Measuring Use-Value Assessment Tax Expenditures

John E. Anderson

Abstract

Use-value assessment is the practice of valuing land for property tax purposes in its current use, rather than its full market value. This practice is widespread in the U.S. and is intended as a means by which to reduce the property tax burden on farmers and slow the conversion of farmland into developed uses. The purpose of this paper is to examine the practice of use-value assessment and determine the foregone property tax revenue, or the so-called tax expenditure, of this policy. The economic theory of land prices is presented and used to frame a context within which use-value assessment tax expenditures can be examined. Empirical models of the difference between market value and use value are then estimated using two data sets from Omaha and Lincoln.

Key words: Property tax, assessments, tax expenditures.
JEL classification: H2, R5

About the Author

John E. Anderson
Department of Economics, University of Nebraska
Lincoln, NE, USA 68588
Janderso@unlinfo.unl.edu

John Anderson is Professor of Economics and Director of Graduate Studies in Economics at the University of Nebraska. He earned his Ph.D. in economics at Claremont Graduate School, Claremont, CA, in 1977. During his teaching career he has taught at Eastern Michigan University, Michigan State University, and the University of Nebraska. His research interests are in tax policy, with special focus on the property tax and state-local fiscal relations. His research has been published in the *Journal of Urban Economics, Regional Science and Urban Economics, Land Economics*, *National Tax Journal* and other scholarly outlets. Outside of academe, he has served as Deputy State Treasurer in Michigan, advising policy makers on tax policy and directing the research program of the Taxation and Economic Policy Office of the Michigan
Department of Treasury. He has served as and advisor to numerous commissions and public agencies on issues of taxation and economic policy.

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1. INTRODUCTION

OBJECTIVE

The objective of this research program is to measure the tax expenditure associated with use-value assessment of agricultural land in urban areas. To do so requires that we first examine carefully the concept of use-value assessment and determine how use-values are determined by local tax assessors. We can then proceed to measure the difference between market value and use-value, which is fundamental to estimating the tax expenditure involved.

USE-VALUE ASSESSMENT: BACKGROUND

We can begin with a definition of use-value assessment provided by Robert Gloudemans, writing for the International Association of Assessing Officers (IAAO) in the 1970s during the height of policy interest in prime agricultural land preservation and the property tax revolt. Gloudemans defined use-value assessment as follows:

> Use-value assessment is the assessment of property upon the basis of its value in a particular (current) use, rather than upon the basis of its market value. Gloudemans (1974, p.1)

With this definition, we have a concise statement of use-value assessment, the most common form of assessment used by state and local governments as they apply property taxes to agricultural property. While there are a number of ways that property taxes on agricultural land can be reduced, including classified tax systems, exemptions, circuit-breakers and other methods, use-value assessment has become the most widely used method in the U.S. since the 1960s.

A tax assessor typically evaluates the value of real property in *highest and best use*, that is, in the property's use that maximizes the return to its owner. Where there are several potential uses of the property, there may be a wide divergence between the value of the property in those alternate uses. Suppose that a cornfield provides its owner with a net rental of A per year. Capitalizing a perpetual income stream of A per year at a discount rate of r, provides A/r as a measure of the value of that property. Now, if that cornfield could be used as a golf course and earn G per year in net rental, its value is G/r. To the extent that $G>A$, the value of the property is greater in its use as a golf course than in its use as a cornfield. Of course, if there is only one feasible use for the property, there is no difference between use value and market value.

How do we know the property's highest and best use? Barlowe (1978, p.16) defines highest and best use this way:

> Real estate is ordinarily considered at its highest and best use when it is used for that purpose or that combination of purposes for which it has the highest comparative advantage or least comparative disadvantage relative to other uses. This concept necessarily calls for consideration of both the use-capacity of the land and the relative demand for the various uses to which it might be put.

We can examine the definition of use-value in greater depth and explore the effects of use-value assessment more generally by developing a model of land value fundamentals and using that model in developing policy analysis.

2. LAND VALUE FUNDAMENTALS

Land Value

Capozza and Helsley (1989) have provided a comprehensive view of the fundamentals of land prices. Their characterization of the price of land includes four distinct aspects of price, depending on the location of the land in relation to the central business district (CBD) and the land's state of development, and is illustrated in Figure 1.

At distances closer than z*, the urban periphery, the price of developed land has four component parts: the value of accessibility, the cost of land conversion, the value of expected future rent increases, and the value of agricultural land rent. The value of accessibility diminishes with increasing distance from the CBD. By the time land is at least z* miles from the CBD, the value of accessibility has declined to zero. The cost of conversion of agricultural land to developed use is assumed to be independent of the location of the land. Notice that the presence of conversion cost implies that land prices jump at the edge of the city. At distance z* there is an upward discontinuous jump in price. The third component of land price is the value of expected future rent increases after development of the land. This value is constant within z* miles of the CBD, but is declining with distance out past z*. The farther out the land, the lower the expected future increase in rent. The presence of this component of price implies land that is still in agricultural use, but lies relatively close to the urban boundary, will command a premium in its price due to the present value of expected future increases in rent which occur after development. The size of that premium depends on distance to the urban perimeter. Finally, the land has a pure agricultural value that is invariant with respect to distance. Regardless of its location, a parcel of land is presumed to have a certain value in agricultural use. The overall pattern of land prices with respect to distance is declining. The farther from the CBD a parcel's location, the lower its price, and other things being equal.

Capozza and Helsley (1989) provide a mathematical expression for the price of developed land P^d that illustrates the four additive components in the above figure. The price of land is given by the equation:

$$P^d(t,z) = A/r + C + (1/r)(T/\bar{L})[\bar{z}(t) - z] + (1/r)\int_t^{\infty} R_\tau(\tau, z)e^{-r(\tau - t)}d\tau. \tag{1}$$

The first term in this expression, A/r, is the capitalized value of agricultural rent. The second term, *C*, is the value of capital improvements applied to the land. Both of these terms are invariant with distance. The third term is the value of accessibility, which is based on transportation cost *T* and mean lot size $\overline{L}$ and declines with distance to the city boundary. Finally, the fourth term is the value of expected future rent increases that will result from population growth. This term depends on distance as well.

