American Finance Association

The Value of the Tax Treatment of Original-Issue Deep-Discount Bonds: A Note
Author(s): Marcelle Arak and Andrew Silver
Source: *The Journal of Finance*, Vol. 39, No. 1 (Mar., 1984), pp. 253-259
Published by: Blackwell Publishing for the American Finance Association
Stable URL: http://www.jstor.org/stable/2327681
Accessed: 27/11/2009 07:38

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at http://www.jstor.org/page/info/about/policies/terms.jsp. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at http://www.jstor.org/action/showPublisher?publisherCode=black.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Blackwell Publishing and *American Finance Association* are collaborating with JSTOR to digitize, preserve and extend access to *The Journal of Finance.*

http://www.jstor.org

THE JOURNAL OF FINANCE • VOL. XXXIX, NO. 1 • MARCH 1984

The Value of the Tax Treatment of Original-Issue Deep-Discount Bonds: A Note

MARCELLE ARAK and ANDREW SILVER*

IN A 1979 ARTICLE in this journal, Livingston [5] examined the tax treatment of original-issue deep-discount bonds (OIDs), and concluded that this tax treatment made the bonds "highly disadvantageous to potential bondholders and firms." Nevertheless, from March 1981 through April 1982, almost 14% of the funds raised in the domestic bond market were raised with bonds issued at deep discounts from their par values. These OIDs had yields to maturity below comparable bonds being issued at par with coupons reflecting current interest rates (i.e., current coupon bonds, or CCBs). To explain the attractiveness of OIDs to investors, market analysts have noted that the bonds were less likely to be called by the issuer, that they had a more certain yield to maturity, and that an inverted yield curve made OID cash flows more appealing.[1]

This note reexamines the perceived tax disadvantages on OIDs issued prior to July 1, 1982 and shows that it applies most strongly to the purchase of *new* OIDs by taxable investors. However, after some seasoning, OIDs will become attractive to taxable investors because they begin to produce capital gain income. In fact, original holders who are nontaxable may be able to earn very high holding-period returns by selling seasoned OIDs to taxable holders in the secondary market.[2] Although the Tax Equity and Fiscal Responsibility Act of 1982 eliminates this advantage on new issues, older issues will still benefit from it.

I. Tax Treatment and Implications

Original-issue deep-discount bonds issued prior to July 1, 1982 are taxed as follows:[3]

* Citibank and the Federal Reserve Bank of New York, respectively. The views expressed are those of the authors and not necessarily those of the institutions with which they are affiliated. The authors would like to thank Joseph Snailer for his valuable research assistance and comments, Sheila Tschinkel for her numerous helpful discussions, and Patrick Corcoran, Howard Esaki, Edward Frydl, Jeffrey Ingber, Marcos Jones, Leonard Sahling, and an anonymous referee for many useful suggestions.

[1] For analyses of bond call provisions see Jen and Wert [4], Pye [7], Elton and Gruber [3], Boyce and Kalotay [1], and Van Horne [9]. McEnally [6] analyzes the more certain yield to maturity, or lower "reinvestment risk", of lower coupon bonds, while Pyle [8] looks at the cash flow implications.

[2] Constantinides and Ingersoll [2] discuss some general considerations regarding the effects of taxes on the timing of secondary market sales, but do not deal with the specific implications of the tax treatment of OIDs.

[3] For tax purposes, a bond is considered to have been issued at a discount "if the original issue discount is greater than or equal to one-fourth of 1 percent of the redemption price at maturity multiplied by the number of complete years to maturity" (1981 Standard Federal Tax Reports, p.

1) The IRS specifies a *linear* accretion schedule, based upon issue price (P_0), and taxes the specified annual accretion as interest income each year.
2) The linear accretions are used to define a benchmark price at each date, which is used to compute capital gains. If the bond is purchased at a price below the benchmark price, a capital gain, equal to the difference between the benchmark price at the date of purchase and the secondary market purchase price, is taxed at the bond's maturity.[4] If the bond has been held more than 1 year, that capital gain is long-term.[5]

If the short-term interest rate is expected, with certainty, to remain constant at r,[6] a taxable investor would be willing to purchase an OID in the secondary market at time h at a price (P_{Th}):

$$P_{Th} = \{\textstyle\sum_{i=1}^{n-h} [(1 - t)c - t(100 - P_0)/n]/[(1 + r_T)^i]\} + \{[(100 - gtG)/(1 + r_T)^{n-h}]\} \quad (1)$$

where c is the semiannual coupon, n is the original term to maturity (measured in semiannual periods), g is the portion of capital gains subject to taxation, t is the investor's marginal tax rate, P_0 is the initial price of the bond, r_T is the semiannual after-tax yield available on current coupon bonds (i.e., $r_T = (1 - t)r$, where r is the semiannual pre-tax yield), and G is the capital gain.

