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Historical Net Discount Rates: Amended and Reinterpreted

Andrew Kraynak and David Schap

Abstract: *Historical net discount rate series of the kind appearing in Ireland and Tucek (2011) are truncated for sake of consistency with published research in forensic economics (and elsewhere) and revised to reflect court admonitions regarding best forensic economic practice. The implications of the newly reported various series for applied work are discussed.*

I. Introduction

Forensic economists (FEs) apply differing approaches to the task of discounting future value to present value, whether in the context of estimating the present value of lost future earnings (where earnings growth must also be taken into account) or in the context of estimating the present value of future medical expenses (where medical cost growth must also be taken into account). Some FEs use current market rates for the purpose of discounting to present value under the theory that one cannot currently invest funds at historical interest rates or any average of them. Other FEs rely on historical interest rates and growth rates, implicitly acknowledging some connection between the two rates across the business cycle. Those FEs using historical interest rates might also point to the absence of a futures market for labor services, implying use of a current market rate for discounting at best solves only one part of a necessarily two-piece problem. This study concerns itself with historical discount rates and growth rates and so should be of particular interest to those FEs that make use of historical net discount rates in their applied work.

Ireland (2000, 2000-01, 2002, 2006 and 2008) and Ireland and Tucek (2010 and 2011) present tabled data on annualized historical interest rates of various types, annual growth rates in both average

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weekly earnings and total compensation, and annual growth rates for both the Consumer Price Index (CPI) and Medical Consumer Price Index (MCPI) for various years. With but a singular technical exception, noted by Ireland and Tucek (2011, p. 111), the protocol that determines inclusion in the tabled data is a simple one: the data must appear in one or more of the annual editions of the *Economic Report of the President* (ERP). From the aforementioned various series the author or authors in each article then distill and report historical average net (of growth) discount rates for earnings, total compensation and medical cost.

For convenience and since it involves the most recent data, we focus our attention on the most recent of the published articles referenced previously, namely Ireland and Tucek (2011). In particular, our concern has to do with the section of the article concerning "Uses of the Tables," (Ireland & Tucek, 2011, pp.111-112) which we quote here at length (parenthetical references to particular tables are from the original and refer to the tables therein):

> In addition to providing forensic economists with varied and flexible values for net discount rates and the real interest rate, these tables enable a forensic economist to counter claims that various net discount rates are justified by historical experience. For example, claims are made in some economic damage reports that purportedly justify total offset or more than offset net discount rates. These claims may rely on time periods or interest rates that the opposing economist does not regularly use. Consequently, the opposing economist may have difficulty demonstrating that such claims are inconsistent with actual history. Having tables that employ multiple discount rates, multiple projections of growth rates and multiple periods over which projections are made provides a useful tool to counter such claims.
>
> In particular, these tables continue to provide little support for employing total offset for anything but net rates based on the MCPI. (See Table 4). For the past 15 years, one can find values close to total offset based on the 91-day Treasury bill for net discount rates based on average weekly earnings or the ECI. To a lesser extent, the same is true for net discount rates based on the 3-year Treasury rate and average weekly earnings or the ECI. *For all other interest rate series presented in these tables,* net discount rates based on average weekly earnings or the ECI do not support claims of total offset. (See Tables 7 and 8.) [Emphasis added.]"

We do not dispute the connection between the authors' assertions in the quoted passage and the data and computed results that underlie the assertions, so our concerns are not narrowly technical in nature.

We do, however, question the appropriateness of the assertions for practicing forensic economists for two primary reasons: (1) published research in forensic economics (referenced in Section III)) arguably makes historical discount rates prior to 1980 irrelevant to the practice of forensic economics today with regards forecasting net discount rates; and (2) the protocol of including various interest rate measures on the basis of their being presented in the ERP, while readily understandable and perhaps even attractive at some level, arguably leads to a lopsided or flawed range of interest rates given certain legal dictates at play in the practice of forensic economics.

In Section II we articulate a case for modifying the data justifiably included in computing relevant historical net discount rates. Calling upon published research in forensic economics and "best practice" considerations flowing out of legal admonitions found in two prominent court opinions, we argue that the most suitable data for practicing forensic economists ought to exclude substantial portions of the Ireland-Tucek tables and ought instead to include some additional data series not presented in their tables. In Section III we review the content of the Ireland and Tucek (2011) tables, then adjust the tables to harmonize them with our Section II discussion. Finally, in Section IV we describe implications of our results for the practice of forensic economics.

II. Accounting for Federal Reserve Policy and Conforming to Legal Mandates

Ireland and Tucek (2011) present various data series that in some cases span fifty years. History teaches many lessons, but in the case of data series related to historical interest rates there needs to be explicit recognition that the distant past may have little relevance to current forensic economic practice. The authors are aware of the point inasmuch as a previous article by Ireland and Tucek (2010) contains the following explicit parenthetical proviso (p. 88): "(As a note of caution, averages for any period longer than 25 years are never applicable, given regime changes in the American economy.)" The omission of such a proviso in the subsequent article by Ireland and Tucek (2011) is cause for some concern, for without it a neophyte reader of the tables may weight the various entries equally, which would be inappropriate. To be clear, by "equal weighting" we are not referring to the method of averaging employed over time (be it arithmetic or geometric); instead we refer to the interpretation of a tabled set of values as if each entry is of equal importance, a clearly

inappropriate practice if many entries are based on a time period of little or no practical importance today.

