited for those wishing to calculate damage awards based on current inflation expectations along with historical average real earnings growth rates with or without educational differentials. Having negative NDRs should be viewed as a legitimate result of a theoretically and contemporaneously consistent damage award calculation. Being able to update inflation expectations as needed to an earnings growth rate forecast should make damage award experts more comfortable with defending such a result, as long as bond and labor market conditions remain similar to those of today.

**Figure 1: "Net Discount Rates", Yearly Observations by Bond Maturity
(~ Market Yields less Earnings Growth Rate, Each Year, BLS Series*)**



* Growth rate from BLS series on average earnings of production and non-supervisory workers in private non-farm payrolls

**Figure 2: "Net Discount Rate", 3-Yr Geo. Mean Observations, by Bond Maturity
(~ Mean Market Yields less Mean Earnings Growth Rate, BLS Series*)**



**"Figure 3: "Net Discount Rates", Yearly Observations by Bond Maturity
 (~ Market Yield less Earnings Growth Rate, SSA Series*)**

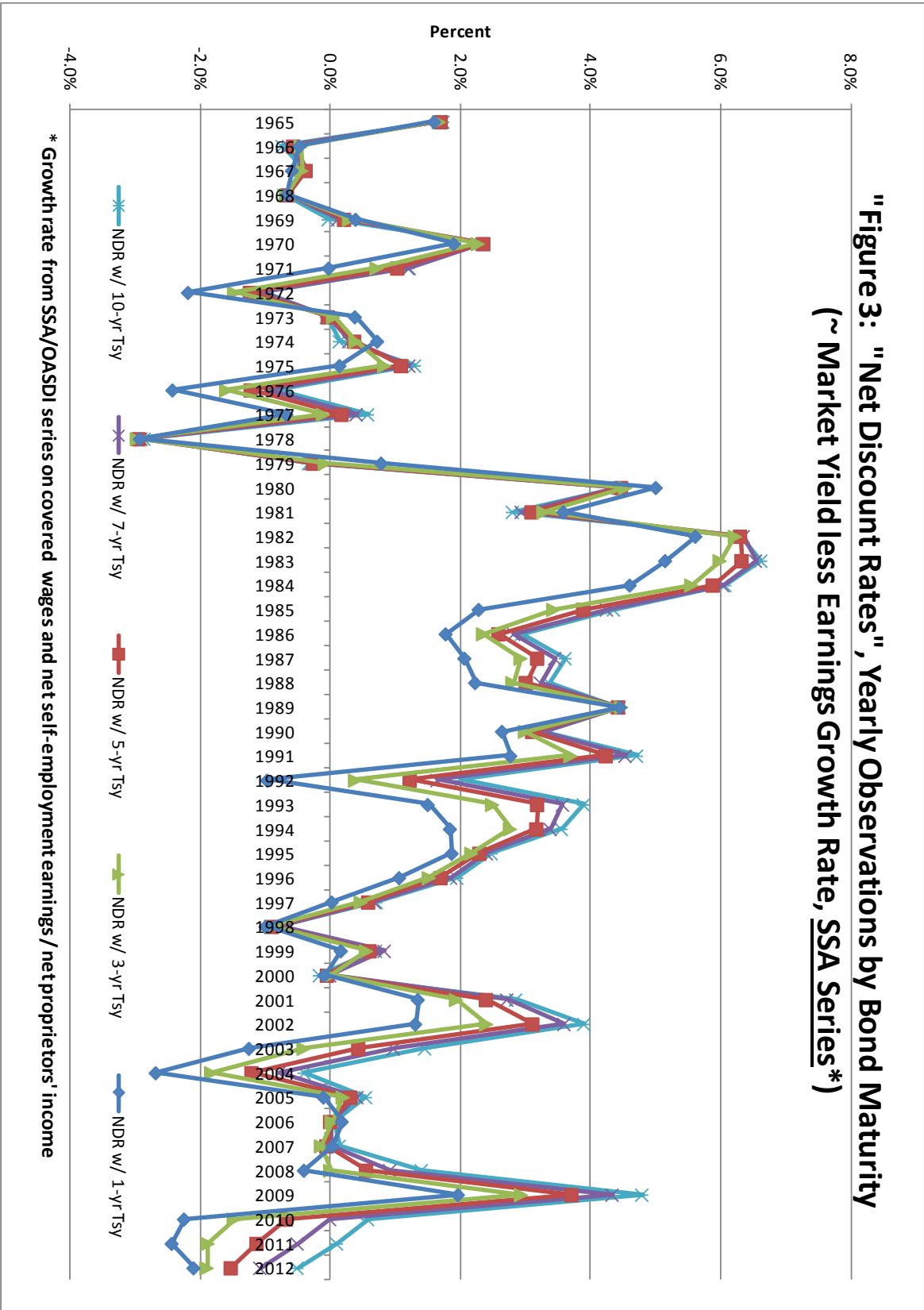
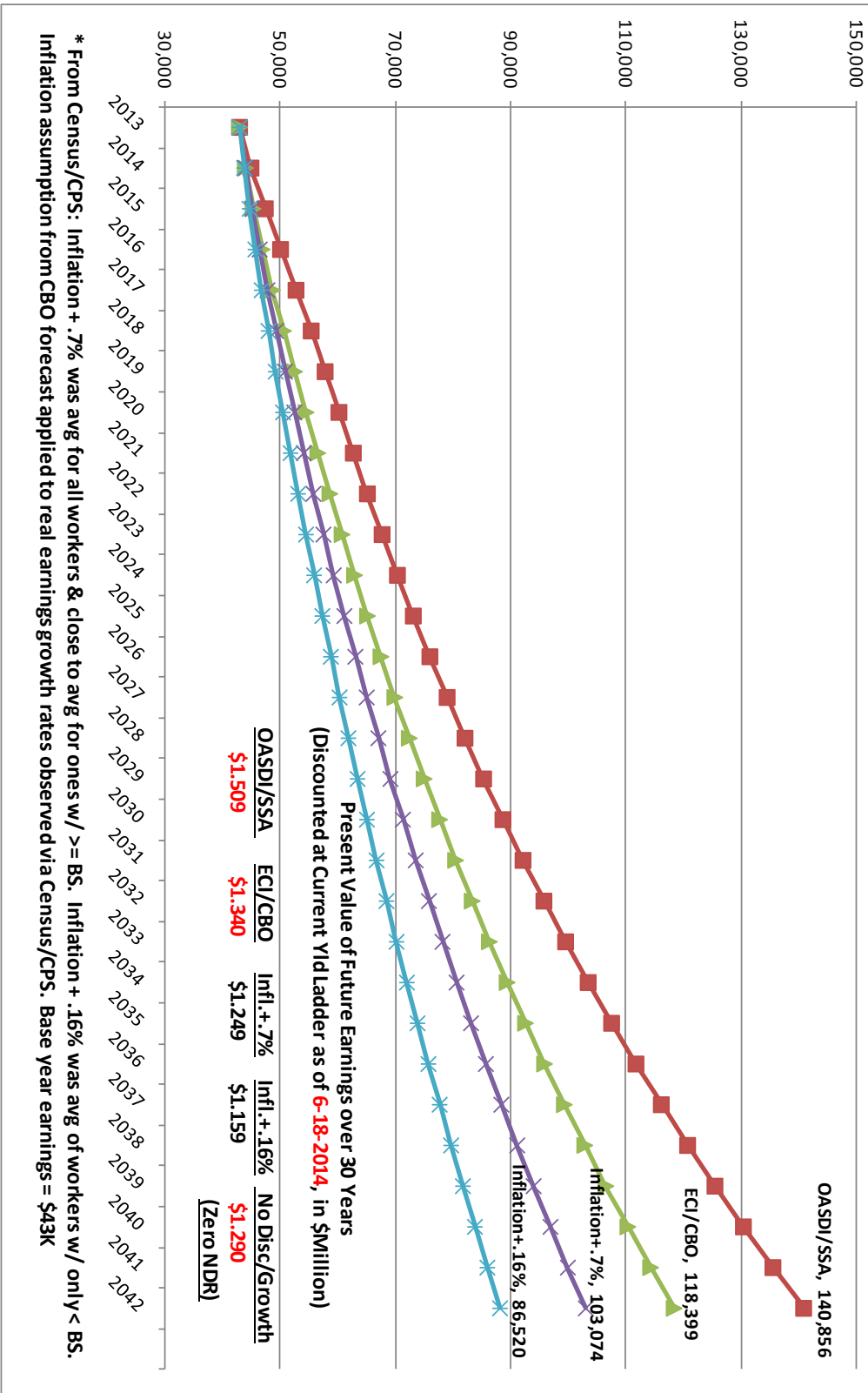