The price of agricultural land is given by the expression

$$P^a(t,z) = A/r + (1/r)\int_t^{\infty} R_\tau(\tau,z)e^{-r(\tau-t)}d\tau. \qquad (2)$$

Of course, the two terms on the right-hand-side of this expression also appear on the right-hand-side of the expression for the price of developed land. Hence, we can write the relationship between the two land prices as

$$P^d(t,z) = P^a(t,z) + C + (1/r)(T/\overline{L})[\overline{z}(t) - z]. \qquad (3)$$

The price of developed land is equal to the price of agricultural land plus the value of capital applied in development plus the value of accessibility.

LAND VALUE IN THE PRESENCE OF A PROPERTY TAX

We may introduce property taxes into the model of land price as well. Using the insight of land value models such as those in Anderson (1986), Rose (1973), Shoup (1970), and Skouras (1978), we can incorporate both pre-development and post-development property taxes in the land value model.

Assume that the property tax rate is ρ_0 prior to development and is ρ_1 subsequent to development. Then, the price of agricultural land is

$$P^a(t,z) = A/(r+\rho_0) + [(1/r+\rho_1)\int_t^\infty R_\tau(\tau,z)e^{-(r+\rho 1)(\tau-t)}d\tau \qquad (4)$$

and the price of developed land is

$$P^d(t,z) = A/(r+\rho_0) + C + [1/(r+\rho_1)](T/L)[z(t)-z] + [1/(r+\rho_1)\int_t^\infty R_\tau(\tau,z)e^{-(r+\rho_1)(\tau-t)}d\tau. \qquad (5)$$

The impact of including property tax rates in the model is to reduce the price of land for three reasons. First, the pure agricultural land value is affected by the tax ρ_0 applied to undeveloped land. The effect of the pre-development property tax is to reduce agricultural land value since we no longer capitalize the annual rent A at the rate r but rather capitalize at the rate (r+ρ_0). The third and fourth terms of the land price equation are affected by the property tax applied to developed land ρ_1. Both of these terms are reduced as we capitalize using the rate (r+ρ_1) rather than the simple discount rate r used in the absence of the property tax. Property taxes are negatively capitalized into value.

3. USE-VALUE ASSESSMENT ISSUES

Use-Value and Tax Assessment

This characterization of the price of land inside and outside the urban area is particularly useful for our consideration of use-value assessment. With full market value assessment, the tax assessor is valuing property according to the upper line in the above figure. At any given distance to the CBD, land prices include the four components identified. Out beyond the distance labeled z* land prices consist of just two components: the value of agricultural land rents and the value of expected future rent increases.

With use-value assessment, the assessor is valuing the property in its current agricultural use. For developed land within the city, that means that the assessor simply recognizes one of the four component parts of land value: the capitalized value of agricultural land rents. Undeveloped land within the city has market value that is composed of three components: the value of accessibility, the value of expected future rent increases, and the value of agricultural land rent. The cost of conversion is missing for undeveloped land. In this case, use-value assessment recognizes just one of the three relevant components of value. As Figure 1 indicates the difference between market value and use value may be quite large for undeveloped land within the city.

For agricultural land outside the city, there are two components of the market price: the value of expected future rent increases due to development and the value of agricultural land rent. In this case, use-value assessment that only recognizes the value of agricultural land rent understates market value as well. The market value of agricultural land includes the value of expected future rent increases after potential development. These two components of market value for agricultural land cause a potential difference of opinion regarding just what use-value assessment means. In a very narrow sense, the value of land in its use in agriculture can be construed as simply the capitalized value of agricultural land rent. But a broader view of use-value assessment could construe agricultural land value to include the value of expected future rent increases as well. Under this view, a use-value assessment standard would recognize two components of land value, not one. While advocates of use-value assessment standards may argue in favor of the narrow interpretation, it must be recognized that the value of farmland, in its use as farmland, includes the value of expected future rent increases due to development. Of course, the magnitude of that quantity declines with distance from the city, and at sufficiently great distances from the CBD becomes irrelevant.

For agricultural land beyond the urban boundary, the mathematical expression for the price of land P^a is:

$$P^a(t,z) = A/r + (1/r)\int_{t`}^{\infty} R_\tau(\tau,z)e^{-r(\tau-t)}d\tau . \qquad (6)$$

There are two terms on the right-hand-side of this equation. The first represents the capitalized value of agricultural rents and the second represents the capitalized value of future increases in land rents due development. The first term is the familiar rule for valuing a perpetuity. A parcel of land generating A dollars in rent per year, with a discount rate of r has the value A/r. The second term involves computing the present value of expected future rent increases. Capozza and Helsley (1989, p.301) summarize the situation of agricultural land near the urban fringe by stating:

> Land still in agricultural use, but closer to the boundary, sells for a premium equal to the present value of future increases in rent that are expected after the land is converted to urban use.

This analysis indicates that there are two determinants of agricultural land value. Application of a use-value standard could include both of these aspects of the price of agricultural land. A narrow application of a use-value standard would simply recognize the first term, the capitalized value of agricultural land rent. But agricultural land near the urban periphery is really worth more than that, as we have seen, even though we only recognize its current use in agriculture. Its value-in-use includes both the capitalized value of the rent stream generated through farming *and* "the present value of future increases in rent that are expected after the land is converted to urban use." Advocates of a narrow use-value standard may wish to dismiss the second term in the value expression, claiming that only agricultural use should be considered. But bears repeating that it is precisely because land is used in agriculture presently that leads to the prospect of some future increases in rent due to development.

Notice that the present value of expected future rent increases is bounded, and hence the property value is bounded. As the dummy of integration ϑ approaches infinity in the second term of the above equation, the value of the integrand approaches zero and the price of agricultural land is bounded.

For example, suppose that a parcel generates A=$1,000 in agricultural rent per year and the assessor uses a discount rate of r=0.05. In this case, the price of the land would simply be 1,000/0.05 or $20,000. This price understates the market value of land by the amount embodied in the second term of the above equation. Of course, this quantity depends on the expected date of development of the land.

