The Importance of the Relationship Between Growth Rates & Discount Rates in Assessing the Value of Economic Damages

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Examining the implied net discount rates in the reports of several economists, we illustrate how easily these economists end up increasing, when they should be, decreasing to present value. To avoid this trap, when experts use data from different sources and time periods, they should insure, the relationship between their growth and discount rates is theoretically and empirically sound, and their valuation model is independent of the decision to invest the amount of an award.

INTRODUCTION

The concept of "net discount rates" (NDR) is a regular topic in the *Journal of Forensic Economics* (JFE), at regional meetings of the National Association of Forensic Economics (NAFE), in the *Journal of Legal Economics* (JEL), and at the meetings of the American Academy of Economic and Financial Experts (AAEFE). Topics range from exploring the concept of a "net discount rate," to the applicability of the concept, to the stability of NDR's over time. The exploration of the topic ranges from the theoretical/empirical assessment to the reporting on the historical trends in selected NDR's. What we examine is the space between the theoretical/empirical, and the documented historical trends. We examine this space by comparing the implied NDR's we have seen in the reports of four economists we review regularly.

What we will be doing in our paper

In this paper, we share how our thinking has evolved in the way we have thought about and used NDR's. We: identify the sources of the growth and discount rates various economists in our region use, estimate their implied net discount rate[1], and compare their NDR's with historical and projected NDR's in published models.

By examining the implied NDR's of these economists with those used in several models, we: highlight how easy it is for an expert to end up increasing rather than decreasing to present value, and suggest the expert should provide a rationale for the relationship between the selected growth and

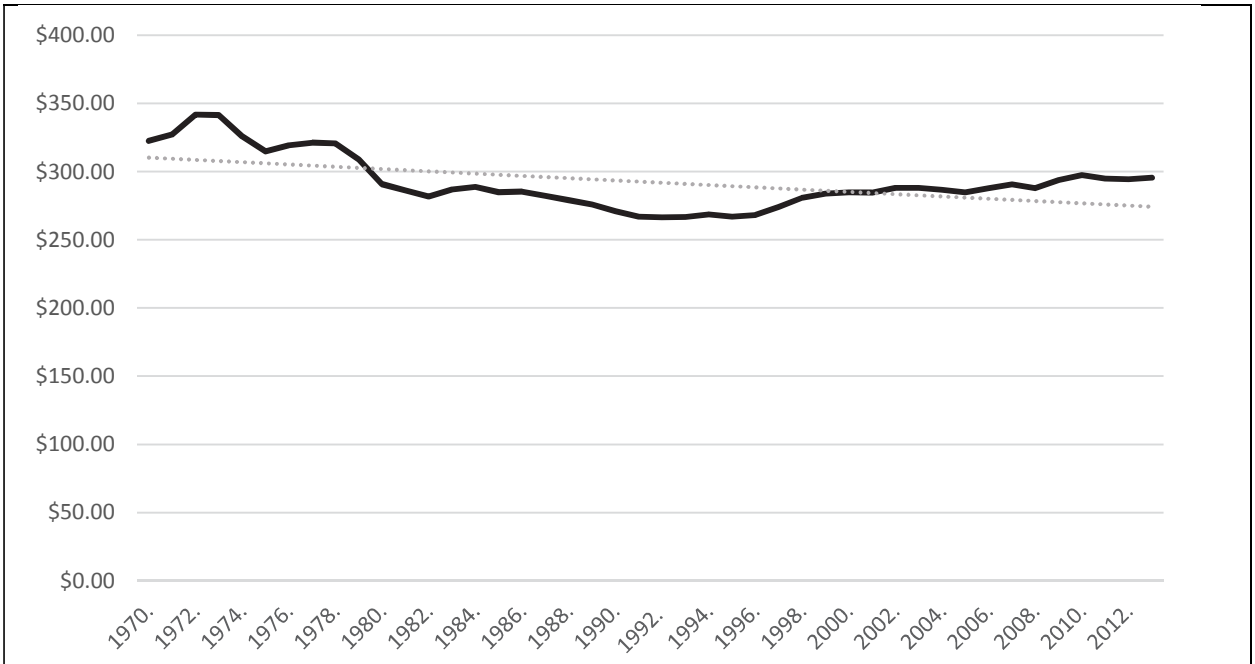
discount rates they've selected. Furthermore, by illustrating these two points, we make the following claims: The process of determining the value of economic damages must be independent of the process of the decision to invest the amount of an award, and when the variables in the valuation model inappropriately mix and match data sources and time periods, the results will be skewed.

How we came to examine this topic

We came to our observations and conclusions based on an internal review of our own approach and a review of reports of other forensic economists. Two economic trends were becoming more obvious and we felt they had to be addressed.

One trend was the stagnation in the growth of average weekly earnings. As noted in Figure 1, real average weekly earnings have been stagnant. The trend has been downward since around 1972.