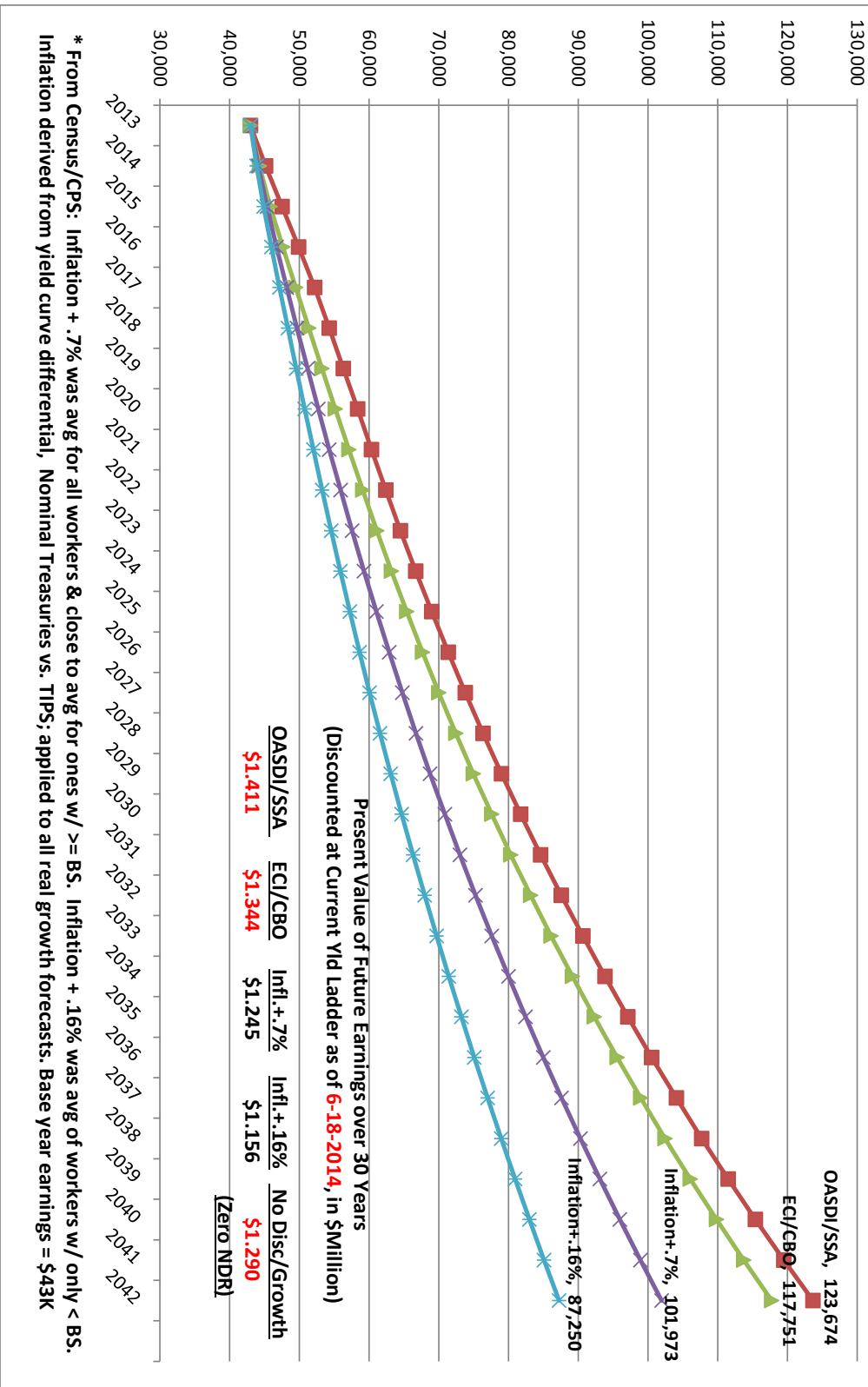
Table 1: Compound Real Annual Growth Rates for Earnings, or Wages & Salaries, Net of Inflation (1)									
1	2	3	5	6	7	8	9	10	
			Covered Wages & Self-Employment Net Earnings, OASDI/SSA (2)	Employment Cost Index, (ECI/BLS) and (ECI/CBO) (3)	Production & Non-Supervisory Workers, Private Ind., (4)	Mean Earnings, All FTYR Workers, (5)	Mean Earnings, FTYR Workers w/ < BA, Census	Mean Earnings, FTYR Workers w/ ≥ BA, Census	
Period	Number of Recessions		(2)	(3)	BLS (4)	(5)	< BA, Census	≥ BA, Census	
Actual	1974-2012	6	0.89%	N/A	-0.05%	0.52%	0.02%	0.46%	
Actual	1980-2012	4	0.99%	0.42%	0.13%	0.70%	0.16%	0.71%	
Actual	1991-2012	2	1.03%	0.48%	0.58%	0.83%	0.29%	0.69%	
Actual	1991-2006	1	1.46%	0.68%	0.62%	1.15%	0.57%	1.27%	
Actual	2002-2012	1	0.40%	-0.09%	0.32%	0.01%	-0.39%	-0.54%	
Forecast	2014-2023	N/A	1.90%	1.24%	N/A	N/A	N/A	N/A	
Forecast	2024	N/A	1.12%	1.18%	N/A	N/A	N/A	N/A	
(1) Nominal earnings for each actual historical period is net of inflation from BLS index CPI-U-RS (research series). Since 2013 results for OASDI/SSA are not yet available, historical period comparisons only extend through 2012.									
(2) Forecast by Trustees of Old Age Survivors Insurance and Disability Insurance Trust Funds (OASDI), Social Security Administration.									
(3) ECI, wages & salaries, is calculated by Bureau of Labor Statistics (BLS) but forecasted only by Congressional Budget Office (CBO).									
(4) BLS Table B-8, from payroll reports of business establishments to the BLS "Current Employment Statistics" survey; not forecasted.									
(5) From Census Bureau's "Current Population Survey" (conducted with BLS) for full-time year-round workers. Aggregation by education level from ASSA 2014 paper by Ed Foster. Note: Real wage growth for all workers is not a weighted average of growth rates for those with < BA & ≥ BA, since weights change over time, reflecting increased % of population with BA degree or higher.									

