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Abstract
The effect of taxes upon Investment patterns in agriculture is an important policy consideration which has received attention in past issues of this journal. However, some authors have inadequately adjusted income stream valuation formulas for the effect of the individual income tax and have consequently reached incorrect conclusions regarding both the present value of future income and the effect of income tax progressivity on the relative valuations of individuals in different tax brackets. Rodewald (1969, 1971) and Devino considered the effect of taxes and financing upon investment decisions, but their incomplete treatment of income taxes produces a valuation formula which will result in incorrect investment decisions*

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THE EFFECT OF INCOME TAX PROGRESSIVITY
ON VALUATIONS OF INCOME STREAMS BY INDIVIDUALS

by

Roy D. Adams

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The effect of taxes upon investment patterns in agriculture is an important policy consideration which has received attention in past issues of this journal. However, some authors have inadequately adjusted income-stream valuation formulas for the effect of the individual income tax and have consequently reached incorrect conclusions regarding both the present value of future income and the effect of income tax progressivity on the relative valuations of individuals in different tax brackets. Rodewald (1969, 1971) and Devino considered the effect of taxes and financing upon investment decisions, but their incomplete treatment of income taxes produces a valuation formula which will result in incorrect investment decisions. A more recent paper by Harris and Nehring considered the impact of farm size on the bidding potential for agricultural land. Like Rodewald and Devino, they adjusted the income stream for taxes, but did not incorporate individual income tax rates in the discount rate used for computing present values. Consequently they concluded that the progressivity of individual income tax rates puts high-tax-bracket individuals at a competitive disadvantage in bidding for the perpetual income stream produced by agricultural land.

The purpose of this paper is to clarify the effect of income tax rates upon the present value of income streams subject to normal income taxes and to describe how income tax effects may be incorporated into general valuation formulas. The next section discusses the relation between present value analysis and bid price models and notes some
practical limitations of the latter. Subsequent sections describe how risk can be correctly incorporated in present value calculations, how normal income taxes affect present values, and how the availability of tax-exempt municipal bond interest affects the present value of taxable income streams and limits the optimum level of taxable investment income. The conclusions are summarized in the final section.

Investment Decision Models

Two different investment decision models are contained in the papers mentioned above. The simpler of the two is that used by Rodewald; in it one computes the present value of the after-tax income stream provided by an asset and purchases it only if that present value is greater than or equal to the cost of the asset.

The bid price model used by Harris and Nehring provides a considerably broader framework for investment decisions. They also compute a present value (using a risk-free discount rate), but the investment decision is not made solely on the basis of that present value. An investor’s bid price also depends on: the risk associated with the considered income stream, the investor’s preferences regarding risk, the riskiness of the investor’s existing portfolio, and the covariance between the return on presently held assets and the return provided by the considered asset. Bid prices equal present values only if the investor is risk neutral or if acquisition of the asset will not change the riskiness of his portfolio holdings. Thus, bid prices are conceptually more general and complete than are decision rules based solely on present value. Whether the bid price model provides a useful
improvement depends critically on the availability and reliability of the additional information required to compute bid prices. That information includes detailed characteristics of investors' utility functions, in addition to estimates of the risks and covariance mentioned above.

Many investors lack at least some of the information needed for bid price calculations and consequently focus on present values in making investment decisions. The following section presents a method for incorporating risk into present value calculations without recourse to the information about utility functions required for bid price models. Since Harris and Nehring's bid price model includes a present value computation, the points made here regarding taxes and present values apply to both decision models. Any tax effects upon present values also apply to bid prices, although the converse is not always true. Since bid price models incorporate utility functions, taxes may have wealth effects on bid prices which do not appear in present value formulas.