The source of the need for a cautionary note concerning "regime change" (i.e. fundamental structural policy change) may be addressed in a scholarly way by referencing here some relevant literature in forensic economics (and elsewhere). We note in particular Gelles and Johnson (1996) and Gamber and Sorensen (1993, citing within related articles by Antoncic [1986] and Hakes and Gamber [1992]) to the effect that there occurred a shift in Federal Reserve monetary policy that altered structurally post-1980 interest rates. Pre-1980 data concerning interest rates are thus considered non-comparable to the more recent data on interest rates. Acknowledgment of this point in the scholarly literature makes equal weighting (in the sense previously described) of the historical data in Ireland and Tucek (2011) problematical.

Among the compiled statistics in Ireland and Tucek (2011) are interest rate data derived from the 3-month, 3-year, and 10-year Treasury Securities, plus corporate bonds and municipal bonds. The spectrum of interest rate data is wide, so a question arises as to the suitability of each of the various series for the practice of forensic economics. A related question concerns whether there are series omitted from presentation that might arguably be better suited to use by forensic economists in applied work. We make no allegation of data censorship here, as the authors principally followed the dictates of the announced protocol for inclusion, namely that the data appear in the ERP. Still, there may be alternative data selection criteria that yield data series more suitable to the practice of forensic economics than the one announced and principally adhered to by the authors. We offer for consideration a protocol derived from United States Supreme Court admonitions regarding selection of a suitable interest rate in forensic economic practice.

The source material to initiate our discussion is found nearly a century ago in *Chesapeake and Ohio Railway Company v. Kelly* (1916), where the Court first indicated that discounting future values should be done based on the interest rate available in the "best and safest" investment opportunity. In a much better turn of phrase than the aforementioned double superlative, the *Chesapeake* Court expressed as well its intention that the return should be that which accrues to an "investment," as opposed to an "investor," thus clearly indicating the return was to be to capital alone, not the larger return that might accrue to a mix of investment capital and business investment acumen or savvy.

In *Jones and Laughlin Steel Corp. v. Pfeifer* (1983), Justice Stevens writing the opinion for a unanimous Court quoted the language "best and safest," referencing the *Chesapeake* decision. Subsequently in the

same opinion the term "safest" appears alone in describing the suitable investment opportunity from which an appropriate discount rate ought be derived. In a passage quite familiar by now to many forensic economists, Stevens also opined in *Pfeifer* (1983): "by its very nature the calculation of an award ... must be a rough approximation."

In highlighting the inexactness of forensic economics, the Court gave forensic economists some latitude in choosing an appropriate interest rate. Still, the Court's focus on a discount rate based on the return to an unsophisticated investor placing funds in a safe investment arguable implies the choice should be tilted toward the secure, low-return end of the spectrum of available investments. One unsophisticated strategy that places capital preservation with a modest safe return in prominence would be investment in short-term U.S. Treasury instruments with continual reinvesting at each maturity opportunity. The strategy effectively neutralizes what otherwise would be the adverse effects of an unanticipated inflation. The strategy is readily implemented at low cost by investing in a mutual fund which itself holds U.S. Treasuries of short duration and reinvests maturing proceeds at each opportunity on behalf of its investors.

Forensic economists are not of singular opinion with regards how to apply the guidance or directives from *Pfeifer*, as is well substantiated by Rosenberg (2011). Accepting for the sake of argument provisionally, however, that Court directives for the practice of forensic economics imply choosing a discount rate based on the return available on short-term U.S. Treasuries, what does one make of a set of tables, as in Ireland and Tucek (2011), which include longer-term securities and even corporate bonds? The tables are arguably misleading, especially when the authors' own interpretation of the results (as quoted earlier, especially where emphasis was added) appears implicitly to weight equally all entries in the tables regardless of the appropriateness of the time frame or the appropriateness of the foundational investment instruments involved for applied work in forensic economics.

In the next section we review the construction of the Ireland and Tucek (2011) tables, then present alternative tables constructed to (1) truncate the data to the post-1980 time frame alone, recognizing the impact of Federal Reserve regime change for interest rate determination; and (2) limit attention to the safe range of investment opportunities available to an unsophisticated investor, namely U.S. Treasuries of short duration, recognizing the arguable impact of Court admonitions regarding choice of a discount rate by forensic economists. What emerges is a pattern of results far different from that appearing in the Ireland-Tucek tables.