In order to estimate the use-value tax expenditure, we need to estimate the vertical difference between the upper price line and the agricultural land rent value in the above figure. Two options are available for accomplishing that task. First, there are some case studies available where the tax assessor has computed both prices. In that situation, we would then build a model of the spatial variation in both sets of prices and integrate the area between them over the whole urban area. Clearly, this is the most straightforward approach to estimating the use-value tax expenditure. Second, in a case study where we have the use-value of the land, but both prices are not available, we would need to estimate the market value for agricultural land in the urban area. That requires estimation of a model which explains how agricultural land values are influenced by urban proximity, such as the model developed in Shi, Phipps, and Colyer (1997). The data requirements of estimating such a model are much more demanding than those for a case study where both prices are available. Hence, it is our preference to work with case studies that permit us to estimate the difference in prices directly, based on assessment data for both use value and market value. We will proceed to identify cases where that can be accomplished.

An Example of the Use-Value Tax Expenditure

We can compute the use-value tax expenditure for some special cases in order to obtain estimates of the magnitude involved. If we assume that there is exponential population growth at a constant rate *g* in the city, we can write the population at time *t* as $N(t) = N(0)e^{gt}$, where N(0) is the population at time *t*=0. This population growth will require that the urban boundary $\bar{z}(t)$ expand over time following the function $\bar{z}(\tau) = \bar{z}(t)e^{g/2(\tau - t)}$. This expansion is required since the model assumes that lot sizes are fixed at $\bar{L}$. With urbanized land area determined in this manner, the price of developed land will follow the function[1]

$$P^d(t,z) = A/r + C + (1/r)(T/\bar{L})[\bar{z}(t) - z] + (T/\bar{L})(g/2)/[r(r - g/2)]\bar{z}(t). \tag{7}$$

The four determinants of value are easily identified: agricultural value, conversion cost, value of accessibility, and value of expected future rent increases.

Similarly, we can write the price of agricultural land outside the urban boundary as

$$P^a(t,z) = A/r + (T/\bar{L})(g/2)/[r(r - g/2)]\bar{z}(t). \tag{8}$$

The price of agricultural land has two components: the capitalized value of agricultural rent and the value of expected future rent increases due to development.

With this specification we can easily consider the importance of the growth premium term. Consider the price of developed land at the edge of the city. Since the land is at the edge of the city the third term in the above equation--the value of accessibility—vanishes, leaving us

1 This relationship holds as long as g<2r. See Capozza and Helsley (1989).

with agricultural land value plus conversion cost plus growth premium. Consider the case where agricultural land rent is A=$150 per year, the discount rate is r=0.03, the city has radius $\bar{z} = 9$ miles, population is 300,000 and the city is circular in shape. Under these conditions the lot size can be computed as $\bar{L} = 0.54$ acres. We also need information on transportation costs of commuting. If we follow Capozza and Helsley (1989) and use the Mills and Hamilton (1984) estimate updated for increases in private transportation cost increases through 1996, we have T=$227.[2] We can further assume that there is a 2% annual growth rate in the city population, the price of land at the periphery is $157,754 per acre including agricultural value of $5,000, conversion cost of $90,000, and a growth premium of $62,754.

It is clear from this simple example that the growth premium can be very substantial. Indeed, in this case, the growth premium is 40 percent of the price of land. Land that has not been prepared for developed use would be worth $90,000 less, but still have a value of $67,754 per acre. Notice that the discounted value of agricultural rents is just $5,000 per acre while the market value of the land is $67,754. The difference is due to expected future rent increases.

A two percent property tax applied to this undeveloped agricultural land at the urban periphery, assessed at full market value, would generate revenue of $1,355 per acre. If, however, the land were valued in agricultural use the tax would generate revenue of just $100 per acre. Hence, the use-value tax expenditure is the difference: $1,255 per acre per year.

4. USE-VALUE WITH UNCERTAINTY AND IRREVERSIBILITY

Capozza and Sick (1994) and Capozza and Li (1994) have developed the theory of land valuation under uncertainty and irreversibility as well. Of course, development provides a return

[2] The Mills and Hamilton figure is T=165. The CPI for private transportation costs increased from 99.3 in 1983 to 131.4 in 1994 (Economic Report of the President, Table B-59). We further assume a 2% increase for 1995 and 1996 to obtain the figure T=227 for 1996.

that is uncertain, and the degree of uncertainty can affect the price of land and the timing of development. Further, we must recognize that once development occurs, the option to develop in the future is gone. Hence, the option value of developing must be considered. Taking these factors into account, they have shown that the price of agricultural land can be expressed as the sum of three distinct components:

$$P^a(z) = A/r + [\hat{g}/r^2]e^{-a(z-z^*)/r} + [(r^2 - a\hat{g})/(ar^2)]e^{-a(z^*-z)/r}. \tag{9}$$

The first term of this land value expression is the pure agricultural land value. The parameter *A* is the agricultural rent and *r* is the discount rate (which represents a riskless real rate of return). Hence *A/r* is the present discounted value of the future agricultural land rents, assuming the asset is a perpetuity. Using the land in agriculture, which is presumed to provide a constant and certain rent of *A* per year in perpetuity, we obtain this measure of the land's value. In the most restrictive sense, this is the land's agricultural use-value. It is the equivalent of a dividend-paying asset value. But the land also has a non-dividend paying option value that is captured in the next two terms. The second term captures the risk-adjusted growth premium associated with the agricultural land. This is the net growth premium expected on the agricultural land. The parameter $\hat{g}$ represents the expected growth of agricultural land rent. The growth premium decays with distance *z* from the central business district (CBD). The third term is the risk-adjusted uncertainty premium associated with the land. If agricultural land rent grew at a certain rate g this term would vanish. But with uncertainty in the expected stream of rent, the value of agricultural land is affected. Rent is assumed to grow at the rate g over time plus follow a Weiner process with no drift and unit variance per unit of time: $dR = gdt + \sigma dB$ (where B follows the Weiner process). Taken together, the second and third terms can be considered the option value of the land.

With uncertainty and irreversibility included in the model of land price, the graphic illustration is given in Figure 2.

5. USE-VALUE ASSESSMENT OF AGRICULTURAL LAND: THE PRACTICE

With this background, it is now possible to use this characterization of the agricultural land price and consider the so-called *use-value* of the land. The most restrictive view of use-value is the first term of the Capozza and Sick formula above, where we simply take the certain annual agricultural rent A and divide by the discount rate r to obtain the capitalized value of agricultural rent. This measure of use-value captures only the value of the land, as measured by the capitalized agricultural income stream.

