Investors have long been painfully aware that inflation increases the real burden of capital gains taxes. An extreme case was noted by Feldstein and Slemrod (1979) who found that the $4.63 billion taxable nominal gain from stock sales by individuals in 1973 was actually a $910 million real loss. The negative impact of inflation on capital gains taxes was one of the rationales behind the former preferential federal income tax rates on long-term capital gains. Other rationales included stimulation of capital formation, lessening tax burdens caused by bunching of gains, and decreasing the tax deterrent to sale of assets (see Feldstein 1983 and 1983a for discussions of these topics).

Although disagreement abounds on the degree to which different factors justify preferential tax treatment of long-term capital gains, there is a consensus that inflation increases the effective tax rate on capital gains. However, no single tax rate (or gain exclusion) can accurately compensate for the highly variable and unpredictable effects of inflation. The negative impact of inflation occurs because inflation increases gross returns from asset sales but does not increase the deductible basis. The most precise way to eliminate this inflation bias is to index the basis for inflation between dates of purchase and sale of any asset subject to capital gains taxation, and to use a uniform tax rate for long- and short-term capital gains (e.g., see Brinner 1973 and Aaron 1976). However, such "basis-indexing" has not been allowed under former and current U.S. income tax laws.

Nevertheless, basis-indexing proposals have been frequent: they were passed by the House of Representatives but not the Senate in 1978 and by the Senate but not the House in 1982. Basis-indexing was also included in a 1984

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Treasury Department proposal (USDT 1984) and in the President's 1985 tax proposal (Prentice-Hall 1985). Since the 1986 Tax Reform Act has established the same tax rates for short- and long-term capital gains, the argument for basis-indexing is likely to become stronger. In view of this, our paper examines potential impacts on present values of future income from non-depreciating assets such as timber, after capital gains taxes, when the basis is indexed for inflation.

**Notation**

The following notation is used:

- **V** = after-tax present value of future asset sale under a benchmark method (current or pre-1987 law) of taxing capital gains.
- **V_p** = after-tax present value of future asset sale under a proposed basis-indexing method of taxing capital gains.
- **V_n** = projected sale price of asset in year n, in constant dollars of year zero.
- **n** = investment horizon, or number of years until asset sale.
- **f** = average annual inflation rate (in decimals).
- **i** = after-tax nominal interest rate, where \( i = r + f + rf \).
- Thus, the discount factor in nominal terms is \( 1/(1+i)^n \) = \( 1/[(1+r)^n (1+f)^n] \). This formulation guarantees a real return of \( r \) when inflation is \( f \).
- **t** = capital gains tax rate.
- **R** = present value ratio: \( V_p/V \).

**Impacts of Inflation on Income Taxes**

Figure 1 shows purchase and sale prices of an asset held for 10 years with and without inflation and illustrates the negative impact of inflation on capital gains taxes. In Figure 1, \( V - V \) is the capital gain after 10 years without inflation. \(^n\) If inflation triples the sale price (keeping the real value unchanged), the capital gain, as well as the capital gains tax, increases 5-fold in the Figure 1 example. Although these relationships change with differing \( f \) and \( n \), under the current tax law, inflation will always cause a disproportionate increase in the capital gains tax. This occurs because the tax savings from deducting the fixed basis \( V \) becomes relatively less as \( f \) increases. Thus, in Figure 1, inflation decreases the asset's after-tax present
FIGURE 1. Effect of Inflation on Capital Gain (CG) Without Basis-Indexing

- If inflation triples sale price
- CG increases 5 times (as does tax)
- With inflation
- No inflation
- Asset cost = V
- Basis
- 0
- Years (n) 10
- $
value. Such present value reductions have been discussed by Nelson (1976) and Bullard and Klemperer (1986).

The foregoing negative impact of inflation can be eliminated by indexing the basis to the average inflation rate over the n year period, as shown in Figure 2. In that case, if inflation triples the asset sale price, the indexed basis, V(1+f)^n, is also tripled, as is the taxable gain. Thus, with basis-indexing, the real gain and present value are unaffected by inflation. Both Figures 1 and 2 are simplified and do not show tax-induced changes in present values; however, the following analyses will do so.

Note that with very long investment periods (n), given acceptable asset growth rates which are exponential, the basis, V, will be very small compared to asset sale price, V_n. The tax savings from deducting the basis will therefore be small relative to real after tax income. Thus, with very long optimal payoff periods, the relative benefit of basis indexing will become small, as we show in the following analyses.

**Procedure**

We consider only non-depreciable assets such as land and timber which are purchased and sold in entirety at a later date. Asset value or purchase price will be the after-tax net present value (V or V_n) of future income from the asset sale. Competition is assumed so that taxes are fully passed back into lower asset values.

For any given before-tax sale price of an asset, we compute a ratio, R: the after-tax present value under an income tax with basis-indexing divided by the after-tax present value without indexing. By testing the sensitivity of R to changes in the optimal investment horizon, the inflation rate, and the interest rate, we illustrate the degree to which asset values are increased by basis-indexing.

When considering varying investment horizons, we assume different assets such as Christmas trees or sawtimber, each with some perceived optimal holding period which is independent of the tax system. Thus, different holding periods should not be considered as alternative sale dates for the same asset.

We examine only the short-term effects that basis-indexing would likely have upon bid prices for selected assets. No attempt is made to examine long run equilibrium effects of basis-indexing on prices and asset values.

