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Estimating the Tax Advantage of Corporate Debt

JOSEPH J. CORDES and STEVEN M. SHEFFRIN*

ABSTRACT

This paper presents estimates of the effective tax value of incremental interest deductions for corporations taking into account that they may not be able to utilize all their interest deductions fully because of either insufficient taxable income or the availability of nondebt tax shields. After describing particular features of the tax code which may drive a wedge between statutory and effective tax rates for debt finance, we present estimates using the Treasury Corporate Tax Model of effective tax rates for a variety of industry groupings. Our estimates suggest that the after-tax cost of debt varies widely across industries.

THE MAGNITUDE OF THE effective tax advantage to debt finance has important implications for corporate financial behavior. One issue which has been examined extensively in the corporate finance literature is whether the value of the firm is affected by the firm's leverage ratio. In a recent contribution, DeAngelo and Masulis [3] have shown that financing decisions can affect the value of the firm if the effective tax advantage to debt finance varies among firms or is reduced by the presence of nondebt tax shields such as investment tax credits and depreciation deductions.

The effective tax advantage to debt is also an important determinant of leverage-related costs. Gordon and Malkiel [5] have recently used the statutory tax rate to estimate expected bankruptcy costs induced by the corporate tax when the firm is assumed to balance the marginal tax advantage to debt with marginal expected bankruptcy costs. If, however, the effective tax rate for interest deductions falls short of the statutory rate, the magnitude of these costs may be overstated.

This paper presents detailed estimates of the marginal effective tax advantage to debt finance. Our estimates, based on data in the Treasury 1978 Corporate Master Statistical File and on simulations done with the Treasury Corporate Tax Model, quantify the impact of increasing interest deductions without changing other items on the corporation's income statement.¹ We simulate the impact of a change in a firm's capital structure holding its investment and production decisions constant. This is an appropriate procedure for estimating the marginal

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¹ See Nester [7] for a discussion of the Corporate Model.

tax consequences of alternative *financing* decisions. Other calculations of effective marginal tax rates, including the recent work by Auerbach and Jorgenson [1] and Joines [6], measure the incremental tax payments that would accrue on additional income earned by a corporation. These latter measures are, of course, appropriate for analyzing *production* and *investment* decisions.²

The next section of the paper describes particular features of the tax code which may drive a wedge between the statutory and the effective tax advantage to debt and which may cause the after-tax marginal cost of debt to vary among firms and industries. We then calculate the marginal effective tax advantage to debt finance using the Treasury Corporate Tax Model and present both overall frequencies of the tax advantage to debt and breakdowns by taxable income class, asset size, and industry. These estimates are, however, calculated under the assumption that firms are unable to carryback or carryforward any unused tax shields. Current tax law contains some limited provisions for firms to carryback tax shields to offset previous years' liability (that is, receive refunds for past taxes paid) or to carryforward tax shields to offset future tax liability. Section III presents data bearing on the actual utilization of the carryback provisions and presents revised estimates taking these factors into account.

I. Statutory and Effective Tax Rates

The effective tax advantage of debt finance equals $\Delta T/\Delta i$ where ΔT is the reduction in corporate tax liabilities due to a small increase, Δi , in interest deductions. The magnitude of $\Delta T/\Delta i$ may vary among different firms and, for any given firm, with its reliance on debt finance. One reason is that statutory corporate tax rates (t_s) are graduated. Another is that the effective tax advantage to debt may diverge from the tax advantage that would be implied by the statutory tax rate. The effective tax advantage to debt finance may be less than the statutory tax advantage due to one or more of the following features of the corporate income tax: (1) rules for computing and claiming net operating loss (NOL) deductions; (2) alternative tax on corporate capital gains; (3) rules for computing and claiming the foreign tax credit (FTC); (4) rules governing the use of the investment tax credit (ITC); and (5) the corporate minimum tax.

Net Operating Loss Deductions

If current allowable tax deductions exceed taxable income, net operating losses are generated. Firms are presently allowed to first carry these losses back to offset any taxable income earned in the prior three years and then to carry net losses forward to the succeeding fifteen years. An increase in interest deductions will cause some firms to incur an increase in net operating losses. If the full amount of such extra deductions can be carried back to prior tax years, the effective tax value of debt deductions will equal their statutory value. If, however, all or some portion of extra debt deductions must be carried forward, their effective tax value will be diminished.