III. Table Construction and Reconstruction

The construction of the most recent Ireland-Tucek tables is carefully described in Ireland and Tucek (2011), Section II, "Explanation of the Tables." We can do no better than to reproduce that discussion here at length and insert our emendations necessitated by the dual considerations raised in the previous section, chiefly (1) truncation to post-1980 data only and (2) inclusion of additional data related to the 6-month and 1-year Treasury Securities and deletion of all other instruments save the 3-month and 3-year Treasury Securities. We include the 3-year Treasury Security not because it is an instrument of short duration particularly, but instead to give a second (upper end) reference series in addition to the 3-month Treasury Security (lower end) both of which appear in Ireland and Tucek (2011), thus "framing" the fresh material presented herein, so to speak. We also extend the data by one year beyond the previous study, through 2011, to make the presentation as current as possible. By inserting our emendations as italicized, bracketed comments into the original table construction descriptions [*like this example, consisting of italicized words inside a set of brackets*], the detailed modifications to the original emerge as clearly as possible. The actual reconstructed tables appear following Section IV.

Ireland and Tucek (2011, pp. 109–111) describe their table construction thusly [*with our commentary concerning adjustments made in the present study appearing in italics and within brackets*]:

> The original purpose of the eight tables was to provide forensic economists with varied and flexible values for net discount rates and the real interest rate, and that objective still underlies the current update [*whereas the present study focuses on fewer data series that are arguably more relevant to legal dictates*]. The eight tables provided should be understood as two sets of four tables each. Tables 1 and 5 provide basic data relied on by the subsequent tables. Table 1 includes data for the 91-day Treasury bill, 3-year and 10-year constant maturity Treasury notes, the corporate Aaa bond rate, and the high grade municipal bond rate [*whereas Table 1 in the present study includes data for the 3-month, 6-month, 1-year and 3-year Treasury securities only*]. Table 1 also includes the annual percentage change in the CPI and in the MCPI. The data for the 91-day Treasury bill rate have been modified to reflect annual yield rather than bank discount rate as per the method explained by Fjeldsted (2000) [*also done in the present study for the 3-month Treasury bill, with an analogous technical adjustment made to the 6-month Treasury bill*]. The period covered by Table 1 ranges from 1961 through 2010 [*1980 through 2011 in the present study*].

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Table 5 repeats the interest rate data found in Table 1, but it replaces data for the CPI and MCPI with data for average weekly earnings of all American workers and the total compensation series for the ECI. The period covered by Table 5 ranges from 1965 through 2010 [*1980 through 2011 in the present study*]; data for the ECI begin in 1980.

Tables 2 and 6 provide a series of multi-year average growth rates for each variable for periods ending in 2010 [*2011 in the present study*]. This results in up to 50 year averages for the CPI and MCPI and up to 46 year averages for the earnings growth rates to interest rate comparisons [*whereas the corresponding numbers in the present study are up to 32-year averages in both cases*]. Table 2, for example, shows that the average rate of effective yields on 91-day Treasury bills from 1961 through 2010 was 5.57 percent and that the average rate of increase in the CPI over that same 50-year period was 4.07 percent [*whereas in the present study the 3-month Treasury bill average effective yield from 1980 through 2011 was 5.41 and the average rate of increase in the CPI was 3.60 during that same 32-year period*]. Table 3 provides calculations of the real interest rate based on comparing each of the interest rates with the growth rate in the CPI for each of fifty possible time periods ending in 2010 [*thirty-two possible time periods ending 2011 in the present study*]. Table 4 provides the same comparisons with the growth rate in the MCPI for up to 50-year periods [*up to 32-year periods here*]. Table 7 is analogous to Table 3; it is based on Table 5 and provides calculations of the net discount rate based on comparing each of the interest rates with the growth rate in the average weekly earnings series for the 46 possible periods from 1965 through 2010 [*32 possible periods from 1980 through 2011 here*]. Similarly, Table 8 provides calculations of the net discount rate based on comparing each of the interest rates with the annual growth rate in the ECI for the 31 possible periods from 1980 through 2010 [*32 possible periods 1980 through 2011 here*].

Note that the data in Tables 1 and 5 are presented in chronological order, with the earliest observations appearing in the first row of each table. In Tables 2 and 6, the first row is labeled '1 Yr. Avg. Rate,' [*labeled simply '1' here*] and the value corresponds to the average for the one-year period ending in 2010 [*2011 here*]. Consequently, these are the same values that appear at the bottom of Tables 1 and 5, respectively. The rows labeled '2 Yr. Avg. Rate' [*simply '2' here*] contain the averages of the rates in the last two rows of Tables 1 and 5, for the years 2009 and 2010 [*2010 and 2011 here*]. Similarly, the rows labeled '3 Yr. Avg. Rate' [*simply '3' here*] contain the averages of the rates at the bottom of Tables 1 and 5 for the years 2008, 2009 and 2010 [*2009, 2010 and 2011 here*]. Tables 3 and 4 are derived from Table 2. Consequently, they start with the present and move further into the past as more years are included in

the corresponding averages used to calculate the net rates. The same is true of the net discount rates appearing in Tables 7 and 8, which are based on the average rates in Table 6.