But, of course, the value of agricultural land is affected by option value as well. If we include the other two terms of the Capozza and Sick formula, we obtain a broader measure of the land's agricultural use value. The value of the land currently in agricultural use includes the capitalized value of the agricultural land rent *and* the option value that arises from the potential to develop that agricultural land in the future. Note that this option value does not include the cost of conversion or other elements of value attributable to actually developing the land. Rather, the option value merely recognizes the inherent value the land has due to the existence of the opportunity to use it in alternative uses in the future. That opportunity is inextricably bound up with the current agricultural use. In non-agricultural use, that opportunity is foregone. Hence, only agricultural land has such option value and it should be recognized as a fundamental part of use-value.

With two elements of agricultural land value to recognize, we clearly have a potential difference in how use-value may be specified in use-value statutes. States clearly differ on this issue. Some states employ a narrow view of use-value, recognizing only the capitalized value of agricultural land rents. For example, Nebraska specifies in statute that the parcel's typical agricultural income stream is to be computed and divided by a capitalization rate to determine use value. This is clearly valuation using just the first term of the Capozza and Sick land value formula given above: *A/r*. Other states take a potentially broader view of use-value. Michigan, for example, provides preferential tax treatment for agricultural land through a circuit-breaker mechanism that requires agricultural landowners to forgo development rights for a specified period of time. Hence the development rights are jointly held with the State. The Michigan statue specifies, however, that the value of the development rights is to be included in the assessed value of the land for property tax purposes.[3] Still other states leave the matter unspecified in their valuation statutes. Florida statutes, for example, specify a list of factors that are considered by the assessor:

a. The quantity and size of the property,
b. The condition of the property,
c. The present market value of the property as agricultural land;
d. The income produced by the property;
e. The productivity of the land in its present use;
f. The economic merchantability of the agricultural product; and
g. Such other agricultural factors as may from time to time be applicable.

While factor *d* would seem to indicate a narrow view of agricultural land value as the capitalized value of agricultural rent, factors *c* and *g* would appear to permit a broader interpretation of use-value to include option value. The State of Maryland also appears to be silent on the issue of just how to determine use-value. Their statutes specify that "Land actively used for farming or agriculture shall be valued on the basis of that use and may not be valued *as if subdivided*." (italics added) There is a wide disparity between the value of pure agricultural land and

[3] Descriptions of state statutes in this and subsequent cases are taken from Aiken (1989) which provides a state-by-

subdivided land, since subdivision signals an intent to develop and involves costs that must be reflected in land value. Thus, the Maryland statutes would appear to give substantial latitude in the determination of use-value, including option value.

Still other states leave the matter even less clearly specified. Massachusetts, for example, specifies in statute that "The value of agricultural or horticultural land shall be that value which such land has for agricultural or horticultural purposes." The state statues further clarify that "The assessor shall consider only those indicia of value which such land have for agricultural or horticultural use." In an attempt to make the matter even more practically applicable, the state statutes provide guidance that "In establishing the use value of agricultural or horticultural land, the assessor shall…(use) his personal knowledge, judgment, and experience."

This brief review of assessment issues in the application of use-value statutes indicates that there are several potential definitions of use-value and some degree of ambiguity in the application of use-value statutes. As a result, we can reasonably expect a good degree of variation across states in the practice of applying use-value standards. We can also therefore expect a good deal of variation as we attempt to estimate the use-value tax expenditure.

6. TWO CASE STUDIES

In order to test the basic model of land values presented above, and use that model to estimate the difference between market value and use value for agricultural land at the urban fringe, two case studies were conducted using Nebraska data sets: Lancaster County, home of the City of Lincoln capital city of the State, and Sarpy County, a fast growing suburban area south of Omaha, the state's largest metropolitan area. Lancaster began permitting use-value assessment of agricultural land in 1997 while Sarpy County began in 1994. Both counties permit use-value

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state description of preferential assessment statutes.

assessment under the State's green belt legislation. Counties must enact zoning regulations as part of the green belt designation, but then are permitted to assess agricultural land in the green belt at its use value rather than at its market value.

In both cases we obtained data from the county assessor that provided parcel characteristics, including the assessor's estimates of both the market value of the property and the use value. While the parcels are taxed on the basis of their use value, Nebraska statutes require the assessor to also record market value for these properties. As a result, we have a unique opportunity to use both values to derive estimates of the tax expenditure due to use-value assessment.

While the model presented above indicates that the *difference* between market value and use value is declining with distance from the CBD, we have estimated the *ratio* of use value to market value as a function of distance. This perspective puts the emphasis on use-value assessment relative to market value assessment. Since agricultural use value should be invariant with respect to distance, subtracting use value from market value simply results in a constant reduction in market value. Hence, estimation of the difference as a function of distance is equivalent to estimation of market value minus a constant as a function of distance. We are not so interested in explaining market value as a function of distance. Rather, we are interested in use value compared with market value as a function of distance. By estimating the ratio of use value to market value as a function of distance, we are able to investigate the extent to which use- value assessment creates a tax expenditure that varies spatially. For given property tax rates, the ratio of use value to market value represents the ratio of property tax based on use-value assessment to property tax based on market-value assessment. The model indicates that this ratio is less than one and rises with distance from the CBD, approaching one in the limit.

Appendix A reports estimates of traditional negative exponential models of the difference between market value and use value as a function of distance to the CBD. Appendix B provides scatter plots of the data for both counties with the difference in value plotted as a function of distance.

LANCASTER COUNTY (LINCOLN) STUDY

The Lancaster County data set consists of parcel-level data for 5,691 individual parcels. The City of Lincoln is nearly at the geographic center of Lancaster County and the parcels in the data set are from locations scattered around the city in all directions. The intersection of 14th and 'O' Streets was designated as the center of the City and distances to each parcel were computed in linear miles (rounded to the nearest mile) to the city center. This intersection is not only in the central business district (CBD), it is also a range and township intersection. Concentric rings were used to determine the distance to the nearest mile for each parcel. The measured distance was rounded upward if a concentric mile ring bisected a parcel. As a result each parcel is *no farther* from the CBD center than the distance assigned.