FIGURE 1
AVERAGE WEEKLY EARNINGS PRIVATE NON-AGRICULTURAL WORKERS, 1982-84 =100; MONTHLY SEASONALLY ADJUSTED

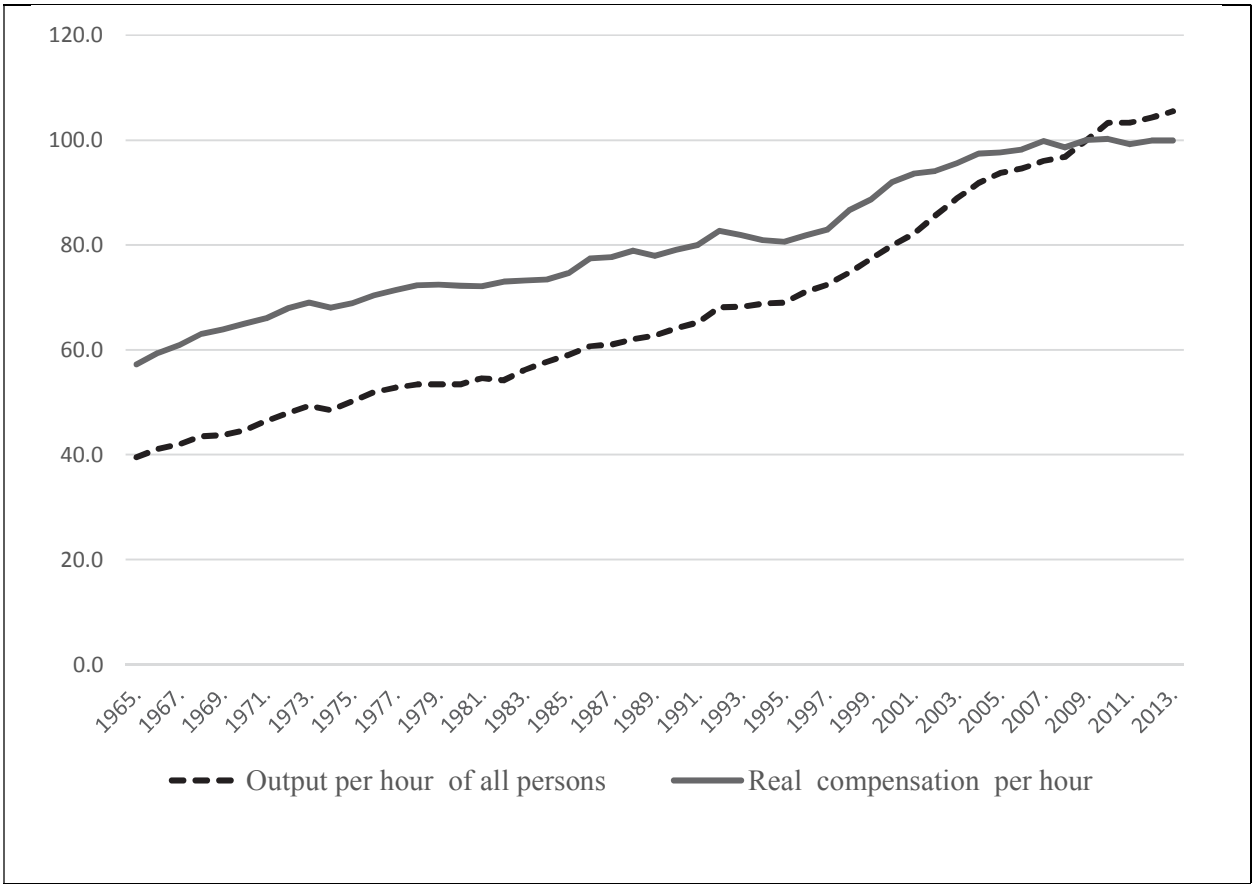


Source: Economic Report of the President 2015 Table B-15, https://www.whitehouse.gov/administration/eop/cea/economic-report-of-the-President/2015

Additional studies of trends in real earnings indicate workers with educational levels less than a bachelor's degree have seen a decline in real earnings since the late 1970s.[2]

The second trend had been the divergence between the growth in real compensation and in productivity. As illustrated in Figure 2, the productivity of the economy has been increasing, but the growth in workers' compensation has been lagging the rate of growth of productivity.

FIGURE 2
PRODUCTIVITY AND COMPENSATION DATA, 1965–2014
INDEX NUMBERS, 2009=100; QUARTERLY DATA SEASONALLY ADJUSTED



Source: Economic Report of the President 2015 Table B-16
https://www.whitehouse.gov/administration/eop/cea/economic-report-of-the-President/2015

Based on these two trends, we began to ask ourselves about the earnings loss reports we were seeing and why economists were increasing to present value, rather than decreasing to present value. Below, we share why the results we were seeing were going awry.

INCREASING TO PRESENT VALUE

We trace five steps we took to reach our conclusions: Exploring the Implications of Negative Net Discount Rates, Mixing & Matching Data Sources, Mixing & Matching Time Periods, Conflating Valuation and Investment, and Linking Growth and Discount Rates to Economic History and Theory.

Exploring the Implications of Negative Net Discount Rates

One key observation we made across a range of forensic economists' reports was generally "growth rates" were higher than "discount rates." When that occurs, the expert ends up increasing rather than decreasing to present value. As shown in the example in Figure 3 below, when growth rates are higher than discount rates, the result will be a negative NDR, and the present value will be greater than the base value.

FIGURE 3
EXAMPLES USING POSITIVE AND NEGATIVE NET DISCOUNT RATES

	Example of using a positive NDR			Example of using a negative NDR		
	Base	**NDR**	**PV**	**Base**	**NDR**	**PV**
Year 1	$10,000	1.00%	$10,000	$10,000	-1.00%	$10,000
Year 2	$10,000	1.00%	$9,901	$10,000	-1.00%	$10,101
Year 3	$10,000	1.00%	$9,803	$10,000	-1.00%	$10,203
Year 4	$10,000	1.00%	$9,706	$10,000	-1.00%	$10,306
Year 5	$10,000	1.00%	$9,610	$10,000	-1.00%	$10,410
Year 6	$10,000	1.00%	$9,515	$10,000	-1.00%	$10,515
Year 7	$10,000	1.00%	$9,420	$10,000	-1.00%	$10,622
Year 8	$10,000	1.00%	$9,327	$10,000	-1.00%	$10,729
Year 9	$10,000	1.00%	$9,235	$10,000	-1.00%	$10,837
Year 10	$10,000	1.00%	$9,143	$10,000	-1.00%	$10,947
	$100,000		$95,660	$100,000		$104,670

The NDR provides a simple way to determine whether the growth rate and the discount rate align. For example, if the NDR is negative, growth rates are outpacing discount rates. With negative discount rates, in effect, we must give someone "more" today to compensate them for their economic losses, instead of giving them "less" today. Instead of "reducing to present value," we are "increasing to present value."

Step 1: We explored the concept of "net discount rates (NDR's)."

The first question we posed was: "If a ***present*** value is less than a ***future*** value, then how is someone increasing to present value?" To answer the question, we highlight the importance of comparing the "future value" with the "base or initial value" when determining whether an expert is increasing or decreasing to present value. See Figure 3 above. We show in our work--and in our review of the work of other experts-- three values: base, future, and present. This is done to highlight when present values are higher than the base values, and when the net discount rates are negative, and the expert is increasing to present value.