The capital gain, however, depends on the purchase price, P_{Th}:

$$G = [P_0 + (100 - P_0)h/n - P_{Th}]. \quad (2)$$

Substituting (2) into (1) and solving the resulting equation for P_{Th} we get:

$$P_{Th} = \{\textstyle\sum_{i=1}^{n-h} [(1 - t)c - t(100 - P_0)/n]/[(1 + r_T)^i]\} + \{100 - gt[P_0 + (100 - P_0)h/n]/[(1 + r_T)^{n-h}]\}/\{1 - gt(1 + r_T)^{h-n}\}. \quad (3)$$

Equation (3) gives the price a taxable investor would pay for a bond, given values of c, t, n, r, h, g, and P_0.

To analyze the implications of the tax treatment of OIDs, it is useful to think of the problem in terms of the extreme-case OID, a zero-coupon bond (ZCB). If nontaxable investors can earn r semiannually, ZCBs implicitly pay interest of rP_{Nh}—this is equal to the change in the value of the bond (from period h to h + 1) to the nontaxable investor. If the IRS taxed this true change in value, then the ZCB would be equivalent to a CCB for a taxable investor. However, the IRS taxes an equal portion of the total accretion annually. In the early years, the

54090). The Tax Equity and Fiscal Responsibility Act of 1982 alters the tax treatment of new OIDs (issued after July 1, 1982) to eliminate all of the effective tax differences between new OIDs and CCBs, but does not affect the distinctions on bonds prior to July 1982. In the remainder of the text, the term "OIDs" refers to those bonds issued prior to July 1982, unless otherwise noted.

[4] If the bond is purchased at a premium over the benchmark price, the first holder reports a capital gain while the new holder accretes linearly from the purchase price to par.

[5] If the second (or any subsequent) holder sells the bond before maturity the capital gain is the difference between the sale price and the IRS' accreted value at the date of sale.

[6] As will be explained later, the value to a taxable investor will then never be greater than the IRS' benchmark price.

linear accretions exceed the implicit interest, whereas in the later years, the linear accretions are smaller than the implicit interest. As a result, the present value of the taxes on a new ZCB (and, in fact, on any new OID) exceeds the present value of the taxes on a CCB. In other words, although the *cumulative* tax liability is the same, the liability is shifted forward in the case of the OID and therefore is more costly in a present-value sense. Clearly, then, a taxable investor will prefer a CCB to a new OID, other things being equal.[7]

Table I illustrates a specific example, a 20-year ZCB which is initially priced to yield 15% to maturity. Column (1) shows the semiannual accretions which are taxed as ordinary income. Using these accretions, we can calculate the benchmark prices, P_{Bh}, for each date, as shown in Column (2). Column (3) lists the value that a nontaxable investor puts on the ZCB (P_{Nh}), and Column (4) shows the first differences of these values.

The important point about the data in the first four columns of Table I, and the point that has not been recognized in the past, is that, assuming that interest rates remain constant, OIDs will trade in the secondary market at prices below P_{Bh}. Consequently, of the total price appreciation, $100 - P_{Nh}$, only *part*, $100 - P_{Bh}$, is taxed as ordinary income, according to the originally scheduled linear accretions. The remaining part, $P_{Bh} - P_{Nh}$, is taxed as a capital gain at maturity. Since the capital gain is taxed at only 40% of the ordinary income rate, and the tax is deferred until maturity, the capital gain portion offers an *advantage* relative to an equal amount that is taxed as it accrues implicitly. Therefore, in general, the disadvantage due to the linear accretion schedule is offset to some extent by the advantage due to the capital gains.

Shortly after its issue, as the bond becomes more seasoned, the capital gain for potential new buyers grows. (See Column (5).) Furthermore, as the remaining term to maturity of the bond declines, so does the disadvantage associated with the portion of the return that is taxed on the basis of the linear accretions. As a result of both of these factors, P_{Th} (Column (6)) rises relative to P_{Nh} in the early years of the bond, and eventually surpasses it. For the example described in Table I, the crossover point at which taxable buyers begin to outbid nontaxable investors for the secondary market ZCB occurs at period 11 (i.e., after 5½ years). (See Column (7).)[8] At period 25, the capital gain begins to fall, and eventually, at period 29, the capital gains advantage falls faster than the linear accretion disadvantage, so that the price gap between P_{Th} and P_{Nh} starts to narrow.

II. Holding-Period Yields to Original Holder

An OID sold at a price of P_{Nh} in period h provides a holding-period return to the original nontaxable investor equal to its yield to maturity. If, however, the OID was sold at a higher price, it would provide a holding-period yield above the yield to maturity. As can be seen in Table I, there is a point in the bond's life after which the maximum price that taxable investors are willing to pay (P_{Th}) does exceed P_{Nh}. A nontaxable investor could realize a holding-period yield above the

[7] A formal proof of this point is available from the authors upon request.