Before turning to our interpretation of the implications of the newly constructed tables for the practice of forensic economics, we address some technical points concerning geometric versus arithmetic averaging. Ireland and Tucek (2010) use arithmetic averaging and assert that while geometric averaging would perhaps be preferable, the difference in the averages would be slight, on the order of at most 4 basis points (p. 99, n.1). We were in fact able to replicate the effects on the data presented in Ireland and Tucek (2010) of geometric versus arithmetic averaging and attest to confirming to within ordinary rounding error the authors' contention that the differences are slight and are on the order of about 4 basis points at most. In the most recent article, Ireland and Tucek (2011) make use of geometric averaging, as do we in the present study for sake of comparability. See Skoog and Ciecka (2008), Spizman (2007) and Spizman and Weinstein (2008) for more on geometric versus arithmetic averaging.

IV. Implications of the Tabled Results

We do not intend for our tables to be a complete substitute for the Ireland-Tucek tables. One stated purpose of their tables was to make available to forensic economists a wide range of data that could be called upon to check or possibly refute claims by other forensic economists who use data involving interest rates or time periods that are not regularly used by the opposing economist so that consistency with actual history may be verified. Clearly, our tables do not serve that function given their more focused purpose of achieving consistency with the widely recognized Federal Reserve monetary policy shift circa 1980 and with legal mandates, as described in Section II.

At the same time, we reiterate our concern with the Ireland-Tucek tables to the degree that they may be misapplied when entries from the distant or obsolete past or from series arguably inappropriate to the ordinary work of forensic economists are implicitly regarded as of equal importance to entries that speak more directly to current situations in a way consistent with established court rulings. We have put forth legal arguments that may incline forensic economists toward use of Treasury instruments of short duration as the basis of the discount rates they choose to use in their professional work. For those persuaded by our arguments, the entries in our tables will be more

relevant to their choice of a suitable discount rate than the far larger set of entries in the Ireland and Tucek (2011) tables. Ours, of course, is not the only possible set of legal arguments; Rosenberg (2010), for example, places emphasis on other aspects of the *Pfeifer* (1983) decision and proposes a method for discounting not based exclusively on Treasury instruments of short duration (although explicitly recognizing at p. 180 that instruments that exclude inflation risk, such as recommended here, are indeed permitted under *Pfeifer*).

Taking our tables in context then, we believe that they effectively refute the notion that there is little empirical support for the total offset method with respect to discounting projected future earnings to present value, whereby the real wage growth rate is thought to just offset the real discount rate. One observes that the net discount rate based on weekly earnings data (Table 7) or employer total compensation cost data (Table 8) and formed using any of the Treasury instruments of 1-year duration or less has, for the period the last 15 or 16 years, been about zero, as a "rough approximation" (recalling Justice Stevens' words in *Pfeifer*). In Tables 7 and 8 the result is observed by reading across the entries associated with 15-year or 16-year averaging, where no entry is larger in absolute size than 22 basis points. Of course, there is nothing magical about the numbers 15 or 16 that they should dictate the time frame over which a discount rate is chosen: for the three series using Treasuries of 1-year duration or less, with fewer years than 15 of the most recent years averaged one finds more than offset (negative discount rates), while averages based on more than 16 years exhibit less than offset in every instance. The most remarkable feature, however, is that for each of the three series based on Treasury instruments of 1-year duration or less, one finds average net discount rates between plus and minus unity ("rough approximation" offset) for any number of most recent years averaged of between 7 and 23 years in Table 7 and between 5 and 26 years in Table 8. Moreover, if one were to follow hypothetically the dictum quoted previously from Ireland and Tucek (2010, p. 88), that "averages for any period longer than 25 years are never applicable," then there would be not many exceptions to total offset (as a "rough approximation") to be found in Table 7 or Table 8 among the entries in the series based on Treasury instruments of 1-year duration or less; and, in the same hypothetical context indicated, there would be very few exceptions indeed to total offset (again, as a "rough approximation") relative to positive net discounting.

Recall that Ireland and Tucek (2011) noted that the evidence in their tables "provide little support for employing total offset for anything but net rates based on the MCPI," thus suggesting at least a modicum of support for total offset in the context of medical cost

discounting. Before reviewing the evidence in our tables regarding total offset in medical cost discounting, where real medical cost increases are thought to just offset the real discount rate, we want to call attention to the fact that both the *Chesapeake* and the *Pfeifer* decisions concern cases of lost future earnings, not future medical costs in particular. That caveat noted, the reasoning brought to the fore in Section II would appear to apply no less forcefully in economic principle to calculating the present value of future medical costs, yet it is perhaps a fine point of law as to whether the reasoning carries equal legal force.

Table 4 provides support for total offset ("rough approximation") in medical cost discounting based on the full 32-year averages based on all three of the Treasury instruments of 1-year duration or less. For those same three Treasury instruments, the net discount rates are less than unity in absolute value ("rough approximation" offset) for every average net discount rate based on from 15 to 32 years. The case for total offset is less compelling based on the most recent averages of 14 years or less, where negative discounting appears to rule based on instruments of short duration, but the legal reasoning pointing to "safest" investment instruments may itself be less compelling in the medical cost context (as observed previously). Thus, whether one might hazard faith in total offset projections in medical cost discounting appears to be open to debate, perhaps in ways somewhat beyond the scope of this study and the tables herein.