Mixing & Matching: Data Sources

Step 2: We explored how experts combined their data sources.

What we mean by "mixing and matching sources" is the expert combines information from different sources, without identifying how the selected variables relate.

One example we found was the forensic economist would use projected inflation or wage growth rates from the projections provided by the annual report of Trustees of the Old-Age Survivors and Disability Income (OASDI)[3], and then use a market or current interest rate as their discount rate, for example, 10 Year Treasuries. The expert would never explain how a "projected" wage growth rate relates to "current" Treasuries rate.

As a second example, the forensic economist would use a "projected" growth rate (for example wage growth) based on a "historical" (past) trend, and use a "market" (current) interest rate; and again, the expert would not explain how these two factors related to one another.

As we considered these relationships, we constructed Table 1 that shows 9 possible scenarios.

What we discovered: Reports containing negative net discount rates tended to mix and match sources and time periods. Experts tended to use Scenario 4 or Scenario 6 as shown in Table 2.

TABLE 1
RELATIONSHIP BETWEEN GROWTH RATES & DISCOUNT RATES
EXPECTED/CONSISTENT

		Growth Rates		
		Historical/Past	Current/Present	Projected/Future
Discount Rates	Historical/Past	**1**	**2**	**3**
	Current/Present	**4**	**5**	**6**
	Projected/Future	**7**	**8**	**9**

TABLE 2
RELATIONSHIP BETWEEN GROWTH RATES &
DISCOUNT RATES: INCONSISTENT

		Growth Rates		
		Historical/Past	Current/Present	Projected/Future
Discount Rates	Historical/Past	1	2	3
	Current/Present	4 **Mixing Data Sources/Time Periods**	5	6 **Mixing Data Sources/Time Periods**
	Projected/Future	7	8	9

See Appendix A for a brief description of each of these scenarios.

Mixing & Matching: Time Periods

Step 3: We explored why these combinations of data sources tended to produce negative net discount rates, and found the following:

1. The mixing and matching of sources, and the mixing and matching time periods tended to lead to negative net discount rates.
2. The mixing and matching of sources and the taking a variable out of context.
    a. Under Scenario 4, the historical growth rates have associated historical interest rates. The expert picked a "growth rate," but they did not select the corresponding "interest rate."
    b. Under Scenario 6, the projected growth rates have associated projected interest rates. Again, the expert picked the growth rate, but not the corresponding interest rate.

Conflating Valuation & Investment

Step 4: We found economists were conflating the valuation of economic damages with a decision to invest and award.

These are two separate and different processes. We call the first process the ***"valuation process,"*** and the second one ***"the investment decision."*** What we have been finding are examples of experts inadvertently conflating the valuation process and the investment process. For a "proper valuation," the valuation model needs have factors that relate to, and are consistent with, one another. (See Appendix B for a discussion of the difference between a valuation model and an investment decision.)

Linking Growth & Discount Rates to Economic History and Theory

Step 5: We "fact checked" to see whether the implied assumptions the experts used were linked to economic history and theory.

One assumption several experts were making was real wages for the average weekly earner would be increasing. However, as we note above in Figure 1, and as a recent article in the *Journal of Forensic Economics*□ notes, for most educational groups, real average weekly earnings have been falling. The article's author based his review of earnings data over the 39-year period (1974-2012).

Another assumption we were seeing was the average weekly earnings will increase at the rate of the projected rate of inflation. The implication of this assumption is: Nominal earnings and inflation will increase at the same rate. On the one hand the expert is selecting a future inflation rate and on the other hand, they are selecting current 10-Year Treasury rates to discount to present value. What the expert ends up assuming is: Long-term inflation rates will be higher than long-term interest rates. We provide an example in Table 6.

A third assumption we were seeing is earnings of the average worker will increase because of growth of productivity in the economy. The data indicates while productivity in the U.S. economy has been increasing, the rate of growth in wages is falling further and further behind the growth in productivity. See Figure 2 above.

SUMMARY

By taking the reader through these five steps-- Exploring the Implications of Negative Net Discount Rates, Mixing & Matching Data Sources, Mixing & Matching Time Periods, Conflating Valuation and Investment, and Linking Growth and Discount Rates to Economic History and Theory--we illustrate how easy it is for an expert to end up increasing to present value without a sound economic historical and theoretical basis for doing so. What we have attempted to outline is how an economic expert, if they are not paying careful attention to their interpretation of economic historical trends, their application of economic theory, and the relationship of the variables in their economic model, they can be increasing, rather than decreasing, to present value.

NET DISCOUNT RATES IN PRACTICE: VALUING EARNINGS LOSSES

In this section, we build on our above discussion, presenting the implied net discount rates in several reports and studies. We use "implied" because an expert might not explicitly specify their net discount rates. However, we note: If an expert provides their growth rate and their discount rate, we can calculate their NDR based on the NDR formula. We use as an example, assessing the value of earnings losses.

Valuing Earnings Losses

In our approach to assessing the present value of a future flow of earnings, we use the growth and discount rates that are compiled in the Economic Report of President (ERP)□. In valuing economic losses, we calculate the historical percentage change in average weekly earnings□ as our growth rate and historical municipal bonds□ rates as our discount rate. We base our methodology on the Tucek Study□ and updated this framework to include the 2014 data. We use historical municipal bond rates because these rates are market-based, safe, and can used as proxy for a non-taxable rate.

The Tucek approach uses a rolling average. By this we mean the two-year average is the average of 2014 and 2013: the three-year average uses 2014, 2013, 2012, and so on.

In Table 3 below, we provide the historical net discount rates based on Tucek's approach, showing the NDR's based on historical rates for municipal bond and for the historical percentage change in average weekly earnings. The range of these rates is positive--between +1.25% and +2.62.

We (JSP&A) use Scenario #1.