² A recent examination of average tax burdens is presented in Gonedes [4].

Alternative Tax on Corporate Capital Gains

Corporations cannot take advantage of the sixty percent capital gain exclusion available to individuals. Instead, corporations must first include the excess of net long-term gain over net short-term capital losses in taxable income and compute the tax at the regular statutory corporate rate. Corporations may then compute an alternative tax determined by: first, computing a tax at the regular tax rates on taxable income minus the excess of net long-term capital gains over net short-term capital losses and then adding to this amount the excess of net long-term capital gains over net short-term capital losses multiplied by the alternative capital gains rate of twenty-eight percent. The method producing the lower total tax liability is used. It is not always advantageous for the corporation to elect to be taxed at the alternative rate. For some firms, increased debt deductions may reduce taxable income sufficiently to make taxation at the alternative rate the less attractive option. While this feature of the tax law may be important for some firms, it is not included in the Treasury Corporate Tax Model and is omitted from the results presented below.

Foreign Tax Credit

Corporations are allowed a credit against U.S. liabilities based on foreign taxes paid. However, a limitation is placed on the total amount of the credit that may be claimed. The limitation is computed by multiplying the U.S. tax liability by the ratio of taxable income from foreign sources to worldwide income. When there are domestic losses which are exceeded by foreign source taxable income so that worldwide income is positive, the foreign tax credit is limited to U.S. tax liability. In this case, an increase in domestic losses would decrease the amount of foreign tax credits that could be claimed because U.S. tax liability would decrease.

In the tax simulations described below, the increased interest deductions are allocated totally to domestic income. In reality, there are complicated rules specifying the allocation of interest deductions between domestic and foreign source income, and our procedure may somewhat understate the reduction in tax liability that would actually occur.

If foreign taxes paid exceed the limitation in the current tax year, firms are permitted two-year carrybacks and five-year carryforwards. Both carrybacks and carryforwards are limited to the amount by which the maximum allowable foreign tax credits exceeds taxes paid in any given carryback or carryforward year.

Investment Tax Credit

After computing its tax liability based on deductions, the alternative tax on capital gains, and foreign tax credits, the firm is allowed to claim an investment tax credit. However, the amount of investment credits which may be used in any given year is subject to a limitation. For 1982 and thereafter, the tax credit can be used to offset the first \$25,000 of taxes and ninety percent of the tax liability exceeding \$25,000. Extra interest deductions, by reducing potential tax liability, may lead to a loss in investment credits. Credits that cannot be used in the current year can be carried back three years and carried forward fifteen years.

Table I
Distribution of the Effective Tax Advantage Per Dollar of Incremental Deductions

All corporations					Non-financial corporations			
$\Delta T/\Delta i$	Number of firms	Percent of firms	Corporate receipts (\$ millions)	Percent of corporate receipts	Number of firms	Percent of firms	Corporate receipts (\$ millions)	Percent of corporate receipts
.44-.46	77182	6.0	2229.3	56	67643	6.0	2090	56
.42-.44	800	0.1	46.6	1	350	— ^a	46.1	1
.40-.42	17085	1.3	49.6	1	14317	1.3	47.8	1
.35-.40	5587	0.4	55.3	1	2089	0.1	52.3	1
.25-.35	37612	2.8	65.0	2	30728	2.8	62.7	2
.10-.25	339597	25.7	195.0	5	247604	23.0	187.5	5
less than .10	842490	63.8	1261.4	33	704579	66.0	1213.6	33
Total $\Delta T/\Delta i = .31$					Total $\Delta T/\Delta i = .31$			

1978 Data, 1983 Law. Excludes Aramco. Source: U.S. Department of the Treasury, Office of Tax Analysis.

^a Less than one-tenth of one percent.