Table 1. Annual Values for Interest and Growth Rates in (M)CPI for Years 1980–2011

Year	3-Month Eff. Yield	6-Month Eff. Yield	1-Year Con. Mat.	3-Year Con. Mat.	CPI Incr. % Yrly Δ	Med. Care % Yrly Δ
1980	12.57	12.61	12.00	11.51	13.50	10.96
1981	15.58	15.58	14.80	14.46	10.32	10.68
1982	11.61	12.26	12.27	12.93	6.16	11.58
1983	9.25	9.50	9.58	10.45	3.21	8.76
1984	10.27	10.69	10.91	11.92	4.32	6.16
1985	7.95	8.22	8.42	9.64	3.56	6.27
1986	6.30	6.41	6.45	7.06	1.86	7.49
1987	6.12	6.43	6.77	7.68	3.65	6.64
1988	7.08	7.40	7.65	8.26	4.14	6.53
1989	8.67	8.68	8.53	8.55	4.82	7.72
1990	7.99	8.03	7.89	8.26	5.40	9.04
1991	5.69	5.81	5.86	6.82	4.21	8.72
1992	3.58	3.72	3.89	5.30	3.01	7.40
1993	3.12	3.26	3.43	4.44	2.99	5.94
1994	4.47	4.90	5.32	6.27	2.56	4.77
1995	5.79	5.92	5.94	6.25	2.83	4.50
1996	5.26	5.37	5.52	5.99	2.95	3.49
1997	5.31	5.47	5.63	6.10	2.29	2.80
1998	5.03	5.10	5.05	5.14	1.56	3.20
1999	4.87	5.01	5.08	5.49	2.21	3.51
2000	6.16	6.28	6.11	6.22	3.36	4.07
2001	3.57	3.53	3.49	4.09	2.85	4.60
2002	1.66	1.74	2.00	3.10	1.58	4.69
2003	1.03	1.08	1.24	2.10	2.28	4.03
2004	1.41	1.61	1.89	2.78	2.66	4.38
2005	3.27	3.54	3.62	3.93	3.39	4.22
2006	4.94	5.05	4.94	4.77	3.23	4.02
2007	4.60	4.70	4.53	4.35	2.85	4.42
2008	1.51	1.76	1.83	2.24	3.84	3.71
2009	0.16	0.29	0.47	1.43	−0.36	3.17
2010	0.14	0.20	0.32	1.11	1.64	3.41
2011	0.06	0.10	0.18	0.75	3.16	3.04

Table 2. Geo. Avg. Values for Interest and Growth Rates in (M)CPI Years 1980–2011

Averages	3-Month	6-Month	1-Year	3-Year	CPI Incr.	Med. Care
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	0.06	0.10	0.18	0.75	3.16	3.04
2	0.10	0.15	0.25	0.93	2.40	3.22
3	0.12	0.20	0.32	1.10	1.47	3.21
4	0.47	0.59	0.70	1.38	2.06	3.33
5	1.28	1.40	1.45	1.97	2.22	3.55
6	1.88	2.00	2.03	2.43	2.38	3.63
7	2.08	2.21	2.25	2.64	2.53	3.71
8	1.99	2.14	2.21	2.66	2.54	3.79
9	1.89	2.02	2.10	2.60	2.51	3.82
10	1.86	1.99	2.09	2.65	2.42	3.91
11	2.02	2.13	2.22	2.78	2.46	3.97
12	2.36	2.47	2.53	3.06	2.53	3.98
13	2.55	2.66	2.73	3.25	2.51	3.94
14	2.72	2.84	2.89	3.38	2.44	3.89
15	2.89	3.01	3.07	3.56	2.43	3.82
16	3.04	3.16	3.22	3.71	2.46	3.80
17	3.20	3.32	3.38	3.86	2.48	3.84
18	3.27	3.40	3.49	3.99	2.49	3.89
19	3.26	3.40	3.49	4.01	2.52	4.00
20	3.28	3.41	3.51	4.08	2.54	4.16
21	3.39	3.53	3.62	4.21	2.62	4.38
22	3.60	3.73	3.81	4.39	2.74	4.58
23	3.81	3.94	4.01	4.56	2.83	4.72
24	3.95	4.08	4.16	4.72	2.89	4.79
25	4.03	4.17	4.26	4.83	2.92	4.87
26	4.12	4.26	4.34	4.92	2.88	4.97
27	4.26	4.40	4.49	5.09	2.90	5.01
28	4.47	4.62	4.71	5.33	2.95	5.05
29	4.63	4.78	4.88	5.50	2.96	5.18
30	4.85	5.02	5.12	5.74	3.07	5.39
31	5.18	5.35	5.42	6.01	3.29	5.55
32	5.41	5.57	5.62	6.18	3.60	5.72