TABLE 3
JSP&A NET DISCOUNT RATE APPROACH

Number of Years to 2014	Growth Rates (Av. Wk. %)	Interest Rates (Muni)	Net Discount Rates
Col 1	*Col 2*	*Col 3*	*Col 4*
1 year avg rate	2.50%	3.78%	1.25%
2 year avg rate	2.15%	3.87%	1.68%
3 year avg rate	2.07%	3.63%	1.53%
4 year avg rate	2.23%	3.79%	1.53%
5 year avg rate	2.44%	3.87%	1.39%
6 year avg rate	2.27%	4.00%	1.69%
7 year avg rate	2.39%	4.11%	1.68%
8 year avg rate	2.58%	4.15%	1.53%
9 year avg rate	2.77%	4.18%	1.37%
10 year avg rate	2.78%	4.19%	1.37%
11 year avg rate	2.72%	4.23%	1.47%
12 year avg rate	2.68%	4.27%	1.56%
13 year avg rate	2.67%	4.33%	1.62%
14 year avg rate	2.67%	4.39%	1.68%
15 year avg rate	2.75%	4.48%	1.68%
16 year avg rate	2.78%	4.54%	1.71%
17 year avg rate	2.85%	4.58%	1.68%
18 year avg rate	2.94%	4.63%	1.64%
19 year avg rate	2.96%	4.69%	1.68%
20 year avg rate	2.93%	4.75%	1.78%
21 year avg rate	2.94%	4.82%	1.83%
22 year avg rate	2.94%	4.86%	1.87%
23 year avg rate	2.93%	4.93%	1.94%
24 year avg rate	2.91%	5.01%	2.04%
25 year avg rate	2.92%	5.10%	2.11%
26 year avg rate	2.95%	5.18%	2.17%
27 year avg rate	2.95%	5.28%	2.26%
28 year avg rate	2.93%	5.36%	2.36%
29 year avg rate	2.89%	5.43%	2.47%
30 year avg rate	2.86%	5.66%	2.62%

In Table 4 below, we provide the historical net discount rates based on Tucek's approach showing the NDR's based on historical rates for the 10 Year Treasuries and historical inflation rates. Again, the range of these rates is positive--between +.049% and +2.80.

Tucek uses Scenario #1.

TABLE 4
HISTORICAL NET DISCOUNT RATES BASED ON TUCEK METHODOLOGY

Number of Years to 2014	Inflation/Growth Rates (Consumer Price Index CPI)	Interest Rates (10yr Treasuries)	Net Discount Rates
Col 1	*Col 2*	*Col 3*	*Col 4*
1 year avg rate	1.60%	2.54%	0.93%
2 year avg rate	1.65%	2.45%	0.78%
3 year avg rate	1.73%	2.23%	0.49%
4 year avg rate	1.85%	2.37%	0.51%
5 year avg rate	1.64%	2.54%	0.88%
6 year avg rate	1.67%	2.66%	0.98%
7 year avg rate	1.69%	2.80%	1.10%
8 year avg rate	1.78%	3.03%	1.23%
9 year avg rate	1.87%	3.23%	1.34%
10 year avg rate	1.90%	3.33%	1.41%
11 year avg rate	1.93%	3.42%	1.46%
12 year avg rate	1.86%	3.47%	1.58%
13 year avg rate	1.86%	3.56%	1.66%
14 year avg rate	1.92%	3.66%	1.71%
15 year avg rate	1.97%	3.82%	1.82%
16 year avg rate	1.96%	3.93%	1.93%
17 year avg rate	1.99%	4.01%	1.98%
18 year avg rate	2.00%	4.14%	2.10%
19 year avg rate	2.03%	4.26%	2.19%
20 year avg rate	2.08%	4.38%	2.25%
21 year avg rate	2.10%	4.51%	2.35%
22 year avg rate	2.15%	4.57%	2.36%
23 year avg rate	2.20%	4.67%	2.42%
24 year avg rate	2.30%	4.81%	2.45%
25 year avg rate	2.41%	4.96%	2.48%
26 year avg rate	2.49%	5.09%	2.54%
27 year avg rate	2.57%	5.23%	2.59%
28 year avg rate	2.63%	5.34%	2.65%
29 year avg rate	2.67%	5.42%	2.68%
30 year avg rate	2.72%	5.60%	2.80%

In Table 5 below, we compare our approach (JSP&A) and Tucek's approach to selecting NDR's. Also, we include for reference the results of 2012 survey of forensic economists. We find in these three approaches, the range of the NDR's is positive.

TABLE 5
COMPARISON OF NET DISCOUNT RATE APPROACHES

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	Discount Rate		Low	High
1	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
2	**JPS&A**	Historical-Avg. Weekly Earnings	Historical-High Grade Municipal Bond (S&P)	Scenario #1	+1.25	+1.94
3	**2012 Survey of Forensic Economists**				+1.10%	+1.60%

Economist A

In this example, the Economist uses a projected growth rate for earnings and a current (market) discount rate (Scenario #6 (Table 2), and they conflate valuation and investment.

Economist A uses projected growth rates from the 2015 OASDI and current interest (discount) rates from the United States Treasury, Daily Treasury Yield Curve Rates "Constant Maturity Treasury Rates."

Economist A is using Scenario #6.

They are using a "projected growth rate" from OASDI and a "market interest (discount) rate." We find: Economist A has an implied negative net discount rates for all but the last six years of their projections. See Table 6 below.

TABLE 6
COMPARISON OF NET DISCOUNT RATE APPROACHES

	CPI (Consumer Price Index -- Inflation Rate)	Interest Rate (Daily Treasury Yield Curve Rate)	Net Discount Rate
Col 1	Col 2	Col 3	Col 4
2015	2.70%	.09%	-2.54%
2016	2.70%	.54%	-2.10%
2017	2.70%	.74%	-1.91%
2018	2.70%	1.12%	-1.54%
2019	2.70%	1.41%	-1.26%
2020	2.70%	1.68%	-0.99%
2021	2.70%	1.92%	-0.76%
2022	2.70%	2.00%	-0.68%
2023	2.70%	2.11%	-0.57%

2024	2.70%	2.23%	-0.46%
2025	2.70%	2.23%	-0.46%
2026	2.70%	2.38%	-0.31%
2027	2.70%	2.46%	-0.23%
2028	2.70%	2.55%	-0.15%
2029	2.70%	2.60%	-0.10%
2030	2.70%	2.62%	-0.08%
2031	2.70%	2.62%	-0.08%
2032	2.70%	2.78%	0.08%
2033	2.70%	2.78%	0.08%
2034	2.70%	2.78%	0.08%
2035	2.70%	2.78%	0.08%
2036	2.70%	2.78%	0.08%
2037	2.70%	2.78%	0.13%

We contend: Economist A has pulled rates from different sources and time periods, leading them to increase, rather than decrease, to present value.