[8] A formal proof that a crossover point does exist is available from the authors upon request.

Table I

Zero-Coupon 20-Year Bond, Priced to Yield 15% to Maturity

Period (h)	(1) Accretion from the IRS ($)	(2) Price from the IRS (P_{Bh}, $)	(3) Market Price to Nontaxable Investor to Yield 15% to Maturity (P_{Nh},$)	(4) Increase in Market Value to the Nontaxable Investor (ΔP_{Nh})	(5) Capital Gains ($P_{Bh} - P_{Nh}$)	(6) Market Price to Taxable Investor to Yield 7½% to Maturity, after Taxes (P_{Th}, $)	(7) $P_{Th} - P_{Nh}$	(8) Holding-Period Yield for Nontaxable Investor[a] (R_h, %)
0	—	5.55	5.55	—	0	−1.66	−7.21	—
1	2.36	7.91	5.96	0.41	1.95	−0.61	−6.57	15.00
2	2.36	10.27	6.40	0.44	3.87	0.49	−5.91	15.00
3	2.36	12.63	6.88	0.48	5.75	1.62	−5.26	15.00
4	2.36	14.99	7.40	0.52	7.59	2.81	−4.59	15.00
5	2.36	17.35	7.96	0.56	9.39	4.02	−3.94	15.00
6	2.36	19.71	8.55	0.59	11.16	5.29	−3.26	15.00
7	2.36	22.08	9.19	0.64	12.89	6.62	−2.57	15.00
8	2.36	24.44	9.88	0.69	14.56	7.99	−1.89	15.00
9	2.36	26.80	10.63	0.75	16.17	9.41	−1.22	15.00
10	2.36	29.16	11.42	0.79	17.74	10.88	−0.54	15.00
11	2.36	31.52	12.28	0.86	19.24	12.40	0.12	15.19
12	2.36	33.88	13.20	0.92	20.68	14.00	0.80	16.06
13	2.36	36.24	14.19	0.99	22.05	15.66	1.47	16.63
14	2.36	38.61	15.25	1.06	23.36	17.38	2.13	17.00
15	2.36	40.97	16.40	1.15	24.57	19.16	2.76	17.25
16	2.36	43.33	17.63	1.23	25.70	21.02	3.39	17.38
17	2.36	45.69	18.95	1.32	26.74	22.95	4.00	17.44
18	2.36	48.05	20.37	1.42	27.68	24.96	4.59	17.44
19	2.36	50.41	21.90	1.53	28.51	27.05	5.15	17.38
20	2.36	52.77	23.54	1.64	29.23	29.22	5.68	17.31

21	2.36	55.13	25.31	1.77	29.82	31.48	6.17	17.25
22	2.36	57.50	27.20	1.89	30.30	33.87	6.67	17.13
23	2.36	59.86	29.25	2.05	30.61	36.33	7.08	17.03
24	2.36	62.22	31.44	2.19	30.78	38.89	7.45	16.91
25	2.36	64.58	33.80	2.36	30.78	41.56	7.76	16.78
26	2.36	66.94	36.33	2.53	30.61	44.36	8.03	16.66
27	2.36	69.30	39.06	2.73	30.24	47.27	8.21	16.53
28	2.36	71.66	41.99	2.93	29.67	50.29	8.30	16.38
29	2.36	74.03	45.13	3.14	28.90	53.48	8.35	16.25
30	2.36	76.39	48.52	3.39	27.87	56.80	8.28	16.13
31	2.36	78.75	52.16	3.64	26.59	60.27	8.11	16.00
32	2.36	81.11	56.07	3.91	25.04	63.89	7.82	15.88
33	2.36	83.47	60.28	4.21	23.19	67.70	7.42	15.75
34	2.36	85.83	64.80	4.52	21.03	71.68	6.88	15.63
35	2.36	88.19	69.66	4.86	18.53	75.84	6.18	15.52
36	2.36	90.55	74.88	5.22	15.67	80.21	5.33	15.41
37	2.36	92.92	80.50	5.62	12.42	84.80	4.30	15.30
38	2.36	95.28	86.53	6.03	8.75	89.61	3.08	15.19
39	2.36	97.64	93.02	6.49	4.62	94.69	1.67	15.09
40	2.36	100.00	100.00	6.98	0	100.00	0	15.00

[a] Assumes bond is originally purchased by nontaxable investor at price P_{Nh} and then sold to taxable investor at price P_{Th}, if $P_{Th} > P_{Nh}$; if $P_{Nh} > P_{Th}$, the bond is assumed to be sold to nontaxable investor at price P_{Nh}. It has been assumed that the investor is in the 50% marginal tax bracket and that 40% of capital gains are subject to taxation, at ordinary income rates.

bond's stated yield to maturity if it sold the bond to a taxable investor at a price P_{Th} when $P_{Th} > P_{Nh}$.