Table 3. Net Discount Rate with CPI for Number of Years Ending in 2011

Real Disc. Rate	3-Month	6-Month	1-Year	3-Year	CPI Incr.	Med. Care
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	−3.01	−2.97	−2.89	−2.34	0.00	−0.12
2	−2.24	−2.19	−2.10	−1.43	0.00	0.81
3	−1.33	−1.25	−1.13	−0.37	0.00	1.71
4	−1.56	−1.44	−1.33	−0.66	0.00	1.25
5	−0.92	−0.80	−0.75	−0.24	0.00	1.30
6	−0.49	−0.38	−0.35	0.04	0.00	1.21
7	−0.44	−0.30	−0.27	0.11	0.00	1.16
8	−0.54	−0.39	−0.33	0.11	0.00	1.22
9	−0.61	−0.48	−0.41	0.08	0.00	1.27
10	−0.54	−0.42	−0.32	0.22	0.00	1.45
11	−0.43	−0.32	−0.24	0.31	0.00	1.47
12	−0.17	−0.06	0.00	0.51	0.00	1.41
13	0.04	0.15	0.21	0.72	0.00	1.40
14	0.28	0.39	0.44	0.92	0.00	1.41
15	0.45	0.56	0.63	1.10	0.00	1.35
16	0.56	0.68	0.74	1.22	0.00	1.30
17	0.70	0.81	0.88	1.34	0.00	1.32
18	0.76	0.89	0.98	1.46	0.00	1.37
19	0.73	0.86	0.95	1.46	0.00	1.44
20	0.72	0.85	0.94	1.50	0.00	1.58
21	0.75	0.88	0.97	1.55	0.00	1.71
22	0.83	0.96	1.03	1.60	0.00	1.79
23	0.95	1.07	1.14	1.68	0.00	1.83
24	1.03	1.16	1.23	1.78	0.00	1.85
25	1.08	1.22	1.30	1.86	0.00	1.89
26	1.21	1.34	1.43	1.98	0.00	2.03
27	1.32	1.46	1.55	2.13	0.00	2.05
28	1.47	1.62	1.71	2.31	0.00	2.04
29	1.62	1.77	1.86	2.46	0.00	2.16
30	1.73	1.90	1.99	2.59	0.00	2.25
31	1.83	1.99	2.06	2.63	0.00	2.19
32	1.75	1.90	1.95	2.49	0.00	2.05

Table 4. Net Medical Discount Rates with MCPI for Number of Years Ending in 2011

Med. Disc. Rate	3-Month	6-Month	1-Year	3-Year	CPI Incr.	Med. Care
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	−2.89	−2.85	−2.78	−2.22	0.12	0.00
2	−3.03	−2.98	−2.88	−2.22	−0.80	0.00
3	−2.99	−2.92	−2.79	−2.04	−1.68	0.00
4	−2.77	−2.66	−2.55	−1.89	−1.23	0.00
5	−2.19	−2.08	−2.02	−1.53	−1.29	0.00
6	−1.69	−1.57	−1.55	−1.16	−1.20	0.00
7	−1.58	−1.44	−1.41	−1.03	−1.14	0.00
8	−1.74	−1.60	−1.53	−1.09	−1.21	0.00
9	−1.86	−1.73	−1.66	−1.18	−1.26	0.00
10	−1.97	−1.84	−1.75	−1.21	−1.43	0.00
11	−1.88	−1.77	−1.69	−1.15	−1.45	0.00
12	−1.56	−1.45	−1.39	−0.88	−1.39	0.00
13	−1.34	−1.23	−1.17	−0.67	−1.38	0.00
14	−1.12	−1.01	−0.96	−0.49	−1.39	0.00
15	−0.89	−0.78	−0.72	−0.25	−1.33	0.00
16	−0.73	−0.62	−0.55	−0.08	−1.28	0.00
17	−0.61	−0.50	−0.44	0.02	−1.30	0.00
18	−0.60	−0.47	−0.39	0.10	−1.35	0.00
19	−0.71	−0.58	−0.49	0.02	−1.42	0.00
20	−0.85	−0.72	−0.63	−0.08	−1.56	0.00
21	−0.94	−0.82	−0.73	−0.16	−1.68	0.00
22	−0.94	−0.82	−0.74	−0.19	−1.76	0.00
23	−0.87	−0.75	−0.68	−0.15	−1.80	0.00
24	−0.81	−0.68	−0.61	−0.07	−1.82	0.00
25	−0.80	−0.66	−0.58	−0.03	−1.86	0.00
26	−0.81	−0.68	−0.59	−0.05	−1.99	0.00
27	−0.72	−0.58	−0.50	0.07	−2.01	0.00
28	−0.56	−0.41	−0.32	0.26	−2.00	0.00
29	−0.52	−0.38	−0.29	0.30	−2.11	0.00
30	−0.51	−0.34	−0.26	0.33	−2.20	0.00
31	−0.35	−0.19	−0.13	0.43	−2.14	0.00
32	−0.30	−0.14	−0.10	0.43	−2.01	0.00

