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Use-Value Appraisal of Farmland

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Use-value appraisal, because it is based on income generated by the agricultural productivity of land, differs significantly from market value appraisal. (1) Use-value (and thus property tax) is unaffected by speculative changes in prices of farmland. (2) Use-value protects farmland on the fringes of urban areas from taxation based on the high market values that sometimes occur because of the potential of converting farmland to commercial or residential uses.

Because Kansas is about to embark on a use-value program that will determine farmland appraisals and property taxes after January 1989, a theoretical and applied analysis of use-value was undertaken. The applied analysis scrutinizes Kansas Senate Bill 164 (SB 164), which specifies the appraisal techniques to be used for Kansas farmland. (A departmental report, cited at the end of this publication, provides a more detailed analysis).

Theoretical analysis of use-value demonstrates that the conventional capitalization formula is mathematically incorrect. The theoretical errors have monetary implications for appraisal of Kansas farmland and for property tax payments on land.

For instance, use-value appraisals as outlined in SB 164 might not rise or fall with increases and decreases in farmland income. This discrepancy between income and appraisal can occur because changes in the capitalization rate found in the use-value formula can overwhelm changes in income value. As a result, appraisals could increase even while income declines, and vice versa.

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Research suggests how provisions in SB 164 might be modified. These modifications yield a formula that (1) conforms with appraisal theory established by both economists and appraisers and (2) ties movements in use-value appraisals to changes in farmland income.

Present Value Equation

All formulae for use-value appraisals have their theoretical foundation in the present value equation:

$$PV = \frac{I_1}{(1+j)^1} + \frac{I_2}{(1+j)^2} + \ldots + \frac{I_\infty}{(1+j)^\infty} \qquad (1)$$

where: PV = Present value of farmland
I_y = Expected income from farmland in year y
j = Expected rate of return from investing in an asset such as farmland
y = Year number: 1 . . . infinity

The $I_y/(1+j)^y$ term for each year is summed for all (infinite) future years to estimate present value of farmland (PV). If annual income from farmland is restricted entirely to that generated from farm production (exclusive of any returns from capital gains or losses, etc.), then equation (1) yields use-value of farmland.

Conventional Use-Value Formula

The lengthy present value equation can be converted into the simple format characteristic of the conventional use-value formula, if two very *restrictive* conditions hold: (1) income remains forever constant in each future year, i.e., $I_1 = I_2 = \ldots = I_\infty$ and (2) the capitalization rate is the real (inflation free) rate of return from the asset whose income is in the numerator. When the above conditions are satisfied, the simplified equation for present value (PV) is

$$PV = Inc_1/c \qquad (2)$$

where Inc_1 is income and c is the capitalization rate.

The format of the conventional use-value formula (used in SB 164) is based on that of equation (2), namely:

$$CUV = ANI/B \qquad (3)$$

where: CUV = Conventional use-value
ANI = Average (8-year) nominal income from farmland (net of expenses)
B = The capitalization rate—average (5-year) interest rate for new farm mortgages financed in Kansas by the Federal Land Bank (SB 164 provides for an addition of 0.75 to 2.75% to the Federal Land Bank rate.)

However, the combination of variables selected for the conventional equation, together with the simplified format for the equation, do not result in an appraisal of farmland equivalent to one that would be obtained with present value analysis or its simplified variant, equation (2).

First, the requirement for equation (2)—*that income remains forever constant*—is not satisfied when income is defined as annual lease payments on farmland. Average income from farming can increase because of inflation and can also increase or decline over time because of shifts in productivity and in market prices.

Second, the capitalization rate in equation (3) is incorrect for at least two reasons: (1) it is derived from the capital market for government securities and, thus, lacks sufficient risk premium for capitalizing investment in agricultural land, and (2) it includes expected inflation. The latter is inappropriate because expected, future inflation is absent in the numerator, which is simply an average of past income figures. Correct appraisal (and present value analysis) requires symmetry: expected inflation must be either present in numerator and denominator, or completely absent in both. The lack of symmetry in the conventional equation by itself renders it invalid.

Third, the income-averaging technique employed in the conventional use-value formula may lead to results that differ from present value analysis. Because the income term is averaged from historical data, income is underestimated during inflationary periods and overestimated in deflationary periods. That is, the average will likely depict income values typical of 4 to 5 years prior to appraisal.