Minimum Tax

Changes in interest deductions can also affect the “add-on minimum tax” on tax preference items. In particular, a fifteen percent tax is levied on a base which equals the tax preference items less the greater of \$10,000 or the full amount of the corporation’s income tax. Thus, for corporations whose taxes exceed \$10,000, extra interest deductions will increase the base for the fifteen percent add-on tax. For the corporate taxpayer, preference items include: accelerated depreciation on real property in excess of straight line, amortization in excess of otherwise allowable depreciation, and some portion of net capital gains.

II. Preliminary Estimates of the Tax Advantage to Debt

The Treasury Corporate Tax Model may be used to estimate the initial impact on corporate tax liabilities of incremental debt deductions. These estimates, presented in Tables I-IV, are based on the assumption that interest deductions are increased by five percent.³ The model itself is based on 1978 corporate returns, but has been modified to reflect 1983 tax laws.⁴ Since the model does not contain firm-specific information on the ability of firms to carryback and/or carryforward unused credits or deductions, the estimates in Tables I-IV are upper-bound estimates of the divergence between the effective and the statutory tax advantage to debt finance. In the next section, data from the Corporate Master File are used

³ The five percent figure was chosen to avoid problems with rounding errors, particularly for industry studies. Simulations with smaller increases in interest deductions yielded similar results. We, of course, are assuming that interest deductions are the last, or “marginal” tax deductions in these simulations. There may be situations in which other actions (leasing transactions, for example) are the “marginal” action.

⁴ The Corporate Model does not have the capacity to incorporate the impacts of safe-harbor leases.

Table II
Tax Value of Incremental Interest Deductions by Taxable Income

Taxable income (\$ thousands)	Δ Interest	Δ Tax liability	Δ Foreign tax credit	Δ Investment credit	Δ Tax liability	Δ Tax liability ^a
			Δ Interest	Δ Interest	Δ Interest	Δ Interest
0-25	317	12	0	.03	.04	.05
25-50	145	13	0	.04	.09	.16
50-70	97	14	0	.05	.14	.20
70-100	120	25	0	.06	.21	.25
100-500	824	279	0	.03	.34	.37
500-5,000	1500	541	.01	.04	.36	.37
5,000-10,000	521	191	.02	.04	.37	.34
10,000-50,000	1225	374	.04	.10	.31	.28
50,000-100,000	756	230	.05	.08	.30	.27
100,000-250,000	862	245	.10	.07	.28	.33
>250,000	1249	458	.04	.04	.37	.36
Total	7619	2384	.04	.05	.31	.31

1978 Data, 1983 Law. Excludes Aramco.

Source: U.S. Department of the Treasury, Office of Tax Analysis.

^a 1976 data, 1981 Law.

The Statutory corporate rates are:

Rate	Taxable Income (\$)
15%	0-25,000
18%	25,000-50,000
30	50,000-75,000
40	75,000-100,000
46	100,000

to present estimates which more realistically reflect the ability of firms to utilize carryback provisions.

Table I presents frequency distributions of the tax value per dollar of incremental interest deductions. The average effective tax advantage to debt finance, $\Delta T/\Delta i$, equals .31 both for all corporations and for nonfinancial corporations. Both of these estimates are substantially below .46 which is the value often assumed. The distribution of $\Delta T/\Delta i$ in Table I is due partly to the graduated structure of corporate tax rates but also to the fact that for many firms the effective tax advantage to debt is less than the statutory tax advantage. For example, since the lowest corporate tax rate is 15 percent, the statutory tax value of an additional dollar of interest deductions must be at least .15. However, $\Delta T/\Delta i$ is less than .10 — well below the statutory minimum — for over 840,000 corporations accounting for approximately one-third of total corporate receipts.

These results suggest that incremental interest deductions impair the ability of many firms to utilize other nondebt tax shields fully. Further evidence of this is provided in Tables II, III, and IV.

Table II reports changes in interest deductions and tax liabilities distributed by taxable income class, that is, income after deductions but before credits. For firms with taxable incomes exceeding \$250 million to which the statutory rate of

forty-six percent applies, the incremental value of debt deductions is thirty-seven percent. The table also shows that for all firms the fraction of the gap between the effective and statutory rates attributable to loss of the foreign tax credit is four percent of the change in interest deductions while the loss of the investment tax credit accounts for five percent. The remainder is accounted for by changes in net operating losses and the minimum tax, or by movement of firms from a higher to a lower corporate tax bracket.