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Table 5. Annual Values for Various Interest and Growth Rates in the Average Weekly Earnings and Employer Cost Index from 1980–2011

Year	3-Month Eff. Yield	6-Month Eff. Yield	1-Year Con. Mat.	3-Year Con. Mat.	Avg. Wkly Earn. % Yrly Δ	ECI % Yrly Δ
1980	12.57	12.61	12.00	11.51	6.83	9.45
1981	15.58	15.58	14.80	14.46	8.61	10.03
1982	11.61	12.26	12.27	12.93	4.28	6.33
1983	9.25	9.50	9.58	10.45	4.79	5.71
1984	10.27	10.69	10.91	11.92	4.13	4.95
1985	7.95	8.22	8.42	9.64	2.36	3.86
1986	6.30	6.41	6.45	7.06	1.59	3.10
1987	6.12	6.43	6.77	7.68	2.35	3.41
1988	7.08	7.40	7.65	8.26	2.98	4.84
1989	8.67	8.68	8.53	8.55	3.51	4.81
1990	7.99	8.03	7.89	8.26	3.45	4.59
1991	5.69	5.81	5.86	6.82	2.50	4.38
1992	3.58	3.72	3.89	5.30	2.72	3.55
1993	3.12	3.26	3.43	4.44	2.89	3.59
1994	4.47	4.90	5.32	6.27	3.25	3.16
1995	5.79	5.92	5.94	6.25	2.26	2.48
1996	5.26	5.37	5.52	5.99	3.30	3.13
1997	5.31	5.47	5.63	6.10	4.50	3.45
1998	5.03	5.10	5.05	5.14	3.87	3.47
1999	4.87	5.01	5.08	5.49	3.25	3.48
2000	6.16	6.28	6.11	6.22	3.86	4.24
2001	3.57	3.53	3.49	4.09	2.66	4.19
2002	1.66	1.74	2.00	3.10	2.62	3.09
2003	1.03	1.08	1.24	2.10	2.23	4.00
2004	1.41	1.61	1.89	2.78	2.13	3.85
2005	3.27	3.54	3.62	3.93	2.88	2.88
2006	4.94	5.05	4.94	4.77	4.32	3.20
2007	4.60	4.70	4.53	4.35	3.90	3.00
2008	1.51	1.76	1.83	2.24	3.04	2.45
2009	0.16	0.29	0.47	1.43	1.52	1.19
2010	0.14	0.20	0.32	1.11	3.20	2.09
2011	0.06	0.10	0.18	0.75	2.55	2.22

Table 6. Geo. Avg. Values for Interest Rates and Growth Rates in Avg. Wkly Earnings and Employer Cost Index for Years Ending in 2011

Averages	3-Month	6-Month	1-Year	3-Year	Avg. Wkly Earn.	ECI
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	0.06	0.10	0.18	0.75	2.55	2.22
2	0.10	0.15	0.25	0.93	2.87	2.15
3	0.12	0.20	0.32	1.10	2.42	1.83
4	0.47	0.59	0.70	1.38	2.58	1.99
5	1.28	1.40	1.45	1.97	2.84	2.19
6	1.88	2.00	2.03	2.43	3.08	2.36
7	2.08	2.21	2.25	2.64	3.06	2.43
8	1.99	2.14	2.21	2.66	2.94	2.61
9	1.89	2.02	2.10	2.60	2.86	2.76
10	1.86	1.99	2.09	2.65	2.84	2.79
11	2.02	2.13	2.22	2.78	2.82	2.92
12	2.36	2.47	2.53	3.06	2.91	3.03
13	2.55	2.66	2.73	3.25	2.93	3.06
14	2.72	2.84	2.89	3.38	3.00	3.09
15	2.89	3.01	3.07	3.56	3.10	3.12
16	3.04	3.16	3.22	3.71	3.11	3.12
17	3.20	3.32	3.38	3.86	3.06	3.08
18	3.27	3.40	3.49	3.99	3.07	3.08
19	3.26	3.40	3.49	4.01	3.06	3.11
20	3.28	3.41	3.51	4.08	3.04	3.13
21	3.39	3.53	3.62	4.21	3.02	3.19
22	3.60	3.73	3.81	4.39	3.04	3.26
23	3.81	3.94	4.01	4.56	3.06	3.32
24	3.95	4.08	4.16	4.72	3.06	3.38
25	4.03	4.17	4.26	4.83	3.03	3.39
26	4.12	4.26	4.34	4.92	2.97	3.37
27	4.26	4.40	4.49	5.09	2.95	3.39
28	4.47	4.62	4.71	5.33	2.99	3.45
29	4.63	4.78	4.88	5.50	3.05	3.53
30	4.85	5.02	5.12	5.74	3.09	3.62
31	5.18	5.35	5.42	6.01	3.27	3.82
32	5.41	5.57	5.62	6.18	3.38	3.99

Table 7. Net Discount Rates with Avg. Wkly Earnings for Non-Agriculture and Non-Supervisory Workers for Number of Years Ending in 2011