In Table 7 below, we compare four approaches to selecting net discount rates. As the Table illustrates, Economist A's model is the only one that generates negative net discount rates. Economist A uses Scenario #6 above in Table 1 and Table 2.

TABLE 7
COMPARISON OF NET DISCOUNT RATE APPROACHES

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	**Discount Rate**		**Low**	**High**
1	**Economist A**	Projected CPI-U	Market-10 Yr. Treasury	Scenario #6	-2.54	+. 13
2	**OASDI/SSA**	Projected-CPI-U	Projected-Government Security Rates	Scenario #1	+. 042	+2.82
3	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
4	**2012 Survey of Forensic Economists**[10]				+1.10%	+1.60%

We further suggest if Economist A uses a "projected growth rate" from OASDI, they should use the corresponding "projected interest (discount) rate." Since OASDI provides a model, the "projected growth rate" and "the projected interest (discount) rate" are related to one another. The "projected growth rate" and "the projected interest (discount) rate" are not independent of one another.

In Table 8 below, we provide the projected inflation rates (Col 2) and their corresponding projected interest rates (Col 3) contained in OASDI. This table illustrates the following:

1. Economist A selected a projected long-term inflation rate (e.g., 2.7%), but he did not choose the corresponding projected interest rate (e.g., 5.6%) associated with the projected inflation rate.

2. Had Economist A used corresponding projected inflation and interest rates, the NDR's would have ranged between +.042% and +2.82%.

TABLE 8
PROJECTED NET DISCOUNT RATES FROM OASDI

	CPI (Consumer Price Index-Inflation Rate)	Interest Rate	Net Discount Rate
Col 1	Col 2	Col 3	Col 4
2015	0.20%	2.20%	2.00%
2016	2.97%	3.40%	0.42%
2017	2.76%	4.10%	1.30%
2018	2.70%	4.80%	2.04%
2019	2.70%	5.10%	2.34%
2020	2.70%	5.30%	2.53%
2021	2.70%	5.50%	2.73%
2022	2.70%	5.50%	2.73%
2023	2.70%	5.50%	2.73%
2024	2.70%	5.60%	2.82%
2025	2.70%	5.60%	2.82%
2026	2.70%	5.60%	2.82%
2027	2.70%	5.60%	2.82%
2028	2.70%	5.60%	2.82%
2029	2.70%	5.60%	2.82%
2030	2.70%	5.60%	2.82%
2031	2.70%	5.60%	2.82%
2032	2.70%	5.60%	2.82%
2033	2.70%	5.60%	2.82%
2034	2.70%	5.60%	2.82%
2035	2.70%	5.60%	2.82%
2036	2.70%	5.60%	2.82%
2037	2.70%	5.60%	2.82%
2038	2.70%	5.60%	2.82%
2039	2.70%	5.60%	2.82%
2040	2.90%	5.60%	2.62%
2041	2.90%	5.60%	2.62%

Source: 2015 OASDI Trustees Report
http://www.ssa.gov/oact/tr/2015/V_B_econ.html#292722
CPI: Table V.B1.—Principal Economic Assumptions
Interest Rate: Table V.B2.—Additional Economic Factors

Not only is Economist A mixing and matching time periods, they are also assuming long-term interest rates will be below long term inflation rates. The data in Table 4 shows: Projected average rates on 10 Year Treasuries will be higher than projected average inflation rates. Economist A, on the contrary, is assuming average inflation rates will be higher than average interest rates.

Alternatively, if Economist A uses a "market interest (discount) rate," then they should use a corresponding "market wage growth rate." They should use Scenario #5 (Table 2). However, no data exists for a "market growth rate" comparable to a "market interest rate." [11]

Given the way in which Economist A combines their sources for growth (inflation) and interest (discount) rates, they are in effect assuming: For the U.S. economy, inflation rates will be higher than interest rates for the period of their analysis. Not only are they increasing to present value, they are assuming a set of economic conditions not supported by the historical record.

Economist B

In this example, the Economist uses a projected growth rate for earnings and a current (market) discount rate (Scenario #6 Table 2); however, this is a modified version since they use two sources for growth data and one source for interest rates. They conflate valuation and investment.

Economist B is using Scenario #6

What is interesting about this approach is Economist B ends up using positive net discount rates, but they get there through a convoluted process. They arbitrarily mix and match time periods and sources, and modify growth rates without any reference to any accepted economic theory or standards for economic modelling.

What we found is Economist B uses a combination of growth rates from the Congressional Budget Office (CBO)[12] and Social Security Administration (SSA)--which is the data from (OASDI)--and interest (discount) rates from municipal bonds. See Table 9 below.

TABLE 9
ECONOMIST B NET DISCOUNT RATE APPROACH

	CBO/SSA (OASDI) (Inflation Rate)	**Interest Rate (Daily Municipal Rate)**	**Net Discount Rate**
Col 1	Col 2	Col 3	Col 4
2015	1.11%	.94%	-0.17%
2016	1.12%	1.26%	0.14%
2017	2.22%	1.70%	-.051%
2018	2.32%	2.29%	-0.03%
2019	2.42%	2.43%	0.01%
2020	3.14%	2.57%	-0.55%
2021	2.41%	2.73%	0.31%
2022	2.42%	2.90%	0.47%
2023	2.42%	3.07%	0.64%
2024	2.42%	3.24%	0.80%
2025	2.41%	3.41%	0.97%
2026	2.42%	3.60%	1.15%

2027	2.72%	3.71%	1.05%
2028	2.55%	4.00%	1.42%
2029	2.88%	4.22%	1.30%
2030	3.19%	4.45%	1.22%
2031	2.77%	4.69%	1.88%
2032	2.65%	4.94%	2.23%
2033	2.71%	5.21%	2.43%
2034	2.70%	5.08%	2.32%
2035	2.73%	4.96%	2.17%
2036	2.71%	4.83%	2.06%
2037	2.82%	4.72%	1.85%

* If for example, the CBO/Social Security Administration assumes real earnings growth of one percent a year, I assume that the real earning of persons with less than a high school education will only grow .482% per year. For high school, I assume .795% per year, for an associate degree or some college, 1.08% per year and for a college graduate, 1.71% per year.