Tables III and IV present similar information by asset size class and industry type respectively. From the asset class breakdown, it is evident that the loss of foreign tax credits is significant only for small and for large firms. The loss in the investment credit, however, affects firms of all sizes. There is also a "U" shape pattern evident in the incremental value of interest deductions; both the smallest and largest firms (as measured by assets) would benefit the most from extra interest deductions. The industry figures displayed in Table IV are noteworthy for their picture of the diversity of circumstances among industries. The numbers in Tables III and IV suggest that the marginal incentives for debt finance differ sharply by industry and asset size. Part of this diversity may be due to transitory factors affecting taxable income for different classes of firms. Subject to this qualification, the figures indicate a possible explanation for differences in debt-equity ratios between industries.

The last column of Tables II, III, and IV calculates the effective tax rates for debt finance using 1976 data with the 1981 tax law. Comparing these measures

Table III
Tax Value of Incremental Interest Deductions by Asset Class

Asset class (\$ thousands)	Δ Interest	Δ Tax liability	Δ Foreign tax credit	Δ Investment credit	Δ Tax lia- bility	Δ Tax lia- bility ^b
			Δ Interest	Δ Interest	Δ Interest	Δ Interest
<250	75	26	.04	.07	.34	.26
<500	47	7	0	.04	.15	.15
<750	47	7	0	.04	.15	.18
<1,000	39	6	0	.05	.15	.14
<2,500	144	31	0	.05	.22	.24
<5,000	120	30	0	.05	.25	.26
<7,500	81	21	0	.05	.26	.27
<10,000	61	17	0	.05	.28	.27
<25,000	283	85	0	.03	.30	.29
<50,000	329	110	0	.02	.33	.33
<75,000	231	81	0	.02	.35	.33
<100,000	183	64	0	.02	.35	.36
<250,000	592	208	— ^a	.03	.35	.36
<500,000	499	183	— ^a	.03	.37	.36
>500,000	4,887	1,510	.05	.07	.31	.30
TOTAL	7,619	2,384	.04	.05	.31	.31

1978 Data, 1983 Law. Excludes Aramco.

Source: U.S. Department of the Treasury, Office of Tax Analysis.

^a Less than .01.

^b 1976 data, 1981 Law.

Table IV
Tax Value of Incremental Interest Deductions by Industry

Industry (\$ thousands)	Δ Interest	Δ Tax liability	Δ Foreign tax credit	Δ Investment credit	Δ Tax liability	Δ Tax liability ^b
			Δ Interest	Δ Interest	Δ Interest	Δ Interest
Agriculture	24	4	0	.13	.17	.16
Mining and Extraction	50	9	.10	.08	.17	.20
Construction	55	17	0	.07	.31	.24
Communication	203	87	0	.01	.43	.42
Wholesale Trade	225	73	— ^a	.04	.32	.33
Retail Trade	242	79	0	.03	.33	.33
Food Manufacturing	103	33	.03	.08	.32	.41
Tobacco-Manufacturing	30	14	0	0	.46	.45
Textile Mill Products	21	7	0	.05	.33	.40
Textile Apparel	19	7	0	.05	.37	.38
Lumber and Wood	35	9	0	.03	.26	.25
Furniture and Fixtures	7	2	0	0	.29	.40
Paper Products	36	11	0	.06	.31	.34
Printing and Publication	26	10	0	.04	.39	.40
Chemicals	102	32	.04	.08	.31	.38
Petroleum and Refining	208	62	0	.10	.30	.33
Rubber and Plastic	24	8	.08	0	.33	.33
Leather Products	5	2	0	0	.40	.20
Stone, Clay, and Glass	26	10	0	.07	.39	.36
Metal (Primary)	120	23	.07	.16	.19	.18
Metal (Fabricated)	52	18	.02	.06	.35	.36
Machinery	134	55	.01	.03	.41	.39
Electrical Equipment	124	41	.02	.11	.33	.33
Motor Vehicles	171	71	0	.01	.45	.42
Trans. Equipment	29	10	.03	.03	.35	.35
Instruments etc.	14	6	0	0	.43	.38
Other Manuf. Products	17	7	0	0	.41	.40
Transportation	143	26	0	.23	.18	.16
Utility	449	116	0	.19	.26	.27

1978 Data, 1983 Law. Excludes Aramco.

Source: U.S. Department of the Treasury, Office of Tax Analysis.