Reformulated Use-Value Equation

Despite the problems noted above, we can preserve the simple and straight-forward format of the conventional equation and yet obtain appraisals equivalent to present value analysis. We require only minor modifications of the formula, plus selection of new variables for the numerator and denominator that conform with present value analysis, namely:

$$UV = \frac{ARI}{r - g} \qquad (4)$$

where: UV = Reformulated use-value
ARI = Average real farmland income
r = Real capitalization rate (net of expected inflation) inclusive of risk appropriate to investment in farmland
g = expected rate of increase or decrease in real farm income

Numerator of the Reformulated Use-Value Equation

Because net farm income fluctuates from one year to the next, we must approximate a "normal" return to land (average weather, average management, and average market conditions) from past income values. Accordingly, the numerator of the use-value equation is an 8-year average of past values for net lease income. But whenever either inflation or deflation exists in the economy, the average will not represent the current price level at which land is ostensibly being appraised.

In order to avoid these distortions, we must adjust past income values to the price level at the time of appraisal. This can be accomplished by utilizing Prices Paid by Farmers, a government price index.

The price-adjusted measure of farmland income is the ARI variable in equation (4).

Denominator of the Reformulated Use-Value Equation

The requirements for the capitalization rate of a reformulated use-value equation are:

1. Real capitalization rate. The capitalization rate must be restricted to a real rate (net of inflation or deflation). The conventional capitalization rate incorporates expected inflation, which can be a highly variable factor. As a result, movements in farmland appraisals may be contrary to changes in farmland income.

2. Risk premium appropriate to farmland investment. The capitalization rate utilized for conventional use-value appraisal understates the risk factor in investment because it is tied to a rate roughly equivalent to the risk-free rate on U.S. government bonds.

3. Adjustment for expected growth or decline in real farm income. Because the income term in the use-value equation is constant, any accommodation for long-term growth or decline in farm incomes must be achieved by an adjustment to the capitalization rate. This adjustment factor is the g variable in the denominator of equation (4).

The base capitalization rate for the reformulated use-value equation would be a stable one that is not influenced by changes in expected inflation. Changes in risk and expected long-term growth (or decline) of incomes could be accommodated by limited variations in the base rate.

Use-Value Example

Two figures will illustrate (1) the mechanics of use-value appraisal and (2) the differences between conventional use-value (SB 164) and reformulated use-value equation (4).

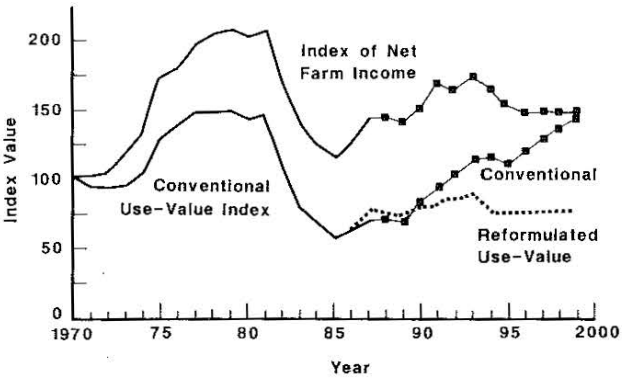

Fig. 1. Index of Net Farm Income and Use-Value.

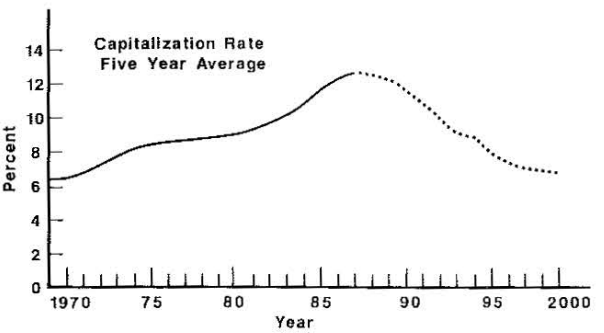

Fig. 2. Conventional Capitalization Rate.

Consider first the mechanics of use-value. In Figure 1, the upper line indicates an index of net farm income in Kansas, averaged over 8 years, as called for by SB 164. In the base year, 1970, the index equals 100. In the 1970s, farm income and the index rose because of favorable market prices and inflation. In the 1980s, the income index fell along with market prices.

Use-value is calculated (according to SB 164) as the capitalized value of the owner's share of income from a lease on farmland. We presume that movements in lease income will correspond with movements in net farm income. By dividing net farm income with the capitalization rate shown in Figure 2, we obtain an index of

the movements in use-value, shown as the bottom line in Figure 1.