Present Value of Uncertain Income Streams

An important characteristic of many income streams is that they are highly variable over time. This feature is incorporated into bid price models, but Rodewald did not explicitly consider it in his present value approach to investment decisions. Hirshleifer (1970, p. 262) discusses two possible methods of accounting for the riskiness of income streams in computing present values. One method (a) is to reduce the distribution of possible returns in each future period to a certainty-
equivalent value, then discount that series of terms with a riskless
discount rate to obtain the "present certainty-equivalent value". The
certainty-equivalent value, like bid prices, depends on the investor's
utility function. The alternate method (b) is to compute the mathematical
expectation of the return in each future period, then discount this series
with the discount rate appropriate to the "risk-class" of the investment.¹
Hirshleifer notes that although both approaches "lead in principle to the
same correct result, the information gaps that are the source of the
difficulty require in practice the employment of method (b) above".
(p. 262)

In its simplest form, the recommended procedure requires only
two pieces of information. One is an estimate of the expected value
of the net income produced by the asset in each future year, \( \pi_i \); the
other is the prevailing rate of return, \( r^o \), on other assets in the
same risk class. The principle underlying estimation of \( \pi_i \) is that it
is returns to invested capital. Therefore, one subtracts from each
year's expected receipts all costs of inputs other than capital.
Property taxes are subtracted because other assets not subject to the
property tax are available.² Debt interest should not be subtracted
because it is part of the return to capital invested in the asset.

The choice of the appropriate risky discount rate is guided by
the principle that it should indicate the rate of return available on
assets containing the same degree of risk as the considered investment.
Since the variance of net income from farmland depends on such factors
as the chosen cropping pattern and the amount of insurance purchased,
the appropriate risky discount rate may vary among investors planning
different uses of the land. The appropriate rate may be difficult to estimate precisely, but as Hirschleifer (1961, p. 118) has noted, the risky discount rate "is at least more of an observable magnitude than the abstract riskless rate of interest". Since the general level of prices is unstable, riskfree investments would exist only if some assets were both free of default risk and were effectively indexed against purchasing power risk. Currently, the riskless interest rate cannot be observed, but a wide range of risky rates are visible.

Income Taxes and Present Values

The above procedure recommended by Hirschleifer abstracts completely from income taxes; the expected income stream and the discount rate he discusses are both in gross-of-tax terms. This section shows that taxes may be safely ignored only when valuing an income stream which is both perpetual and is subject to only normal income taxes. If the income stream is finite in time or if special income tax features such as accelerated depreciation, capital gains, tax credits, etc., apply to it, then the individual's tax rate does affect present values and must be applied to both the income stream and the discount rate.

As Modigliani and Miller (1963) noted in their analysis of the effect of corporate income taxes upon costs of capital and valuation formulas, there are two equally good methods for valuing perpetual income streams subject only to normal taxes. One can either discount gross-of-tax returns with the gross-of-tax cost of capital or one can discount net-of-tax income with the net-of-tax cost of capital. Their footnote 16, pp. 441-442 (1963) states:
"Although the before-tax and the net-of-tax approaches to the cost of capital provide equally good criteria for investment decisions when assets are assumed to generate perpetual (i.e., non-depreciating) streams, such is not the case when assets are assumed to have finite lives. ... In the latter event, the correct method for determining the desirability of an investment would be, in principle, to discount the net-of-tax stream at the net-of-tax cost of capital. Only under this net-of-tax approach would it be possible to take into account the deductibility of depreciation. .."

The expressions for the after-tax costs of capital developed by Modigliani and Miller (1958, 1963) for corporations are not applicable to individual proprietors because individuals are not subject to the corporate income tax. The appropriate discount rate for individual (unincorporated) investors to use in computing present values is the rate of return available on other assets in the same risk class; this is the opportunity cost of alternate uses of invested funds, regardless of whether the source of those funds is equity, debt, or any combination of the two. 3 Therefore, the gross-of-tax cost of capital invested by an individual is simply, r°, the prevailing rate-of-return in the asset's risk class, and the net-of-tax cost of capital is r°(1-t), where t is the investor's marginal income tax rate. The net-of-tax expression recognizes that foregone returns would be subject to taxation (unless it is municipal interest discussed below). 4
The simple formula for the present value of a perpetuity illustrates Modigliani and Miller's point about the equivalence of the gross-of-tax and net-of-tax approaches. The present value, $V$, of the net-of-tax perpetual income stream, $\pi(1-t)$, discounted with the net-of-tax cost of capital, $r^0(1-t)$, is identical to the present value of the gross-of-tax perpetual stream $\pi$, discounted at the gross-of-tax cost of capital, $r^0$.