Figure 4: Forecasted Earnings Growth from SSA & CBO and Average Real Growth Rates from 1980-2012 observed via Census/CPS *



* From Census/CPS: Inflation + .7% was avg for all workers & close to avg for ones w/ >= BS. Inflation + .16% was avg of workers w/ only < BS. Inflation assumption from CBO forecast applied to real earnings growth rates observed via Census/CPS. Base year earnings = \$43K

Figure 5: Forecasted Real Earnings Growth Only from SSA & CBO and Average Real Growth Rates from 1980-2012 observed via Census/CPS *



* From Census/CPS: Inflation + .7% was avg for all workers & close to avg for ones w/ >= BS. Inflation + .16% was avg of workers w/ only < BS. Inflation derived from yield curve differential, Nominal Treasuries vs. TIPS, applied to all real growth forecasts. Base year earnings = \$43K

Table 2: Solve for Net Discount Rate

	OASDI/SSA	ECI/CBO	Inflation+.7%	infl + .16%
PV	(1,411,003)	(1,343,578)	(1,245,079)	(1,155,727)
1	43,000	43,000	43,000	43,000
2	45,171	44,278	44,119	43,883
3	47,521	45,832	45,361	44,875
4	49,913	47,633	46,734	45,987
5	52,216	49,492	48,182	47,157
6	54,288	51,353	49,670	48,353
7	56,305	53,244	51,185	49,560
8	58,371	55,166	52,728	50,780
9	60,346	57,130	54,302	52,016
10	62,400	59,110	55,917	53,276
11	64,520	61,134	57,577	54,563
12	66,715	63,229	59,288	55,883
13	68,990	65,402	61,055	57,240
14	71,352	67,658	62,883	58,638
15	73,804	70,002	64,775	60,078
16	76,354	72,439	66,734	61,563
17	79,002	74,970	68,762	63,094
18	81,757	77,604	70,864	64,673
19	84,614	80,337	73,036	66,299
20	87,585	83,178	75,286	67,975
21	90,660	86,120	77,605	69,693
22	93,842	89,166	79,996	71,455
23	97,137	92,320	82,461	73,261
24	100,547	95,585	85,001	75,113
25	104,077	98,966	87,619	77,012
26	107,730	102,467	90,319	78,959
27	111,512	106,091	93,101	80,955
28	115,427	109,843	95,969	83,001
29	119,479	113,728	98,926	85,099
30	123,674	117,751	101,973	87,250
IRR = Disc Rate "r"	3.044%	3.044%	3.030%	3.013%
Earn Growth Rate "g"	3.710%	3.535%	3.022%	2.470%
NDR = (r-g)/(1+g)	-0.642%	-0.474%	0.007%	0.530%

End Notes

¹ A concept close to NDR is that of the “below market discount rate”, in which expected inflation is netted out of both the future earnings growth rate and the future market rate of interest, leaving a single “real” market rate for discounting. Using a below market discount rate was one of three options offered by the Supreme Court in its landmark 1983 Pfeifer decision (Jones and Laughlin, 1983). Two other methods could be said to be sanctioned, the case-by-case method in which expected inflation is included in both the future earnings growth rate and the market rate for discounting, and also, implicitly, the total offset method as one way to apply the below market interest rate method. The below market method alone was later mandated by a Federal circuit court, saying that “... in the absence of a stipulation by the parties concerning the method to be used, fact-finders shall determine and apply an appropriate below-market discount rate as the sole method to adjust loss-of-future-earnings awards to present value to account for the effect of inflation.” (Culver, 1984, p. 117).

²Net discount ratio or NDR is defined as $1/(1+NDR)$ where NDR is the net discount rate (Clark, 2008, p. 232). Since this is a simple translation involving no other variables, for purposes here, findings about the net discount ratio are referenced as applying to the more commonly used term net discount rate.

³ While the official CPI-U-RS extends back only to 1978, the BLS extrapolated further back to 1974 to calculate earnings for 1974 - 1977 in 2012 dollars. In a paper presented at the ASSA/NAFE conference session in January 2014, Professor Ed Foster presented his analysis of earnings by educational attainment in which he very closely replicated the unofficial CPI-U-RS data by BLS. His work is used in this paper in order to extend the CPI-U-RS back from 1978 to 1974.

⁴ The SSA/OASDI series includes both real and nominal earnings growth data. However, real earnings growth data for this series incorporates the CPI-W, which is the Consumer Price Index for Urban Wage Earners and Clerical Workers. The CPI-W is used by SSA to adjust annual benefits paid to Social Security beneficiaries and Supplemental Security Income recipients, rather than using the CPI-U. Because of the desire to standardize the measure of inflation across all four sources, the published real historical earnings growth rates data for the OASDI/SSA series were ignored; instead, inflation based on the CPI-U-RS was applied to the nominal earnings growth rates to obtain historical real earnings growth rates that would be comparable with the other earnings sources. For historical ECI and average earnings of production and non-supervisory workers, nominal earnings alone are published, so no recalculations of published real earnings growth rates were needed, as nominal earnings were simply reduced by the CPI-U-RS.