**After-Tax Present Value Ratio**

Under a benchmark tax without indexing, computing in nominal terms (including inflation) the present value or a
FIGURE 2. Effect of Inflation on Capital Gain (CG) with Basis-Indexing

If inflation triples sale price

CG is tripled (as is tax)

Indexed basis = $V(1+f)^n$

With inflation

No inflation

Asset = $V$

Years (n)

0

10
buyer's maximum bid for an asset yielding \( V_n \) in \( n \) years is:

\[
V = \frac{V_n (1+f)^n - t(V_n (1+f)^n - V)}{(1+r)^n (1+f)^n}
\]  

(1)

Under basis-indexing proposals, present value or a buyer's maximum bid for the same asset is:

\[
V_p = \frac{V_n (1+f)^n - t[V_n (1+f)^n - V_p (1+f)^n]}{(1+r)^n (1+f)^n}
\]  

(2)

After basis-indexing, the after-tax present value is not affected by inflation, since the inflation factors \((1+f)^n\) cancel out.

Setting \( V_n = 1 \), equations (1) and (2) can be solved for \( V \) and \( V_p \) so that \( V \) and \( V_p \) no longer appear in the right side (see Klemperer and O'Neill 1987 for more details).

Forming a ratio of after-tax present value under the proposed indexing method to after-tax present value under the benchmark tax method,

\[
R = \frac{V_p}{V}
\]  

(3)

If \( R > 1 \), asset value is increased by proposed tax (original owner prefers proposed law).

If \( R = 1 \), asset value unchanged (original owner is indifferent).

If \( R < 1 \), asset value is decreased by proposed tax (original owner prefers current tax).

Since our examples use the same tax rate with and without indexing, we will show \( R \geq 1 \).

**Sensitivity Analysis**

Using equation (3), Table 1 shows present value ratios, \( R \), for several investment horizons and inflation rates, assuming the current 34% corporate capital gains tax with and without basis-indexing. Based on Nordhaus (1974), Table 1 uses a 6% long-range real after-tax rate of return to corporate capital, but other rates are also examined. As long as inflation exceeds zero, basis-indexing reduces taxes, as reflected in the table's \( R \) ratios greater than 1 when \( f > 0 \). The percentage increase in asset value from basis-indexing can be inferred from the \( R \) ratios. For example, with 6% inflation and a 15-year investment horizon, the \( R \) ratio is 1.096, which means basis-indexing would boost asset value by 9.6%.
<table>
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<th>10</th>
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<td>1.0189</td>
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</table>

*(Present value under proposed tax with basis-indexing) * (present value under current un-indexed tax), from equation (3). Same gross future return in either case, under given assumptions. If \( R > 1 \), proposed tax increases asset value. If \( R = 1 \), asset value is unchanged.
Table 1 shows that as investment horizon lengthens, the relative present value increase from basis-indexing first rises and then declines for any \( f > 0 \). At the 6% real interest used in Table 1, the maximum present value benefit from basis-indexing occurs for assets with roughly a 10-year optimal holding period when inflation is less than 20%. The middle curve in Figure 3 shows these relationships for a 10% inflation rate. The figure also shows that as the interest rate decreases, the advantage from basis-indexing increases, and the maximum advantage occurs at longer investment horizons.

Both Table 1 and Figure 3 show that as the investment horizon lengthens beyond 10 or 20 years, the relative present value increase becomes less. This is contrary to arguments that long duration investments such as timber suffer most under an unindexed income tax during inflationary periods. Given a real after-tax interest rate of 6% or more, Table 1 and Figure 3 show that the percentage present value increase from basis indexing becomes negligible for investment horizons over 50 years (\( R \) ratios are nearly 1).

**Conclusions**

Initially it was assumed that the asset purchase cost and basis exactly equalled the computed present value \( V \) or \( V_p \). If purchase price is less than \( V \) or \( V_p \), present values should be computed by substituting actual purchase cost for \( V \) and \( V_p \) in the right sides of equations (1) and (2).

The wide range of impacts that fixed inflation can impose on after-tax present values argues for basis-indexing from a tax neutrality standpoint. The case is even stronger when considering the large historical variation in inflation rates. Benefits from such indexing would remove a major rationale for returning to the former capital gains tax rate preference.

Because of the complex interrelationships between the interest rate, investment horizon, inflation rate, and tax rate, it is difficult to generalize about effects of basis-indexing, with or without increased tax rates. However, for real after-tax rates of return in the 6% range, some general observations about tax impacts on values of single-input single-output investments can be made:

1) For investments with horizons exceeding 30 years, once inflation reaches about 6%, further inflation will make little difference in the degree to which basis-indexing will affect asset values.

2) If the capital gains tax rate is unchanged and inflation is between 35 and 15%, the percentage present value increase from basis-indexing is maximum for investments to be liquidated in roughly 10
FIGURE 3. Relationship Between Present Value Ratio (R) and Investment Horizon at Different Real Interest Rates [10% inflation; Capital gains tax rate = 34%]*

* If R > 1, proposed tax increases asset value.

If R = 1, asset value is unchanged.

Higher R indicates greater percentage increase in asset value from basis-indexing.
years. Investments with shorter and longer horizons receive smaller percentage benefits.

In addition to predicting gainers and losers from selected basis-indexing proposals, the findings here have possible land use implications. For example, the land purchasing power of land uses with roughly 10-year payoff periods (e.g., Christmas trees or short rotation fiber crops) would be more enhanced by basis indexing than the land bidding power of uses such as long rotation sawlog crops. If indexing were adopted, the resulting shift in land use, if any, could be viewed as more efficient, since basis-indexing would remove inflation's bias against intermediate horizon investments under the current tax law. More detailed analyses of basis-indexing with alternative tax rate combinations are reported in Klemperer and O'Neil (1987).
Literature Cited