\begin{equation}
V = \frac{\pi(1-t)}{r^0(1-t)} = \frac{\pi}{r^0}
\end{equation}

This also demonstrates that the present value of a perpetual stream does not depend on the tax bracket of the individual.\(^5\)

The problem with Harris and Nehring, Rodewald, and Devino's present value formulas is that Harris and Nehring explicitly, and Rodewald and Devino apparently, used a gross-of-tax interest rate to discount net-of-tax income streams. Harris and Nehring note that their present value formula [equation 6, p. 162] implies that individual valuations will decrease as the marginal income tax rate rises and high income persons will \textit{ceteris paribus} bid less for farmland than will persons in lower tax brackets (p. 163). Since neither Devino nor Rodewald mentioned any adjustment of the discount rate for income tax rates, they presumably would also use a gross-of-tax rate in discounting. If so, Harris and Nehring's conclusion is also implied by Rodewald's and Devino's analyses, although none of the above authors has mentioned this.

Although income taxes may be safely ignored in valuing perpetuities subject only to normal income taxes, this is not true in general. If
the income stream is subject to only normal taxes and if it terminates after \( n \) periods, its present value is:

\[
V^* = \sum_{i=1}^{n} \frac{\pi_i(1-t)}{[1 + r^0(1-t)]^i} = \frac{\pi}{r^0} \left[ 1 - \frac{1}{[1 + r^0(1-t)]^n} \right].
\]

Since

\[
\frac{\partial V^*}{\partial t} < 0,
\]

the present value of the income stream will be less to high tax bracket individuals than to those with lower marginal tax rates. Samuelson has previously demonstrated this relation and has also shown that the effect may be offset by the effect of the deductions for depreciation which commonly apply to assets with finite lives. Samuelson showed that the net effect of the tax rate vanishes only when tax deductible depreciation exactly equals true economic depreciation.

If the considered income stream qualifies for any special tax considerations, such as accelerated depreciation deductions or the investment tax credit, then (as Modigliani and Miller argued) the net-of-tax approach is required. In this case, one needs to adjust the expected income stream for the tax factors considered by Rodewald and by Devino, but two corrections to Rodewald's method are required. One, recognized by Devino (p. 135), is that those finance charges which represent interest on debt should not be subtracted, because the discount rate accounts for the required return on all capital invested. Second, the discount rate must be adjusted for the individual's marginal tax rate to obtain the net-of-tax opportunity cost of capital he invests. The present value of finite income streams
which qualify for special tax treatment generally does depend on the individual's tax rate. Normally taxed perpetuities (such as indefinitely held farmland) are a special case in which the tax rate has no effect on present value.

The Effect of Municipal Bonds

Although the progressivity of the income tax per se does not reduce high income persons' valuations of normally taxed, perpetual income streams, the availability of tax-exempt interest from municipal bonds does put an upper limit on the optimum level of taxable investment income, and does thereby deter some high tax bracket individuals from acquiring taxable income streams.

Figure 1 illustrates the optimal investment strategy for high income individuals. $Y_1$ is the individual's wage and salary income minus exemptions and deductions; $Y_0$ is equal to $Y_1$ minus taxes on $Y_1$; $Y_m$ is the level of taxable income above which municipals provide the greatest after-tax return; and $Y_2 = Y_m - Y_1$ is the optimal level of taxable investment income. Maximum after-tax income from invested equity is obtained by investing $Y_2/r^o$ dollars in assets paying a taxable return of $r^o$, and investing the remainder of equity in municipals paying rate $r^m$. Line 1 shows gross-of-tax income from this strategy and line 2 shows net-of-tax income. The initial segments of line 2 have slopes equal to $r^o(1-t)$ and the kinks correspond to movements between tax brackets. Line 3 shows the inferior net-of-tax return which would result from a portfolio comprised entirely of municipal bonds. Notice that the optimum level of taxable investment
Figure 1
income to acquire before moving into municipals is determined by $Y_1$, the individual's taxable wage and salary income; $Y_m$ is determined by the structure of interest rates and tax rates.