Real Disc. Rate	3-Month	6-Month	1-Year	3-Year	Avg. Wkly Earn.	ECI
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	−2.43	−2.39	−2.31	−1.76	0.00	−0.32
2	−2.70	−2.65	−2.55	−1.89	0.00	−0.70
3	−2.25	−2.17	−2.05	−1.29	0.00	−0.57
4	−2.06	−1.94	−1.83	−1.16	0.00	−0.57
5	−1.52	−1.40	−1.35	−0.85	0.00	−0.63
6	−1.17	−1.06	−1.03	−0.64	0.00	−0.71
7	−0.95	−0.82	−0.78	−0.40	0.00	−0.61
8	−0.92	−0.78	−0.71	−0.27	0.00	−0.32
9	−0.95	−0.82	−0.74	−0.26	0.00	−0.10
10	−0.95	−0.82	−0.73	−0.18	0.00	−0.04
11	−0.78	−0.67	−0.59	−0.04	0.00	0.10
12	−0.53	−0.42	−0.36	0.15	0.00	0.12
13	−0.37	−0.26	−0.20	0.30	0.00	0.13
14	−0.27	−0.16	−0.10	0.37	0.00	0.09
15	−0.20	−0.09	−0.03	0.45	0.00	0.02
16	−0.07	0.04	0.11	0.58	0.00	0.01
17	0.13	0.25	0.31	0.77	0.00	0.02
18	0.19	0.32	0.40	0.89	0.00	0.01
19	0.19	0.32	0.41	0.92	0.00	0.05
20	0.23	0.36	0.45	1.00	0.00	0.09
21	0.36	0.49	0.58	1.15	0.00	0.17
22	0.54	0.67	0.75	1.31	0.00	0.21
23	0.73	0.85	0.92	1.46	0.00	0.26
24	0.86	0.99	1.07	1.61	0.00	0.32
25	0.98	1.11	1.20	1.75	0.00	0.35
26	1.11	1.25	1.33	1.89	0.00	0.39
27	1.27	1.41	1.50	2.08	0.00	0.43
28	1.43	1.58	1.67	2.27	0.00	0.44
29	1.53	1.68	1.77	2.37	0.00	0.46
30	1.71	1.87	1.96	2.57	0.00	0.51
31	1.86	2.02	2.08	2.66	0.00	0.53
32	1.96	2.12	2.17	2.71	0.00	0.59

Table 8. Net Discount Rates with the Total Compensation Series of the Employer

Real Disc. Rate	3-Month	6-Month	1-Year	3-Year	Avg. Wkly Earn.	ECI
Year (1=2011)	Eff. Yield	Eff. Yield	Con. Mat.	Con. Mat.	% Yrly Δ	% Yrly Δ
1	−2.11	−2.07	−2.00	−1.44	0.32	0.00
2	−2.01	−1.96	−1.86	−1.20	0.70	0.00
3	−1.68	−1.61	−1.48	−0.72	0.58	0.00
4	−1.49	−1.37	−1.26	−0.59	0.58	0.00
5	−0.89	−0.78	−0.72	−0.22	0.64	0.00
6	−0.46	−0.35	−0.32	0.07	0.71	0.00
7	−0.34	−0.21	−0.17	0.21	0.61	0.00
8	−0.60	−0.46	−0.39	0.05	0.32	0.00
9	−0.85	−0.72	−0.64	−0.16	0.10	0.00
10	−0.90	−0.78	−0.69	−0.14	0.04	0.00
11	−0.88	−0.77	−0.68	−0.14	−0.10	0.00
12	−0.65	−0.54	−0.48	0.03	−0.12	0.00
13	−0.50	−0.39	−0.33	0.18	−0.13	0.00
14	−0.36	−0.25	−0.19	0.28	−0.09	0.00
15	−0.22	−0.10	−0.04	0.43	−0.02	0.00
16	−0.08	0.04	0.10	0.57	−0.01	0.00
17	0.12	0.23	0.29	0.75	−0.02	0.00
18	0.18	0.31	0.39	0.88	−0.01	0.00
19	0.15	0.28	0.36	0.87	−0.05	0.00
20	0.14	0.27	0.36	0.92	−0.09	0.00
21	0.19	0.32	0.41	0.98	−0.17	0.00
22	0.33	0.46	0.53	1.10	−0.21	0.00
23	0.47	0.59	0.66	1.20	−0.25	0.00
24	0.54	0.67	0.75	1.29	−0.32	0.00
25	0.62	0.76	0.85	1.40	−0.35	0.00
26	0.72	0.85	0.94	1.49	−0.39	0.00
27	0.84	0.97	1.06	1.64	−0.43	0.00
28	0.98	1.13	1.22	1.82	−0.44	0.00
29	1.07	1.22	1.31	1.91	−0.46	0.00
30	1.19	1.36	1.45	2.05	−0.51	0.00
31	1.32	1.47	1.54	2.11	−0.53	0.00
32	1.36	1.52	1.56	2.10	−0.59	0.00

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