⁵ At the time this article is being written (June 2014), 13 months have elapsed since the 2013 OASDI/SSA forecast was published. Although a more current forecast has become available by the time this article is published, the need to use possibly outdated earnings forecasts, especially the inflation component therein, is a primary source of criticism in using such earnings forecasts. A methodology is presented further in this paper to resolve the problem of materially-outdated inflation assumptions embedded within the forecast of either the SSA Trustees or the CBO. Applying the proposed method for adjusting inflation expectations to the obviously outdated mid-2013 OASDI/SSA forecast will help to illustrate its potential benefit.

⁶ The actual compound annual real earnings growth rate for those with a BA degree or higher from 1980 -2012 was actually .71%, while the average all Census/CPS survey respondents was .7%. The reason why the average for all respondents does not appear to be closer to a mid-point between the two groupings rather than skewed toward those with a BA degree or higher was explained above resulting from the mix of educational attainment changing over time toward a more highly educated population. Since the real earnings growth rates for the overall average population and the average of those with a BA degree or higher were almost identical, the rounded growth rate of .7% per year was used to minimize false precision on the latter measure.

⁷ For both forecasted and actual values, the range of annual inflation rates has been much higher and generally more volatile than the range of annual real earnings growth rates. Thus, reflecting timely changes in inflation expectations would seem to be more urgent to update when the market moves, other things being equal.

⁸ Since bond equivalent yields reflect the fact that coupon payments are semiannual, the annualized yield to maturity, or in this case, annual inflation compensation, must compound in mid-year. Also, since BKEVEN rates are only available for years 2 – 20, for years 21 and later, we keep constant the BKEVEN rate from year 20. In this analysis, there is no need for a year 1 BKEVEN rate since we first adjust the \$43k earnings in year 2.

References

Articles, Books, Presentations, and Websites:

- Albrecht, Gary R. and Kurt V. Krueger. 2014. "Structural Growth in Labor Costs: Evidence from the Employment Cost Index." *Journal of Forensic Economics*, 25(1): 17-24.
- Board of Governors of the Federal Reserve System. Economic Research-Federal Reserve Bank of St. Louis, Treasury Constant Maturity Series.
www.research.stlouisfed.org/fred2/categories/115
- Braun, Bradley Junsoo Lee, and Mark C. Strazicich. 2008. "Historical Net Discount Rates and Future Economic Losses: Refuting the Common Practice." *Economic Foundations of Injury and Death Damages*, ed. R.T. Kaufman, J.D. Rodgers, and G. Martin, 468-491. Cheltenham, U.K.: Edward Elgar Publishing Ltd.
- Brookshire, Michael L. and Frank Slesnick. 1999. "A 1999 Survey Study of Forensic Economists - Their Methods and Their Estimates of Forecast Variables." *Journal of Litigation Economics Digest*, 4(1): 65-96.
- Brush, Brian C. 2003. "The Past as Prologue: On the Accuracy of Using Historical Averages in Discounting Future Lost Earnings to Present Value." *Journal of Legal Economics*, 13(1): 81-107.
- _____. 2004. "Assessing Alternative Methods of Estimating the Present Value of Future Earnings: A Fifteen Year Update." *Journal of Forensic Economics*, 17(1): 1-15.
- _____. 2011. "Using Historical Simulation to Compare the Accuracy of Nine Alternative Methods of Estimating the Present Value of Future Lost Earnings." *Journal of Forensic Economics*, 22(1): 1-20
- Bureau of Labor Statistics, Employment, Hours and Earnings from Current Employment Survey (CES), Table B-8, "Average hourly and weekly earnings of production and nonsupervisory employees on private nonfarm payrolls by industry sector, seasonally adjusted." June, 2014.
<http://www.bls.gov/webapps/legacy/cesstab8.htm>.
- Bureau of Labor Statistics. March 2013. "Employment Cost Index, Historical Listing – Volume I: Current Dollar, September 1975-December 2005." Data series referenced in paper as ECI/BLS (years before accessible via website download, see next).
- Bureau of Labor Statistics. 2014, "Employment Cost Index: Wages & Salaries: Private Industry Workers." Data series referenced in paper as ECI/BLS, accessed through St. Louis Federal Reserve website: <http://research.stlouisfed.org/fred2/series/ECIWAG>

Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, *The 2013 Annual Report of The Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*. Washington, DC. Data referenced in paper as OASDI/SSA, accessible only via hard copy reports. (Earlier, single year data from same named annual reports for years 2008 and 2009).