Municipal bond holders' valuation of the taxable income stream $\pi$ depends on the value of $\pi$ relative to the investors optimum level of taxable investment income, $Y_2$. If $\pi \leq Y_2$, then the appropriate net-of-tax discount rate for valuing the net-of-tax returns $\pi(1-t)$ is $r^0(1-t)$, despite the fact that the investor holds some municipals. Since the optimum portfolio contains $Y_2 \geq \pi$ of taxable investment income, the asset producing $\pi$ will be substituted for previously held assets producing taxable income at the rate $r^0$. Therefore, municipal bond holders whose optimum taxable investment income level is as large as $\pi$ will value $\pi$ as highly as do lower tax bracket individuals.

However, those investors for whom $\pi > Y_2$ will attach a lower present value to $\pi$ than will lower bracket individuals. Consider first those individuals for whom $Y_2 = 0$ because their wage and salary income alone puts them in the tax bracket where the highest after-tax return on invested equity is obtained from municipal bonds, paying rate $r^m$. This rate is the after-tax opportunity cost of capital for them and is the appropriate discount rate for valuing after-tax returns. Since in this tax bracket $r^m > r^0(1-t)$, using $r^m$ as the discount rate will cause their valuation of $\pi$ to be less than that of lower tax bracket individuals. To match their valuations, the after-tax opportunity cost of capital would have to be the lower rate $r^0(1-t)$.

If the municipal bond holder's optimal level of taxable investment income is positive but less than $\pi$, his valuation of $\pi$ will lie between...
the two cases just considered. The excess of \( \pi(1-t) \) over \( Y_2(1-t) \) will be discounted at rate \( r^m \) and these investors' valuations will also fall below those of persons in lower tax brackets.

The conclusion is that municipal bond holders' valuations of taxable income streams will be less than other individuals' valuations if acquisition of the taxable income stream would raise their taxable investment income above the optimum. Whether this is the case depends largely on the municipal bond holder's level of taxable wage and salary income. If this is high, then optimal taxable investment income is low, and large taxable income streams will be valued less by them than by others.

The existence of an upper bound on the optimum level of taxable income an investor will want to receive (before investing in municipals) has been previously recognized by Dean and Carter. In their analysis of the effect of income taxes upon the optimum size of unincorporated firms operating in an industry where economies of scale exist, they recognized that, because of progressive tax-rates and the availability of tax-exempt interest, individuals find that beyond a limit the after-tax return from expanded farm size is less than the municipal rate.

However, Dean and Carter (p. 762, and note 12) also argued that this limit may be circumvented by the use of debt. In their scenario, a high bracket individual limits his equity investment in the farm operation and expands with debt while investing his residual equity in municipals. The tax deductions from debt interest keep down the level of taxable income from the enterprise, while scale expands with
invested debt capital. Carman implicitly accepted the validity of Dean and Carter's analysis when he examined the effects of the tax reform act of 1969 on optimum farm size. However, Dean and Carter's analysis ignores a provision of the income tax law which prohibits the scenario they describe.

Section 265(2) of the Internal Revenue Code of 1954 stipulates that, "No deduction shall be allowed for interest on indebtedness incurred or continued to purchase or carry obligations... the interest on which is wholly exempt from the taxes imposed by this subtitle." The Revenue Procedures (72-18 and 74-8) issued by the IRS to set guidelines concerning 265(2) and the court cases interpreting this provision indicate that it does not automatically disallow all interest deductions by municipal bond holders; among other allowances, the courts have permitted interest deductions on loans taken for nonrecurrent business needs. In the case of Wisconsin Cheeseman, Inc. v. United States the courts permitted the deduction of interest on a loan, the proceeds of which were used to pay for the construction of a new plant, although Cheeseman held municipals. Similarly, in the case of Ball v. Commissioner, Ball, who held tax-exempt bonds throughout the relevant years, was permitted interest deductions on a variety of loans including two which were used to acquire ranches.