Table 1 provides descriptive statistics for the Lancaster County data. The table lists means, standard deviations, minimums and maximums for each variable. The mean ratio of use value to market value per acre is 0.639 in Lancaster County. This mean indicates that on average use-value assessments per acre are 63.9% of full market value. As a result, agricultural land owners are benefiting from an average reduction of 36.1% reduction in their assessed valuation

In addition to distance and size variables, school district dichotomous variables are included. For example, in Lancaster County the first school districted listed is Palmyra with a reported mean of 0.0483. This mean indicates that 4.83% of the parcels in the sample are located in the Palmyra School District. The school districts with the highest means are Waverly, Norris and Crete. These districts are the most commonly represented among parcels in the sample. For Sarpy County, the most common school districts represented in the sample are South Sarpy, Gretna, and Papillion-LaVista.

Lancaster County regression models are reported in Table 3. In the first model we simply regress the ratio of use value to market value per acre on a constant and distance. The model of land prices presented earlier in this paper indicates that market value is above use value and that the difference declines with distance from the CBD. As a result, we expect that the ratio of use value to market value should be less than one and rise with distance. Estimation results for Model 1 indicate that the ratio of use value to market value rises with distance, as expected. In Model 5 we regress the natural logarithm of the ratio on a constant and the natural logarithm of distance. With this specification, the estimated coefficient on the distance variable can be interpreted as an elasticity. In elasticity terms, the elasticity of the use value to market value ratio with respect to distance is 0.518. This elasticity indicates that a 10% increase in distance from the CBD has the effect of reducing the ratio by 5.18%.

Model 2 adds the size of the parcel as an explanatory variable. This addition more than doubles the adjusted R^2 of the model, indicating that the variation in the use value market value ratio is more fully explained with size included in the model. The estimated coefficient on the size variable is positive indicating that larger parcels have use-value assessments closer to market value than do smaller parcels, other things being equal. This result lead us to consider whether larger parcels are located at greater distances from the CBD, resulting in a potential problem due to a correlation between distance and size. The pairwise correlation between the two variables is very small, estimated as 0.093, however, indicating that this concern is not noteworthy. This is to be expected if agricultural use values are truly independent of distance to the CBD as indicated in the model of land value fundamentals.

In Model 3 we regress the ratio of use value to market value on a constant, distance and distance squared, checking on the possibility of a non-linear spatial relationship. The estimated coefficient on the square of distance is negative, opposite that for distance, indicating that the ratio rises with distance at a decreasing rate. This is exactly what the model of land prices presented above predicts. Model 4 simply adds the size variable to Model 3. The results remain consistent with those of previous models. The ratio of use value to market value rises with distance at a decreasing rate and size increases the ratio as well.

Model 6 includes a set of dichotomous variables for all but one of the school districts in the county. (The omitted district is Olive Branch G.) Eight of the school district variables have significant coefficients, indicating that parcels located in those districts have a different ratio of use value to market value, other things being equal. The estimated coefficient for the Oak Valley district, a one-room school northwest of Lincoln, is positive. That positive coefficient means that the ratio of use value to market value is higher for parcels in that district, controlling for distance and size of parcel. Hence, Oakview district properties benefit less from use-value assessment. The estimated coefficients for the Waverly, Middle Creek, and Rokeby B district properties are also positive and significant indicating that those properties benefit less from use-value assessment, in relationship to the omitted district. Finally, the Rokeby A, Cheney A, and Cheney E districts have negative and significant coefficients, indicating that properties in those districts have a lower ratio of use value to market value. As a result, properties in that district benefit from use-value assessment to a greater extent, compared to the omitted district.

SARPY COUNTY (OMAHA) STUDY

For the Sarpy County data, a total of 1,343 parcels were included in the assessor's data set. In this case, distances were measured from the intersection of 9th Cass Streets in Omaha. Sarpy County is located on the south side of Omaha and has been in the path of fast residential development moving in south and southwesterly directions out of Omaha. The County contains the cities of Bellevue, Papillion, and LaVista, as well as Offutt Air Force Base.

Table 2 reports descriptive statistics for the Sarpy County data set. The mean ratio of use value to market value is 0.2477 in this case, indicating that land owners in Sarpy County benefit from a 75.23% reduction in assessed value, compared to market value. Comparing the Sarpy County data with that from Lancaster County presented in Table 1, it is clear that use-value assessment is resulting in a much larger reduction in assessments in Sarpy County than in Lancaster County.

Estimation results for the Sarpy County models are reported in Table 4. In this case we found that the ratio of use value to market value also rises with distance from the CBD, although the elasticity is much greater. While the coefficient on distance is small in Model 1, the elasticity estimate from Model 5 indicates an elastic relationship between distance and the ratio of use value to market value. A 10% increase in distance results in a 10.5% increase in the ratio of use value to market value. Thus, the difference between the two values is driven to zero at a faster rate with distance. We find a similar non-linear pattern in Sarpy County as we found in Lancaster County. The ratio of use value to market value rises at a decreasing rate with respect to distance from the CBD. The correlation between size and distance in Sarpy County is also very small, estimated as 0.097, indicating that there is not likely to be any problem including both variables in Models 2, 4, and 6.

Inclusion of the school district dichotomous variables indicates that the ratio of use value to market value is different in four of the districts, other things being equal. The ratio is higher in Omaha, Bellevue, Papillion-LaVista, and South Sarpy districts, compared to the omitted district (Louisville). As a result, we have clear evidence that the ratio of use value to market value is higher for properties in these districts, indicating that use-value assessment provides less benefit to land owners.

7. Summary and Conclusions

Use-value assessment of agricultural land near urban areas is intended as a means to provide property tax relief to agricultural landowners, retain open space at the urban fringe, and retard urban sprawl. While states permit use-value assessment for any or all of these reasons, there are fiscal impacts for local government units that follow this policy decision. School districts, counties, and other units of local government receive less property tax revenue than they would with full market value assessment of the land. The difference in tax revenue to local government units is the use-value tax expenditure.

Our review of the issues related to use-value assessment has provided a theoretical model that demonstrates the difference in market value and use value for land at the fringe of an urban area. With that difference, the tax expenditure can be computed. The theoretical model was then tested using two data sets for the Omaha and Lincoln urban areas. Green belt designation in both urban areas permits use-value assessment of agricultural land and requires that the assessor provide both market value and use value for each parcel. Using that data, we estimated the ratio of use value to market value for parcels as a function of distance, parcel size, and school district location.