Bureau of Labor Statistics. 2001. "The Employment Cost Index: What is it?" *Monthly Labor Review*, September 2001: 3-16.

Bureau of Labor Statistics. 2014. "CPI Research Series Using Current Methods (CPI-URS)." <http://www.bls.gov/cpi/cpiurs.htm>

Bureau of Labor Statistics. 2014. "Consumer Price Index - All Urban Consumers." Series ID: CUSR0000SA0. <http://data.bls.gov/cgi-bin/srgate>

Bureau of Labor Statistics. 2014. "Consumer Price Index - Urban Wage Earners and Clerical Workers." Series ID: CWSR0000SA0. <http://data.bls.gov/cgi-bin/srgate>

Bureau of Labor Statistics, "Consumer Price Index research series using current methods, 1978– 98", *Monthly Labor Review*, June 1999: 29-38.

Clark, Steven P., T. Daniel Coggin, and Faith R. Neale. 2008. "Mean Reversion in Net Discount Ratios: A Study in the Context of Fractionally Integrated Models." *Journal of Risk and Insurance*, 75(1): 231-247.

Cushing, Matthew J., and David I. Rosenbaum. 2006. "Historical Averages, Units Roots and Future Net Discount Rates: A Comprehensive Estimator." *Journal of Forensic Economics*, 19(2): 139-159.

_____ and _____. 2008. "How Much Confidence Do We Have in Estimates of Future Net Discount Rates?" *Journal of Forensic Economics*, 20 (1): 1-13. [Note: Publication date of 2008 differs from original issue date of 2007 cited at top of paper, as National Association of Forensic Economics reorganized its library of back issues. Publication date of February 2008 is date referenced online.]

_____ and _____. 2010. "Predicting Net Discount Rates: A Comparison of Professional Forecasts, Time-series Forecasts and Traditional Methods." *Journal of Forensic Economics*, 21(2), 2010: 147-171.

Dulaney, Ronald A. 1987. "An Historical Simulation Approach to the Present Valuation of Future Earnings." *Journal of Forensic Economics*, 1(1): 37-48.

Foster, Edward. 2014. "Real Earnings by Education, 1974-2012." Unpublished paper presented at National Association of Forensic Economists Session, Allied Social Science Association –Annual Conference, January 3-4, 2014.

- Franz, Wolfgang W. 1993. "Should Net Discount Rates Vary by Level of Earnings?" *Journal of Forensic Economics*, 6(2): 169-170.
- Gamber, Edward N., and Robert L. Sorensen. 1993. "On Testing for the Stability of the Net Discount Rate." *Journal of Forensic Economics*, 7(1): 69-79.
- _____, and _____. 1994. "Are Net Discount Rates Stationary? The Implications for Present Value Calculations: Comment." *Journal of Risk and Insurance*, 61: 503-512.
- Gilbert, Roy F. 1996. "The Below Market Discount Rate Method Vs. East Coast Black Magic." *Journal of Forensic Economics*, 9(1): 1-16.
- Gurkaynak, Refet S., Brian Sack, and Jonathan H. Wright. 2006. "The U.S. Treasury Yield Curve: 1961 to the Present." Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Board of Governors of the Federal Reserve System, 2006-08.
<http://www.federalreserve.gov/Pubs/feds/2006/200628/200628abs.html>
- _____, _____ and _____, 2008. "The TIPS Yield Curve and Inflation Compensation." Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Board of Governors of the Federal Reserve System, 2008-05.
<http://www.federalreserve.gov/Pubs/feds/2008/200805/200805abs.html>
- Haydon, Randall B., and Samuel C. Webb. 1992. "Selecting the time Period Over Which the Net Discount Rate is Determined for Economic Loss Analysis." *Journal of Forensic Economics*, 5(2): 137-147.
- Hayes, P., M. Schreiber, J.E. Payne, B.T. Ewing, and M. Piette. 2000. "Are Net Discount Rates Stationary? Some Further Evidence." *Journal of Risk and Insurance*, 67(3): 439-449.
- Horvath, Philip A. and Edward L. Sattler. 1997. "Calculating Net Discount Rates—It's Time to Recognize Structural Changes: A Comment and Extension." *Journal of Forensic Economics*, 10(3): 327-332.
- Johnson, Walter D. and Gregory M. Gelles. 1996. "Calculating Net Discount Rates: It's Time To Recognize Structural Changes." *Journal of Forensic Economics*, 9(2): 119-129.
- Levy, Frank, and Richard Murnane. 1992. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." *Journal of Economics Literature*, 30(3): 1333-81.
- Martin, Gerald D. 2012. *Determining Economic Damages*, Rev. 24, 8/12. Costa Mesa, CA: James Publishing.