However, the courts have also ruled that interest deductions on such loans become disallowed if the loans are continued beyond some reasonable retirement period. In the case of Illinois Terminal Railroad Co. v. United States the court disallowed the deduction of interest on a loan originally incurred in connection with the acquisition
of a bridge because the court’s opinion was that the railroad’s dominant purpose in continuing the loan was to maintain its holdings of tax-exempt bonds. I infer from these and related cases that the municipal bond holder who uses debt in purchasing land is permitted to deduct the interest only if the debt is retired within some "reasonable" interval. Therefore, investors cannot indefinitely use debt to circumvent the upper bound on optimum taxable income identified in figure 1. Consequently, some municipal bond holders will find taxable income streams unattractive because of this limit.

Summary and Conclusions

One of the principal conclusions of this analysis is that the progressivity of the income tax per se does not affect different investors’ valuations of normally taxed perpetual income streams. Since farmland does not qualify for special tax factors unless it is resold, investors planning indefinite holding of land are not differentially affected by progressive income tax considerations. However, the availability of tax-exempt municipal interest limits the optimum level of taxable investment income and section 265(2) of the IRS code prohibits circumventing this limit with the use of debt. Therefore, municipal bond holders are deterred from acquiring taxable income streams if the acquisition would move them above the optimum level of taxable income. A previous study by Dean and Carter ignored section 265(2) and consequently overestimated optimum farm size.

Although my results, like those of Harris and Nehring, imply that high income investors may value farmland less highly than lower income
individuals, the source and extent of the valuation disadvantage differ. Harris and Nehring's attribution of the valuation disadvantage to the progressivity of the income tax implies that the effect operates throughout all levels of taxable income. My conclusion is that the progressivity of the income tax deters only some high income municipal bond holders from acquiring farmland. Further, this effect is attributable to the existence of municipal interest, rather than to the progressive income tax itself.

Although most investors may safely ignore income tax rates in the significant special case of farmland valuation, this analysis indicates that asset valuation should generally be conducted in net-of-tax terms. To correctly value non-perpetual income streams and assets qualifying for special tax consideration, it is necessary to adjust both the income stream and the discount rate for the effect of individual income tax rates.
FOOTNOTES

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1. The concept of risk-equivalent classes of assets is discussed by Modigliani and Miller in their 1958 and 1963 papers. Income streams in a risk class differ only by a factor of proportionality.

2. If property taxes are expected to grow over time, this expectation should be incorporated.

3. This approach is consistent with Modigliani and Miller's findings. Their 1958 paper (pp. 268-9) showed that, in the absence of corporate income taxes, the cost of capital to a firm is independent of its debt-equity mix and equal to the rate of return to unlevered equity invested in its risk class. Their 1963 paper shows that the corporate income tax does create an advantage to corporate debt finance and that the correct discount rate for corporate investment decisions does depend on leverage. However, the tax effect is the only permanent advantage to corporate debt and this advantage does not apply to individual unincorporated investors. It can be shown that the debt-equity mix of individual investors strongly affects the expected value and variance of returns to invested equity. However, the debt-equity mix is irrelevant to present values because the effects of
leverage apply to all investments and should not be attributed to any particular investment. If a considered asset is to provide as large a return to levered equity as do other assets in its risk class, it must provide \( r^0 \) dollars of gross-of-tax returns to each (equity and debt) dollar invested.

4. The net-of-expression is less simple if part of the return is growth. Since allowing for income growth over time complicates the exposition of this section without charging the results, I assume henceforth that the income stream considered is not expected to grow over time.

5. The omission of the special treatment of capital gains in this formula is justified by the assumption that the investor expects to retain the asset (in his family) indefinitely.

6. If this prohibition did not exist, individuals in high tax brackets could earn arbitrage profits by borrowing money, deducting the interest from taxable income, and investing the loan proceeds in tax-exempt municipal bonds.

7. Neither the IRS nor the courts have specified how quickly debt must be retired to avoid invoking 265(2), but the Illinois Terminal Railroad Co. case demonstrates that indefinite continuance of debt is not permitted.
REFERENCES


17. The Wisconsin Cheeseman, Inc. v. United States, 338 F.2d. 420 (7th Cir. 1968).