Empirical results indicate that the implications of the theoretical model are confirmed. The ratio of use value to market value is less than one and rises at a decreasing rate with distance from the CBD in both communities. Since the ratio of use value to market value is equivalent to the ratio of property taxes under the two assessment regimes, we know that the tax expenditure is large near the CBD and declines with distance. At any given distance from the CBD, our estimated equations can explain the ratio of use value to market value. One minus that ratio represents the proportion of property tax foregone due to use-value assessment. For example, if our model predicts the ratio to be .20 at a given distance, then the use-value tax expenditure is measured as 80% of the tax that would have been collected under a market value assessment standard. The average ratio is 0.639 for properties in Lancaster County and 0.2477 in Sarpy County. Hence, the average tax expenditure is approximately 36% of revenue in Lancaster County and 75% of revenue in Sarpy County.

The estimated models also reveal that the ratio of use value to market value is also affected by school district location. In Lancaster County there are school districts where the ratio is significantly lower as well as districts where it is significantly higher. In Sarpy County there are districts where the ratio is significantly higher. These results indicate that service provision by local school districts also has an impact on the relationship between use value and market value. Of course, use value should be unaffected by school district quality while market value should reflect school district quality. Hence, the ratio of use value to market value would be expected to be lower in high quality school districts and higher in poor quality districts.

The use-value tax expenditure in our case studies amounts to $3.153 million in Lancaster County and is $5.854 million in Sarpy County. That represents an average of $6.42 per acre over 491,524 acres of land in Lancaster County and an average of $59.75 per acre over 97,976 acres of land in Sarpy County.

Our study makes no attempt to determine whether these tax expenditures are justified in terms of benefits provided to community residents as a result of more open space or slower urban growth at the perimeter. Hence, we cannot pass judgment as to whether the tax expenditures are worth while in any meaningful way. We can, however, state accurately for the first time just how large the use value tax expenditure is, and explain how the tax expenditure varies with distance, size of parcel and school district location.

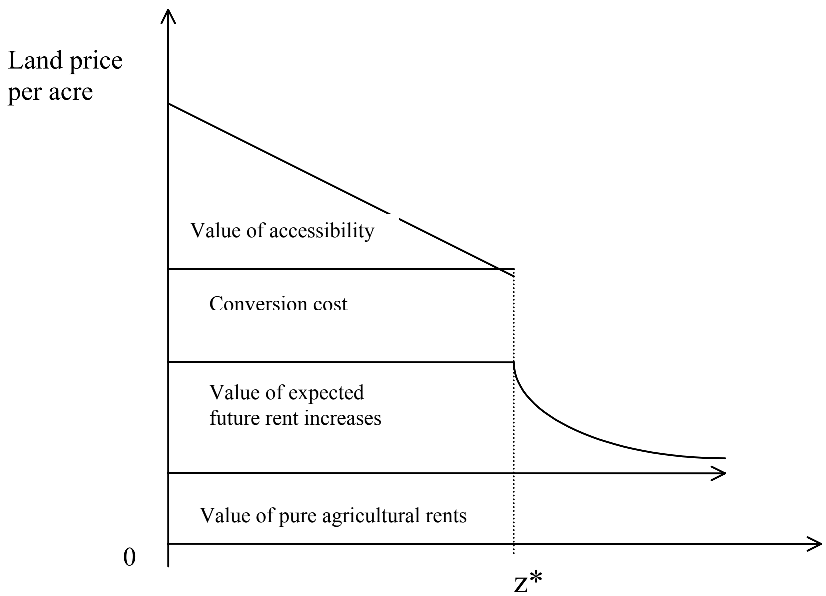


Figure 1: Fundamentals of Land Price

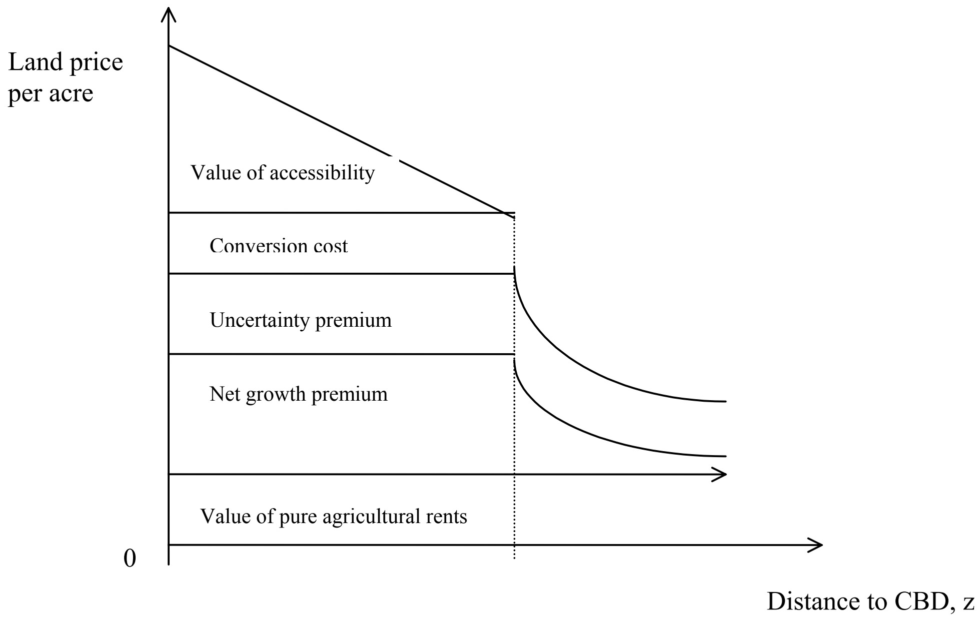


Figure 2: Land Price with Uncertainty and Irreversibility

Table 1
Descriptive Statistics for Lancaster County Data (n=5,691)