However, if Economist B uses a "projected (forecast) growth rate" from CBO, then they should use the corresponding "projected (future) interest (discount) rate." Since CBO provides a model, the "projected growth rate" and "the projected interest (discount) rate" relate to one another. The "projected growth rate" and "the projected interest (discount) rate" are not independent of one another.

In Table 10 below, we provide the projected growth rates (Col 2) and their corresponding projected interest rates (Col 3) contained in the CBO report. This Table illustrates the following:

1. Economist B selected a projected long-term inflation rate (e.g., 2.0%), but they did not choose the corresponding projected interest rate (e.g., 4.3%) associated with the projected inflation rate.
2. Had Economist B used corresponding projected inflation and interest rates, their NDR's would have ranged between +1.50% and +2.25%.

TABLE 10
PROJECTED NET DISCOUNT RATES FROM CBO

	CPI (Inflation Rate)	**Interest Rate (10-year Treasuries)**	**Net Discount Rate**
Col 1	Col 2	Col 3	Col 4
2015	.60%	2.50%	1.92%
2016	1.80%	3.30%	1.50%
2017	2.00%	3.90%	1.83%
2018	2.00%	4.30%	2.24%
2019	2.00%	4.30%	2.25%
2020	2.00%	4.30%	2.25%
2021	2.00%	4.30%	2.25%
2022	2.00%	4.30%	2.25%
2023	2.00%	4.30%	2.25%
2024	2.00%	4.30%	2.25%
2025	2.00%	4.30%	2.25%

Source: CBO's August 2015 report: An Update to the Budget and Economic Outlook:2015 to 2015 www.cbo.gov/publication/50724
CPI: Figure 2-11; Inflation
Interest Rate: Figure 2-2; Forecast of Interest Rates by CBO, the Federal Reserve, and Federal Funds Future

In Table 11, we compare five approaches to selecting NDR's. As the Table illustrates, Economist B's model is the only one generating both negative and positive NDR's.

TABLE 11
COMPARING NET DISCOUNT RATE APPROACHES

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	Discount Rate		Low	High
1	**Economist B**	Projected CPI-U	Market-Daily Municipal Rate	Scenario #6	-.55	+2. 43
2	**CBO**	Projected CPI-U	Projected Interest Rates	Scenario #9	+1.50	+2.25
3	**OASDI/SSA**	Projected-CPI-U	Projected-Government Security Rates	Scenario #1	+. 042	+2.82
4	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
5	**2012 Survey of Forensic Economists**				+1.10%	+1.60%

Economist C

In this example, the Economist appears to use a historical growth rate for earnings and a historical discount rate (Non-Theoretically Modified Scenario #1 Table 2); however, they adjust these rates without a theoretical basis. They use a modified Scenario #1 and they conflate valuation and investment.

Economist C uses a Non-Theoretically Modified Scenario #1

Growth Rates

Economist C constructs their growth rate in two steps:

Step 1: They use the data from Bureau of Labor Statistics (BLS)--base year earnings--to determine a historical growth rate.

Step 2: They add to that a productivity rate and an inflation rate. Here we quote: *"The average rate of inflation over this period was 2.29% per year. Thus, we have seen that it is eminently reasonable to expect his income could have risen at an annual rate 3.76%---2.29% for inflation and 1.47% for productivity increase. For purpose of this study, a 4.0% escalation factor is used."*

Growth Rate = 4.0%

Discount Rate

Economist C constructs their discount rate as follows, we quote:

> *One way to put the question of interest rate choice is to ask, "what sort of rate can be earned today on the kind of assets a prudent person would choose if he/she were trustee of a sum of money for someone else?" Because there is no universally accepted rate for this purpose, calculations of the present value of future income have been made based on a 3.75% after-tax discount (interest) rate.*

This is another example where the discount rate is not linked to economic theory or to history. Economist C provides no theoretical basis for selecting his portfolio of interest rates. Economist C selects a mixture of taxable government bonds and Aaa Corporate Bonds over a 10-year period.

Discount Rate = 3.75%

Economist C Increases to Present Value

Economist C ends up using a 4.0% growth rate based on mixing historical productivity and inflation rates, and historical interest (discount) rates from taxable government yield and Aaa Corporate Bonds over a ten-year period of 3.75%. This leads to an implied negative 0.24% NDR. See Table 12 below.

Economist C Conflated the Valuation Process and the Investment Decisions

As we have noted above, Economist C is using an interest rate associated with an investment decision to assess the valuation, and they have not established an economic historical or theoretical relationships between the growth and discount rates they chose.

TABLE 12
ECONOMIST C NET DISCOUNT RATE APPROACH

	Growth Rate (Productivity/ Inflation Rate)	Interest Rate (Government Yield/Aaa Corp Bonds)	Net Discount Rate
Col 1	Col 2	Col 3	Col 4
2015	4.0%	3.75%	-0.24%
2016	4.0%	3.75%	-0.24%
2017	4.0%	3.75%	-0.24%
2018	4.0%	3.75%	-0.24%
2019	4.0%	3.75%	-0.24%
2020	4.0%	3.75%	-0.24%
2021	4.0%	3.75%	-0.24%
2022	4.0%	3.75%	-0.24%
2023	4.0%	3.75%	-0.24%
2024	4.0%	3.75%	-0.24%
2025	4.0%	3.75%	-0.24%

In Table 13 below, we compare five approaches to selecting NDR's. As the Table illustrates, Economist C's model is the only one generating negative NDR's.