Column (8) of Table I shows the *annual* holding-period yield, R_h, on a 15% ZCB, derived from:

$$R_h = 2[(P_{Th}/P_0)^{1/h} - 1] \tag{4}$$

for each holding period. This ZCB, held for 8½ years, would produce a holding-period yield of 17.44%! As Table I indicates, this is the maximum holding period yield that could be obtained from this particular bond—shorter and longer holding-periods produce lower holding-period yields.

In general, the optimal holding-period depends on the bond's parameters, that is, the values of n and r and the coupon, if any, and the marginal tax rate of the marginal taxable investor. While it is difficult analytically to derive a general expression for the optimal value of h,[9] it *is* possible to calculate how the optimal holding-period changes for different particular values of the parameters. Our calculations indicate that at interest rates in the vicinity of 15% and maturities in the vicinity of 20 years: (1) higher interest rates produce a longer optimal holding period; (2) the longer the original maturity of the OID, the longer the optimal holding-period relative to the original maturity; (3) the larger the coupon, the longer the optimal holding-period; and (4) the higher the marginal tax rate of the (marginal) investor, the shorter the optimal holding-period.

If issuers are forced to pay implicit rates on new OIDs equal to the rate on CCBs, nontaxable investors can potentially earn rates of return well in excess of market yields—almost 2½ percentage points more in the case of the zero-coupon 20-year OID with a 15% yield to maturity. They can do this by buying new OIDs and selling them to taxable investors at the time at which their holding-period yield is a maximum. (This, of course, assumes that the nontaxable investor captures the full tax advantage when the bond is sold to the taxable investor.) To achieve maximal yields over longer periods, the nontaxable investor would then put the proceeds into a new OID.[10] Thus, OIDs would be held for the first part of their lives by nontaxable investors and for the last part of their lives by taxable investors.

It is also possible, of course, that *issuers* may capture the benefits of the tax advantage (especially immediately after OIDs are first introduced, when there are relatively few OIDs in the market). For the 20-year zero-coupon OID mentioned above, 13.8% is the minimum yield and $6.93 is the maximum price at which the bond could be sold so that both the initial nontaxable investor and the secondary market taxable purchaser earned the required after-tax rates equivalent to a 15% CCB.

[9] To derive a general expression for the optimal value of h, one would substitute Equation (3) into Equation (4), differentiate with respect to h, and set the result equal to zero. However, the result is a very complex nonlinear equation in h, and cannot be solved for the optimal value of h.

[10] If the nontaxable investor did not have the opportunity to buy another OID with the same yield, the return would be maximized by holding the first one longer.

III. Concluding Remarks

As noted earlier, the Tax Equity and Fiscal Responsibility Act of 1982 made the taxation of OIDs issued after July 1, 1982 conform to the pattern of implicit accruals. Thus, new OIDs will not produce the expectation of capital gains income. Old OIDs, however, will continue to have the tax advantages described above.

REFERENCES

1. W. M. Boyce and A. J. Kalotay. "Tax Differentials and Callable Bonds." *Journal of Finance* 34 (September 1979), 825–38.
2. George M. Constantinides and Jonathan E. Ingersoll, Jr. "Optimal Bond Trading with Personal Tax: Implications for Bond Prices and Estimated Tax Brackets and Yield Curves." *The Journal of Finance* 37 (March 1982), 349–54.
3. Edwin J. Elton and Martin J. Gruber. "The Economic Value of the Call Option." *The Journal of Finance* 27 (September 1972), 891–901.
4. Frank C. Jen and James E. Wert. "The Value of the Deferred Call Privilege." *National Banking Review* 3 (March 1966), 369–78.
5. Miles Livingston. "A Note on the Issuance of Long-Term Pure Discount Bonds." *The Journal of Finance* 34 (March 1979), 241–46.
6. Richard W. McEnally. "How to Neutralize Reinvestment Rate Risk." *Journal of Portfolio Management* 6 (Spring 1980), 59–63.
7. Gordon Pye. "The Value of Call Deferment on a Bond: Some Empirical Results." *The Journal of Finance* 22 (December 1967), 623–36.
8. David H. Pyle. "Is Deep Discount Debt Financing a Bargain?" *Chase Financial Quarterly* 1 (Fall 1981), 39–61.
9. James C. Van Horne. "Called Bonds: How Does the Investor Fare?" *Journal of Portfolio Management* 6 (Summer 1980), 58–61.