Variable	Mean	Standard Deviation	Minimum	Maximum
Ratio of use value to market value per acre	0.639	0.2166	0.0374	1.00
Distance (miles)	13.04	4.19	3.00	24.00
Distance squared (miles squared)	187.55	114.09	9.00	576.00
Distance cubed (miles cubed)	2.92E+3	2.55E+3	27.00	1.38E+4
Size (acres)	86.37	968.32	0.08	73,026.00
Size squared (acres squared)	9.45E+5	2.57E+5	6.40E-3	5.33E+9
Log Distance	2.51	0.35	1.10	3.18
Log Size	4.03	0.84	-2.53	11.20
School District Dichotomous Variables:				
Palmyra	0.0483	0.2145	0.00	1.00
Lincoln	0.0302	0.1712	0.00	1.00
Crete	0.1388	0.3458	0.00	1.00
Milford	0.0060	0.0771	0.00	1.00
Oak Valley	0.0130	0.1133	0.00	1.00
Adams	0.0007	0.0265	0.00	1.00
Waverly	0.2655	0.4416	0.00	1.00
Malcolm	0.0791	0.2699	0.00	1.00
Norris	0.2160	0.4115	0.00	1.00
Raymond Central	0.1125	0.3160	0.00	1.00
Middle Creek	0.0102	0.1004	0.00	1.00
Haines Branch	0.0156	0.1241	0.00	1.00
Rokeby A	0.0065	0.0804	0.00	1.00
Rokeby B	0.0151	0.1220	0.00	1.00
Rokeby C	0.0083	0.0905	0.00	1.00
Cheney A	0.0105	0.1021	0.00	1.00
Cheney B	0.0028	0.0530	0.00	1.00
Cheney D	0.0014	0.0375	0.00	1.00
Cheney E	0.0037	0.0606	0.00	1.00
Olive Branch C	0.0112	0.1055	0.00	1.00

Table 2
Descriptive Statistics for Sarpy County Data (n=1,343)

Variable	Mean	Standard Deviation	Minimum	Maximum
Ratio of use value to market value per acre	0.2477	0.1562	0.0067	1.00
Distance (miles)	16.47	4.35	6.00	25.00
Distance squared (miles squared)	290.22	142.71	36.00	625.00
Distance cubed (miles cubed)	5.40E+3	3.73E+3	216.00	1.56E+4
Size (acres)	72.05	58.91	0.53	455.25
Size squared (acres squared)	8.66E+3	1.56E+4	0.28	2.07E+5
Log Distance	2.76	0.28	1.79	3.22
Log Size	3.89	1.02	-0.63	6.12
School District Dichotomous Variables:				
Omaha	0.0156	0.1241	0.00	1.00
Belleview	0.0491	0.2162	0.00	1.00
Millard	0.0141	0.1181	0.00	1.00
Papillion-LaVista	0.1132	0.3169	0.00	1.00
Loisville	0.0037	0.0609	0.00	1.00
Gretna	0.3343	0.4719	0.00	1.00
South Sarpy	0.4698	0.4993	0.00	1.00

Table 3
Use Value/Market Value Models: Lancaster County

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.37112[a] (0.90977E-2)	0.25324[a] (0.95465E-2)	0.25582[a] (0.24531E-1)	0.15317[a] (0.24030E-1)	-1.8306[a] (0.48089E-1)	0.13167[a] (0.41341E-1)
Distance	0.20509E-1[a] (0.63081E-3)	0.18308E-1[a] (0.60084E-3)	0.39560E-1[a] (0.36705E-2)	0.34889E-1[a] (0.35293E-2)	0.51755[a] [log] (0.18128E-1)	0.32656E-1[a] (0.47339E-2)
Distance Squared			-0.70972E-3[a] (0.12992E-3)	-0.61751E-3[a] (0.12371E-3)		-0.48810E-3[a] (0.16207E-3)
Size		0.19929E-2[a] (0.96697E-4)		0.19886E-2[a] (0.9662E-4)		0.19457E-2[a] (0.94070E-4)
Palmyra						-0.21891E-2 (0.30760E-1)
Lincoln						0.32565E-1 (0.34302E-1)
Crete						0.47108E-2 (0.29715E-1)
Milford						0.11210E-1 (0.35580E-1)
Oak Valley						0.16559[a] (0.36055E-1)
Adams						-0.18071E-2 (0.39686E-1)
Waverly						0.65240E-1[b] (0.29586E-1)
Malcolm						0.29754E-1 (0.30577E-1)
Norris						0.19564E-1 (0.29222E-1)
Raymond Central						0.43361E-1 (0.30064E-1)
Middle Creek						0.65487E-1[c] (0.37409E-1)
Haines Branch						0.17590E-1 (0.33744E-1)
Rokeby A						-0.83556E-1[c] (0.45530E-1)
Rokeby B						0.58970E-1[c] (0.35923E-1)
Rokeby C						-0.51158E-1 (0.36471E-1)
Cheney A						-0.21793[a] (0.36689E-1)
Cheney B						-0.18828[a] (0.39672E-1)

Table 3
Use Value/Market Value Models: Lancaster County, *continued*

Cheney D						-0.6494E-1 (0.85939E-1)
Cheney E						-0.20514[a] (0.47724E-1)
Olive Branch C						-0.19891E-1 (0.31230E-1)
Adjusted R^2	0.157	0.364	0.161	0.367	0.156	0.406

Coefficient estimates are reported with White heteroskedastic-consistent standard errors in parentheses below the coefficient estimates. Superscripts a, b, and c indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Use Value/Market Value Models: Sarpy County

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.011 (0.015)	-0.2775E-2 (0.1500E-1)	-0.3042E-1 (0.4637E-1)	-0.3657E-1 (0.4660)	-4.5261[a] (0.1903)	-0.5829[a] (0.9111E-1)
Distance	0.014[a] (0.909E-3)	0.1405E-1[a] (0.9107E-3)	0.1982E-1[a] (0.6155E-2)	0.1854E-1[a] (0.6230E-2)	1.0524[a] [log] (0.6773E-1)	0.5851[a] (0.9448E-2)
Distance Squared			-0.1668E-3 (0.1942E-3)	-0.1380E-3 (0.1966E-3)		-0.1029E-2[a] (0.2762E-3)
Size		0.2639E-3[a] (0.7049E-4)		0.2623E-3[a] (0.7056E-4)		0.2829E-3[a] (0.6623E-4)
Omaha						0.3547[a] (0.5521E-1)
Bellevue						0.3174[a] (0.5557E-1)
Millard						0.5310E-1 (0.4862E-1)
Papillion-LaVista						0.1928[a] (0.4972E-1)
Gretna						0.7290E-1 (0.4728)
South Sarpy						0.1642[a] (0.4802E-1)
Adjusted R^2	0.160	0.169	0.160	0.169	0.174	0.245

Coefficient estimates are reported with White heteroskedastic-consistent standard errors in parentheses below the coefficient estimates. Superscripts a, b, and c indicate significance at the 1%, 5%, and 10% levels, respectively.