^a Less than .01.

^b 1976 data, 1981 Law.

with the effective tax rates calculated from 1978 data with 1983 tax law provides an indication of the stability of these measures with respect to time and variations in tax law. In general, the correspondence is fairly close. For example, utilities had a twenty-seven percent effective tax rate for 1978 and a twenty-six percent effective rate for 1976. However, there were some industries whose tax situations changed — for leather products the rates were forty and twenty percent respectively. The correlation coefficient between the two sets of effective tax rates for the industry classifications is .74, indicating that overall these rates are reasonably stationary and could be expected to persist over time.

Table V
Tentative Credits Accounted for by
Firms with Positive Carryforwards from
Prior Years

	Ratio of carryover to tentative credit	Percent of firms	Percent of tentative credits
>	0	15.2	46.1
>	.1	15.0	22.4
>	.3	14.5	18.3
>	.5	13.4	15.8
>	.7	12.9	14.0
>	.9	12.7	11.1

Source: 1976 *Statistics of Income* (excluding financial and service corporations).

III. The Effect of Carrybacks and Carryovers

Some of the losses or "leakages" of the tax advantage of incremental interest deductions could be reduced through the ability for firms to carry back deductions and credits to offset previous year's tax liabilities or carry these forward to offset prospective liabilities.⁵ The Corporate Tax Model does not allow for this. However, data on tax carryforwards can be used to shed some light on this issue. In any given year, a firm will carry investment credits forward only if it has no previous tax liabilities remaining. This fact can be used to calculate an upper-bound on the amount of credits that can potentially be carried back.

Due to data limitations, 1976 is the most recent year for which we are able to present detailed estimates of carryforwards. These estimates are presented in Tables V and VI. Table V indicates that in 1976 forty-six percent of the investment credits were earned by firms which had positive carryovers of the ITC from previous years. This means that, at most, fifty-four percent of unused earned credits could potentially have been carried back. In practice, the fraction of unused earned credits that could actually be carried back would have been less because many firms would quickly exhaust their past tax liability. Table V also gives an indication of the importance of firms with large amounts of carryforwards relative to credits earned in the year. Firms with very large carryforwards measured in this way may be quite unlikely even to utilize the credits that they carry forward. Over eleven percent of all credits earned in 1976 were accounted for by firms whose carryforwards exceeded nine-tenths of their earned credits.

Column (1) in Table VI presents data on the ability of firms in different

⁵ Safe-harbor leasing could mitigate some of the problems of utilizing unused credits and deductions flowing from *new* investments. By "selling" deductions and credits on new investment to lessors with sufficient taxable income, a corporation with insufficient taxable income need not accumulate *extra* unused deductions and credits. This would allow a greater share of new investment to be debt-financed. However, because the safe-harbor rules do not apply to investment made prior to 1981, any unused nondebt tax shields generated by such investments could not be transferred to other firms through safe-harbor leases. The presence of these existing unused credits and deductions, therefore, will still influence firms' *financing* decisions. Furthermore, the leasing provisions for most industries will expire in 1983.

industries to carryback unused investment credits. The estimates reveal a fairly wide dispersion among industries in carryback abilities. Roughly forty percent of unused credits in manufacturing were accounted for by firms with positive carryforwards from prior tax years. However, within manufacturing, there were industries with fairly small carryforwards (furniture and fixtures, paper products, textiles, and printing and publishing) while other industries had substantial carryforwards (electrical equipment and petroleum and refining).