Nelson, David M. 1989. "The Relative Accuracy of Net Discounting." *Journal of Forensic Economics*, 2(2): 41-44.

Payne, James E., Bradley T. Ewing and Michael J. Piette. 1999 (1999a). "An Inquiry Into the Time Series Properties of Net Discount Rates." *Journal of Forensic Economics*, 12(3): 215-223.

_____, _____ and _____. 1999 (1999b). "Mean Reversion in Net Discount Rates." *Journal of Legal Economics*, 9(1): 69-80.

Pelaez, Rolando F. 1989. "The Total Offset Method." *Journal of Forensic Economics*, 2(2): 45-60.

_____. 1995. "The Below Market Discount Rate Method: Junk Science in the Courtroom?" *Journal of Forensic Economics*, 8(1): 55-67.

_____. 1997. "The Below Market Discount Rate Method: A Rejoinder to Professor Gilbert." *Journal of Forensic Economics*, 10(1): 77-90.

_____. 1995. "Net Discount Rate and Below Market Discount Rate: Two Methods in Forensic Economics." *Journal of Forensic Economics*, 12(3): 225-237.

Rosenberg, Joseph I. and Rick R. Gaskins. 2012. "Damage Awards Using Intermediate Term Government Bond Funds vs. U.S. Treasuries Ladder: Tradeoffs in Theory and Practice *Journal of Forensic Economics*." *Journal of Forensic Economics*, 23(1): 1-31.

Schilling, Don. 1985. "Estimating the Present Value of Future Income Losses: An Historical Simulation 1900-1982." *Journal of Risk and Insurance*, 52(1): 100-116.

Schwartz, Eli. 1997. "Below Market Interest Rates and the Total Offset Method Re-Visited." *Journal of Forensic Economics*, 10(1): 91-94.

Sen, Amit, Gregory M. Gelles, and Walter D. Johnson. "A Further Examination Regarding the Stability of The Net Discount Rate." *Journal of Forensic Economics*, 13(1): 23-28.

Slesnick, Frank L., Michael L Brookshire and Michael R. Luthy. 2013. "A 2012 Survey of Forensic Economists: Their Methods, Estimates, and Perspectives." *Journal of Forensic Economics*, 24(1): 67-99.

U.S. Census Bureau, 2013. Current Population Survey Annual Social and Economic Supplement (CPS ASEC). Data referenced in paper as Census/CPS, from Table P-32 "Educational Attainment—Full-Time, Year-Round Workers 18 Years Old and Over by Mean Earnings, Age and Sex."

<http://www.census.gov/hhes/www/income/data/historical/people/index.html>

U.S. Congressional Budget Office. 2014. The Budget and Economic Outlook: 2014 to 2024. Data referenced in paper as ECI/CBO.
<http://www.cbo.gov/publication/45066>

Legal Cases:

Culver v. Slater Boat Co., 722 F. 2d 114 - Court of Appeals, 5th Circuit 1983, Rehearings Denied February 24, 1984.

Jones & Laughlin Steel Corp. v. Pfeifer, 462 U.S. 523, 103 S. Ct. 2541, 76 L.Ed.2d 768 (1983).