We note in Figure 1 that use-value did not increase as rapidly as farm income from 1970 to 1982. This is because the conventional capitalization rate (average interest rate of mortgages financed by the Federal Land Bank) increased during this period. (A rising capitalization rate, which is the denominator of the use-value formula, depresses the capitalized value of income; a falling capitalization rate boosts the capitalized value of income.) Had the capitalization rate remained constant, income and use-value would have moved together, as one line.

The relationship between farmland income and the capitalization rate in the use-value formula allows us to predict what will happen to use-value in the future, given hypothetical scenarios of income and interest behavior.

We can speculate about the course of use-value appraisals for the 10 years following the adoption of use-value in 1989. Suppose, for instance, that farmland income after 1986 is equal to the average income between 1978 and 1985. This assumption is illustrated by the line for farm income in Figure 1 for the years following 1987. (Average income fluctuates until 1995 because of the continued influence of income values that enter the average from years prior to 1986).

Suppose also that future interest rates and, therefore, conventional capitalization rates, return to the level that prevailed in 1970 (approximately 6.5% for both 1970 and 1999). The progression of the 5-year average of capitalization rates from 1970 to 1999 is illustrated in Figure 2, where 1987 is assumed to have the peak rate, 12.69%, of that time span. (This figure for 1987 is based on the average of 1981-85 rates.) Starting in 1988, we assume that capitalization rates begin a decline to the 6.5% rate in 1999, as illustrated in Figure 2.

If interest rates (and the conventional capitalization rate) return to the level of the early 1970s, **use-value appraisals will be driven upward by the fall in rates alone.** Should the capitalization rate fall to its 1970 level, the indices for farm income and use-values shown in Figure 1 would converge. In Figure 1, the effect of falling capitalization rates is illustrated by the 120% upward movement in the conventional use-value line from 1985 to 1999. If farm incomes increase in the future because of either improved market prices or because of inflation, use-value could rise by considerably more than 120%.

In contrast with the conventional equation, the reformulated use-value equation would tie farmland appraisals to farm income. For illustrative purposes, it is assumed that reformulated use-value is calculated with a fixed capitalization rate of 12%. The result, indicated by the dotted line in Figure 1, is a reformulated use-value roughly 50% of the conventional use-value in 1999.

Theoretical analysis suggests that use-value should follow the movements of farmland income. If Kansans wish to revise conventional use-value (SB 164) so that land appraisals will follow the path of farmland income, appropriate legislative changes will be necessary.

Modifications of Conventional Use-Value

1. Instead of a capitalization rate derived from the 5-year average interest charged by the Federal Land Bank, a capitalization rate that remains roughly constant might be used. A rate that remains stable over time will assure that farmland appraisals increase or decrease with changes in farm income, rather than in response to the expected inflation factor in market interest rates.

2. A basic capitalization rate could be determined by the Kansas Legislature. The rate would be selected to yield a targeted relation of appraisals to market values for some base period, say 1978-85. Such a capitalization rate would cause use-value to move upward or downward in response to farm income, much as present value would respond. However, the basic capitalization rate could be selected so that use-value would be less than present value of farmland.

The basic rate would be denoted a long-term equilibrium rate, though not a constant. [Constant, statutory capitalization rates are used by Colorado (11.5%) and Iowa (7.0%).] This base rate could be modified in response to changes in risk and income trends. A suggestion for doing so is indicated below.

3. The capitalization rate might vary by a total of 3 percentage points, 1.5 percent above and below an equilibrium rate. If the long-run equilibrium rate were 12.0 percent, the minimum would be 10.5 percent and the maximum 13.5 percent. (SB 164 includes a related concept: a discretionary increase of up to 2.75 percent above the interest rate derived from Federal Land Bank rates.) The rate could be increased (use-value of land will accordingly decrease) if the rate of growth in farm income should decline or if high real interest rates increase the financial risk of farming. (Louisiana and Mississippi make such adjustments.)

4. Senate Bill 164 states that net income is the lease value (owner's share) from 8 prior years. This analysis suggests that the net lease figures from prior

years should be adjusted so that all income is expressed at the price level existing at the time of appraisal. Such a modification would prevent distortions of use-value by prior inflationary or deflationary periods. For instance, under current legislation, the 1972–82 inflation will continue to drive upward the use-value appraisals until 1990, even if the decade of the 1980s experiences little inflation or increase in farm income.

In sum, policy makers may wish to utilize economic theory as a guide to modifying legislation. The results of incorporating such theory can be use-value appraisals that are truly a function of farmland income.

For detailed information, write for *Analysis of Use-Value Appraisal in Kansas* (Department Report, KAES Contribution No. 87-207-D), Department of Economics, Kansas State University, Manhattan, KS 66506.

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