TABLE 13
COMPARING NET DISCOUNT RATE

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	Discount Rate		Low	High
1	**Economist C**	Historical Productivity/ CPI-U	Historical-Treasury/Aaa Corp Bonds	None of the 9 Scenarios. No sound method for determining the discount rate.	-.24	-.24
2	**CBO**	Projected CPI-U	Projected Interest Rates	Scenario #9	+1.50	+2.25
3	**OASDI/SSA**	Projected-CPI-U	Projected-Government Security Rates	Scenario #9	+. 042	+2.82
4	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
5	**2012 Survey of Forensic Economists**				+1.10%	+1.60%

Economist D

In this example, the Economist appears to use a historical growth rate for earnings and a historical discount rate (Modified Scenario #1 Table 2); however, they adjust these rates without a theoretical basis. They use a modified Scenario #1, and they conflate valuation and investment.

Economist D uses a Non-Theoretically Modified Scenario #1

Growth Rate

Economist D constructs their growth rates as follows:

Step 1: They use the data from BLS (base year earnings) to determine a historical growth rate.

Step 2: They add to that the geometric growth of the "Employment Cost Index Historical Listing."

Growth Rate = 2.52%

Discount Rate

Economist D constructs their discount rate by using an historical "blended rate" of 6 month T-bills, 3 Year T-bonds, and 10-year T-bonds from 2003-2013.

Discount Rate = 2.48%

Economist D Increases to Present Value

Economist D uses a 2.52% growth rate based on the historical geometric rate of the employment cost index and a 2.48% effective rate base on the historical "blended rate" of the 6-months T-bills, 3 Year T-bonds, and 10 Year T-bonds from 2003-2013. See Table 14 below.

TABLE 14
ECONOMIST D NET DISCOUNT RATE APPROACH

	Growth Rate (Employment Cost Index)	Interest Rate (6-months T-bills, 3 Yrs T-bonds 10 Yrs. T-bonds)	Net Discount Rate
Col 1	Col 2	Col 3	Col 4
2015	2.52%	2.48%	-0.04%
2016	2.52%	2.48%	-0.04%
2017	2.52%	2.48%	-0.04%
2018	2.52%	2.48%	-0.04%
2019	2.52%	2.48%	-0.04%
2020	2.52%	2.48%	-0.04%
2021	2.52%	2.48%	-0.04%
2022	2.52%	2.48%	-0.04%
2023	2.52%	2.48%	-0.04%
2024	2.52%	2.48%	-0.04%
2025	2.52%	2.48%	-0.04%

In Table 15 below, we compare five approaches to selecting NDR's. As the Table illustrates, Economist D's model is the only one generating negative net discount rates.

TABLE 15
COMPARING NET DISCOUNT RATE APPROACH

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	Discount Rate		Low	High
1	**Economist D**	Historical Employment Cost Index	Historical-Treasury Bills & Bonds	None of the 9 Scenarios. No sound method for determining the discount rate.	-.04	-.04
2	**CBO**	Projected CPI-U	Projected Interest Rates	Scenario #9	+1.50	+2.25
3	**OASDI/SSA**	Projected-CPI-U	Projected-Government Security Rates	Scenario #9	+. 042	+2.82
4	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
5	**2012 Survey of Forensic Economists**				+1.10%	+1.60%

SUMMARY

In our discussion, we illustrate how easily it is for an expert to mix and match data sources and time periods. This results in assumptions not based in economic history or theory, and in the expert increasing to present value without sound empirical or theoretical basis.

TABLE 16
COMPARING NET DISCOUNT RATE APPROACH

		Selection of Rates		Scenarios from Table 1	Net Discount Rates (NDR's)	
		Growth Rate	Discount Rate		Low	High
1	**JPS&A**	Historical-Avg. Weekly Earnings	Historical- High Grade Municipal Bond (S&P)	Scenario #1	+1.25	+1.94
2	**Economist A**	Projected CPI-U	Market-10 Yr. Treasury	Scenario #6	-2.54	+. 08
3	**Economist B**	Projected CPI-U	Market-Daily Municipal Rate	Scenario #6	-.55	+2.43
4	**Economist C**	Historical Productivity/ CPI-U	Historical-Treasury/Aaa Corp Bonds	None of the 9 Scenarios. No sound method for determining the discount rate.	-.24	-.24
5	**Economist D**	Historical Employment Cost Index	Historical-Treasury Bills & Bonds	None of the 9 Scenarios. No sound method for determining the discount rate.	-.04	-.04
6	**CBO**	Projected CPI-U	Projected Interest Rates	Scenario #9	+1.50	+2.25
7	**OASDI/SSA**	Projected-CPI-U	Projected-Government Security Rates	Scenario #9	+. 042	+2.82
8	**Tucek**	Historical-CPI-U	Historical-10 Yr. Treasury	Scenario #1	+. 049	+2.80
9	**2012 Survey of Forensic Economists**				+1.10%	+1.60%

CONCLUSIONS

Examining the implied growth and discount rates contained in the reports of several economists' models, we have highlighted how easy an expert can end up increasing to present value when they otherwise should not be doing so. Furthermore, we suggest when experts use data from different sources and time periods, they need to provide a rationale for the relationship between the growth and discount rates they use. Finally, we argue when an expert assesses the present value of a future stream of earnings flows, they should distinguish clearly between the process of valuation, and the process of deciding to invest an award.

APPENDIX A

PERMUTATIONS & COMBINATIONS OF GROWTH AND DISCOUNT RATES

Relationships Between Growth Rates & Discount Rates				
		Growth Rates		
		Historical/Past	Current/Present (Market)	Projected/Future
Discount Rates	Historical/Past	**1** Historical Growth Rates/ Historical Interest Rates	**2** Current Growth Rates/ Historical Interest Rates	**3** Projected Growth Rates/ Historical Interest Rates
	Current/Present (Market)	**4** Historical Growth Rates/ Current Interest Rates	**5** Current Growth Rates/ Current Interest Rates	**6** Projected Growth Rates/ Current Interest Rates
	Projected/Future	**7** Historical Growth Rates/ Projected Interest Rates	**8** Current Growth Rates/ Projected Interest Rates	**9** Projected Growth Rates/ Projected Interest Rates

Scenarios 1 & 9	Possible	Comparable data available. We use Scenario 1. Scenario 9 is a possibility.
Scenarios 2 & 8	Unlikely	However, no conceptual basis for these relationships. There is no observable measure for the current growth rate--that is, there are no data available for a "market growth rate" that would be comparable to a "market interest rate."
Scenarios 3 & 7	Possible	However, no conceptual basis for these relationships.
Scenarios 4 & 6	Possible	However, mixing & matching time periods. These are the scenarios we see most often.
Scenarios 5	Unlikely	No data available for a "market growth rate" comparable to a "market interest rate."