APPENDIX A

The following two pages contain scatter plots of the difference between market value and use value and distance measured in miles to the CBD for both data sets used in the case studies.

Figure 3
Difference Between Market Value and Use Value:
Lancaster County

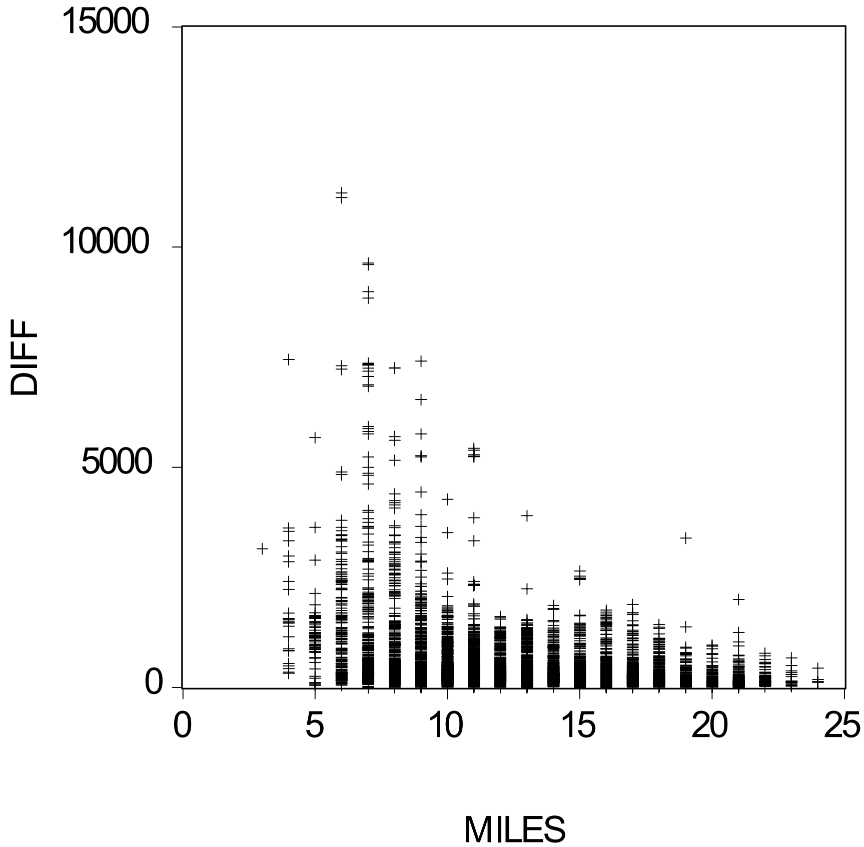
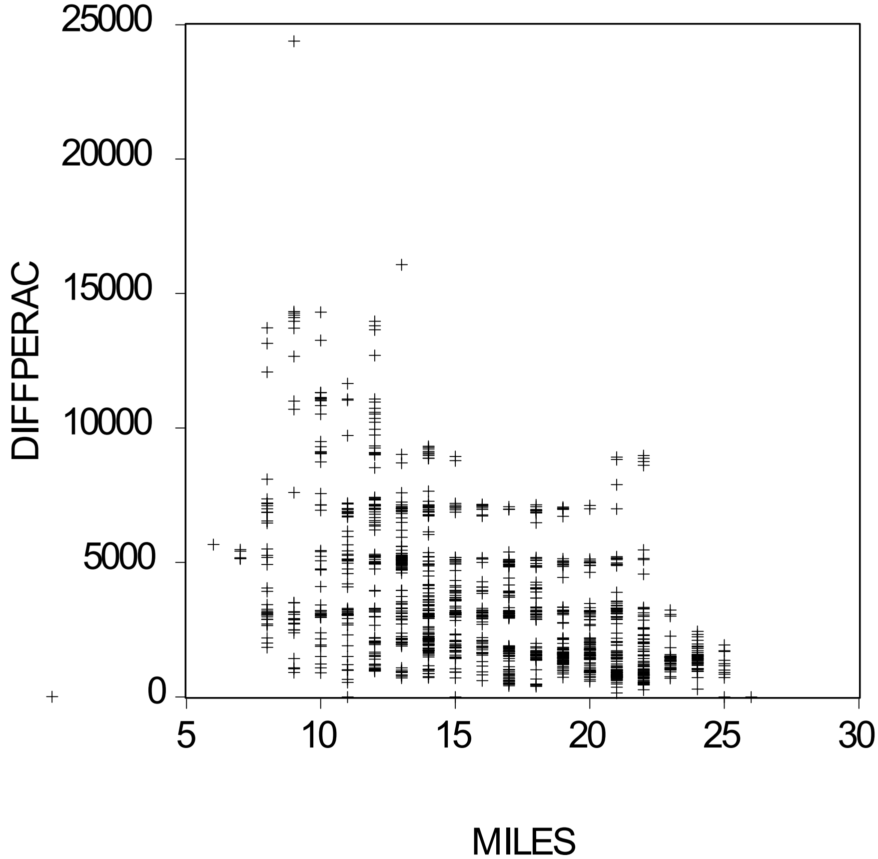


Figure 4
Difference Between Market Value and Use Value:
Sarpy County



APPENDIX B

We also estimated a traditional negative exponential model of the difference between market value and use value per acre as a function of distance to the CBD. In this specification, the logarithm of the difference between market value and use value is regressed on a constant and distance. The estimated coefficient on the distance variable is interpreted as the gradient, representing the percentage rate of change in the price difference with distance. Table 5 reports the estimated coefficients and their standard errors.

The estimated gradients are relatively small (less than one in absolute value) indicating that the difference between market value and use value falls at a slow rate with distance from the CBD. The gradient for Sarpy County is smaller than that for Lancaster County, reflecting the larger metropolitan area and its influence on market values.

Table 5
Negative Exponential Model of Market Value-Use Value Difference per Acre

	Lancaster County	Sarpy County
Constant	7.2456[a]	9.4141[a]
	(0.0463)	(0.7090E-1)
Distance to CBD	-0.1154[a]	-0.9635E-1[a]
	(0.3339E-2)	(0.4094E-2)
R^2	0.193	0.288

Coefficient estimates are reported with White heteroskedastic-consistent standard errors in parentheses below the coefficient estimates. Superscripts a, b, and c indicate significance at the 1%, 5%, and 10% levels, respectively.

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