If relative carryback abilities among industries are assumed to be the same in 1976 and 1978, the estimates in column (1) on Table VI can be used to adjust the initial calculations of the tax advantage to debt finance presented in Table IV. The adjusted calculations, also presented in Table VI, are based on several assumptions. First, we assumed that each percentage in the first column of Table VI is a reasonable estimate of k_i , the fraction of unused investment credits which

Table VI
Tentative Credits Accounted for by Firms with
Positive Carryovers from Prior Tax Years

Industry	Percent of tentative credits	Tax value of debt deductions adjusted for carrybacks and carryforwards
Food	27	.37
Tobacco	42	.46
Textiles	17	.36
Apparel	20	.40
Lumber and Wood	45	.28
Furniture and Fixtures	11	.29
Paper Products	10	.35
Printing and Publishing	20	.42
Chemicals	37	.36
Petroleum and Refining	53	.35
Rubber and Plastic	47	.33
Leather Products	35	.40
Stone, Clay, and Glass	25	.43
Metal (Primary)	42	.28
Metal (Fabricated)	30	.39
Machinery	34	.43
Electrical Equipment	64	.39
Motor Vehicles	37	.46
Transportation Equipment	29	.37
Instruments, etc.	16	.43
Total Manufacturing	39	.38
Agriculture	38	.24
Mining	63	.21
Construction	49	.35
Transportation and Utilities	39	.36
Wholesale and Retail Trade	63	.34

Source: 1976 *Statistics of Income* and Table IV.

could not be carried back to prior tax years in industry i . Under this assumption, the *maximum* fraction of unused investment credits which could be carried back in each industry is given by $(1-k_i)$. The actual fraction of unused credits which could be carried back must lie between 0 and $(1-k_i)$; we assume that the fraction of unused investment credits carried back in industry i is $.5(1-k_i)$.

Under the Economic Recovery Tax Act of 1981, unused investment credits which cannot be carried back can be carried forward for up to fifteen years. This figure will be used in the subsequent calculations. The estimated fraction of unused investment credits carried forward in industry i equals one minus the fraction carried back. Whether firms are actually able to utilize these carryforwards depends upon future profitability, future generation of competing tax shields, and so forth. As a first approximation, we assume that firms spread their carryforwards over the fifteen year carryforward period on a straight line basis and that firms discount future carryforwards at a rate of twelve percent. Under these assumptions, each dollar of carryforward is actually worth 41 cents in present value terms.

The tax benefits ultimately realized by the firm per dollar of unused investment credit will equal the fraction of that dollar carried back plus the discounted value of the fraction carried forward. Based on the empirical assumptions made in the paragraph above, this sum will equal $.5(1-k_i) + .41[1-.5(1-k_i)]$. Since the estimated value of k for all corporations is .46, substituting this number into the formula implies that roughly 56 percent of unused investment tax credits are ultimately carried back or carried forward. Substituting the estimates of k_i in Table VI into the formula, this fraction ranges from a high of sixty-seven percent in the paper products industry to a low of roughly fifty percent in the electrical equipment industry and in the mining sector. Column (2) of Table VI presents estimates of the effective tax advantage to debt, adjusted for carrybacks and carryforwards of unused investment credits.

Data on carryforwards can also shed light on the question of whether the inability to use credits is a transitory or more permanent phenomenon for firms. Evidence on this issue can be provided by looking at the correlation between the utilization of investment credits earned in any given year with carryforwards from previous years. Firms that carryforward credits could not utilize them fully in past years. If these firms also fail to utilize credits fully in the current year, it is an indication that this phenomenon tends to persist. Some evidence on this issue is available from industry data.

Specifically, we are able to compare the percent of credits earned in a given year (1976) that were actually utilized with the percent of credits earned by firms with positive carryovers. The latter percentage is presented in Column (2) of Table V. Data on the utilization of tax credits by industry is presented in Cordes and Sheffrin [2]. The estimated correlation is $-.49$ indicating that industries with a high propensity to carryover credits are less likely to utilize credits that are earned in the current year.

IV. Conclusions

This paper has presented estimates of the effective tax value of incremental interest deductions. Our estimates imply that there is a significant wedge between

the statutory and the effective tax advantage to debt and that there is significant variation in the after-tax marginal cost of debt faced by different firms and industries. Further research is now needed to determine whether firms adjust their desired leverage ratios in response to the effective tax price of debt in a manner which is consistent with maximizing the value of the firm.

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