Stability of an "Earnings Net Discount Rate":

1. We recognize the stability of an earnings NDR is a contested issue in the forensic economics literature.
2. For example, with respect to scenario 9, we recognize using a forecasted growth rate in conjunction with a forecast of an interest rate from the same source would only superficially meet the requirement that growth and discount rates be consistent. Without detailed knowledge and analysis of the underlying forecast process, any claim of consistency is nothing more than speculation.

3. However, in our examples and discussions above, we make no claim the implied earnings NDR's within the CBO forecast model are consistent or inconsistent (stationary or non-stationary), and likewise we make no similar claims regarding the implied earnings NDR's in the OASDI forecast. Our position is: If an expert chooses a growth rate from a model containing an interest rate, then they should choose the corresponding interest rate. For example, if they choose the projected rate for wage growth from the OASDI model, they are obliged to choose the corresponding projected interest rates. The expert cannot have one without the other. What we tried to illustrate in our examples is: An expert will tend to end up with negative NDR's when they mix and match data sources and time periods, regardless of whether they tested the stability of the earnings NDRs.
4. Further, is it our position: Whether the earnings NDR's are stable or not, the expert still must separate the valuation process from the investment decision, and ultimately the overall relationships between growth and discount rates must make economic historical and theoretical sense.

APPENDIX B

CONFLATING VALUATION & INVESTMENT

Valuation Process

When one under takes a "valuation," they determine the worth of an asset. One widely used practice is to assess the value of a set cash flows. For example, in the case of determining the economic damages of an individual in a personal injury case, the asset is their human capital, and the cash flow is the loss of the flow of their earnings over time. In constructing a valuation model, the expert must decide on proper growth and discount rates. Part of what determines "proper," is the meaningful relationship between these rates. As we suggest above and will reiterate below, these rates should be selected from the same time periods and should relate to one another in such a way as not to skew results of the valuation.

Investment Decision

When we talk about making an "investment," we are talking about how "*the use of capital to create more money, either through income-producing vehicles or through more risk-oriented ventures designed to result in capital gains.*[13] In the case of an economic damages case, "the capital" is the value of the potential award derived from the valuation model. The "investment decision" involves figuring out[1]:

(1) The goals and risk tolerance of the person awarded the sum of funds so they can develop a plan for investing the money received to achieve their long-term financial goals.
(2) The person's comfort zone for taking risk because all investments require some degree of risk. An appropriate mix of investments. Asset allocation is important because it has a major impact on whether financial goals will be met. If not enough risk is in the portfolio, the investments may not earn a large enough return to meet the goals.

Conflating Valuation & Investment

In Scenario #4 and Scenario #9, we suggest: The expert is conflating the valuation determination and the investment decision. They are using a risk-free current investment (for example 10 Year Treasuries) to determine the value of the earnings flows because of an injury. We determined: "To properly" value the asset (to assess the earnings flows), the expert should select variables that have a "time relationship." Our position is the valuation determination requires the expert to use Scenario #1 or Scenario #9.

We are arguing as experts, we must differentiate our valuation model from our investment model. The valuation model looks at the ***worth*** of the asset; the investment decision looks at how to ***preserve*** the value of that ***worth*** to ensure that funds are available in the future. For example, in a personal injury case, the investment decision looks at how a plaintiff is going to make their award last throughout term of the projected loss of earnings flows.

ENDNOTES

1. See Gerald D. Martin, *Determining Economic Damages*, Santa Ana: James Publishing Group, 2012. The net discount rate formula is as follows: Net Discount Rate= ((1+ nominal discount rate)/ (1+nominal growth rate))-1. When an expert supplies their growth and discount rates, we can compute their net discount rate. This is what we refer to as an "implied discount rate."

2. Edward Foster. (2015). Real Earnings of Full-Time Workers by Education, Age Group and Sex, 1974–2012. *Journal of Forensic Economics* 25(2), 2015, pp. 221-241.

3. The Annual Report of The Board of Trustees of The Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds (https://www.ssa.gov/oact/tr/2016/tr2016.pdf). Last visited 3/2/2017.

4. Edward Foster. (2015). Real Earnings of Full-Time Workers by Education, Age Group, and Sex, 1974–2012. *Journal of Forensic Economics* 25(2), 2015, pp. 221-241.

5. Council of Economic Advisors Economic Report of President https://www.gpo.gov/fdsys/browse/collection.action?collectionCode=ERP (Last visited 3/2/2017).

6. Percent Change in Average Weekly Earnings-found in the Economic Report of the President (2015-Table B-15).

7. Municipal Bond Rate- found in the Economic Report of the President (2015-Table B-17)

8. We follow the approach of David G. Tucek. "Historical Net Discount Rates–An Update Through 2013," *Journal of Legal Economics* 21(1): pp. 119–131. We note with appreciation that this data series was initially developed by Thomas Ireland and he provided annual updates until Tucek took over with this version of the data series. The Tucek Study updates the NDR's through 2013. We use data from the Economic Report of the President (2015) to update the NDR's through 2014.

9. We provide the information provided in Slesnick, et al (2013) "A 2012 Survey of Forensic Economists: Their Methods, Estimates, and Perspectives." *Journal of Legal Economics* 24(1), 2013, pp.67-99, an additional benchmark to show the ranges in which NDR's that economist use fall.

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

11. If some cases, we find: An Expert will use a projected inflation rate as a growth rate and a current market rate as the discount rate. However, there is a "market inflation rate," -- the 10 Year Treasury Break-Even Rate. So, in this case the Expert could use Scenario #5.

12. Congressional Budget Office (CBO) Budget and Economic Outlook and Updates https://www.cbo.gov/about/products/major-recurring-reports#1) (Last viewed 3/2/2017)

13. Financial Navigating in the Current Economy: Ten Things to Consider Before You Make Investing Decisions, U.S. Securities and Exchange Commission, https://www.sec.gov/investor/pubs/tenthingstoconsider.htm

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