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**Commodity
Costs and Returns
Estimation
Handbook**

A Report of the AAEA Task Force on Commodity Costs and Returns

July 20, 1998

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CHAPTER 7

LAND

Land is the solid part of the earth's surface. Its value in agriculture is tied to its capacity for providing services used to produce an agricultural product. Part of land's agricultural use value is a result of the climate that dictates the length of the growing season, available rainfall, and other determinants of the crops that can be produced and the risk involved.

Land has at least two distinguishing characteristics. The first is its location fixity. As a result of land's location fixity, if the control of land is to be transferred, the users of the land must relocate their production activities. Land's second distinguishing characteristic is its ability to maintain over time and use its physical qualities that give it value. **Capital** was defined in Chapter 2 as a stock that is not used up during a single production period, provides services over time, and retains a unique identity. Land is thus clearly a capital input. And because land can exist for a long time without significant deterioration, it is also considered to be a durable input as discussed in Chapter 6. Land that can exist for an infinitely long time without significant deterioration is referred to as an infinitely lived durable.

Most analysts recognize that the two properties of land, location fixity and long if not infinite life, are approximations of reality. For example, land in sod farms is indeed transferrable. Moreover, lack of proper maintenance may result in land losing some of its physical properties that give it value in a short period of time. Still, land serves as a reference point for defining an asset whose physical properties are long lasting and cannot be moved except with considerable effort and cost that is usually considered prohibitive.

Land is differentiated from real estate inasmuch as real estate includes capital structures attached to the land. Capital structures such as buildings, grain bins, and fences are durable assets that can be removed and their services obtained at a different location. These types of structures are treated as durable assets and are not included in the costs or services of land. Other capital structures that are a part of real estate such as wells, terraces, levees, leveling, and tiling become part of the land and acquire its properties of being immovable and durable. These investments are not transferrable but depreciate over time. Because services of these investments cannot be transferred to another location, even though they can be removed (negative salvage value), they are usually treated as part of the land. When rental rates are used to estimate the cost of land use, the cost of these investments will typically be included in the rental rate. If the cost of land use is estimated using an ownership approach, these capital items should be handled using capital recovery as discussed in Chapter 6. If land preparation costs are specific to a given enterprise and are used up over several production periods, they should be handled as preproductive costs as considered in Chapter 10. Water rights may be considered part of land if these rights are not transferrable; or, they may be considered to be separate from land if they can be separated from the land, as discussed in Chapter 9.

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TERMS AND DEFINITIONS

A distinction between land's agricultural use value and its market value is required to measure costs and returns (CARs) associated with agricultural land use. It is also important to recognize that in some cases, the agricultural use value of land differs from its market value. One explanation for the difference may be the expectation that land will be used in nonagricultural activities beginning at some future date. For example, land close to an urban center may have a high price based on expected value in residential housing. Another explanation is that land earns nonagricultural returns concurrently with agricultural returns as may be the case where a producer is able to extract a payment during winter months for hunting or trapping. The importance of distinguishing between land's agricultural use value and its market value is that not all CARs associated with land should be charged to land's agricultural use.

Ownership of land entitles an individual to the control of the sum total of natural and manmade resources associated with the land (Barlowe: 8). What is being controlled is a resource with value that if liquidated would, with the passage of time, generate a return. The value of this resource, as has been stated already, is its current agricultural use value. The foregone return associated with land's agricultural use represents land's opportunity cost. Conceptually, the opportunity cost of land would be approximated by multiplying the current agricultural value of the land by an appropriate interest rate, thus giving a perpetuity with the same present value as ownership of the land's agricultural use value. A more detailed discussion of interest rate choice is presented in Chapter 2. Finally, opportunity cost is not the same as the cost of financing land. Financing land purchases is not part of land ownership costs because land purchases reflect alternative means of acquiring or controlling land and are often tied to acquisition costs rather than use values. Moreover, trade-offs are often made between the sale price of land and the interest rate charged, as in some land contract sales.

Besides opportunity cost, property taxes are the other major cost of owning land. Consistent with the distinction between agricultural use value and land's market value, only the portion of property taxes reflecting land's agricultural use value should be included as an agricultural land cost. Several states have no property tax. Many other states already have some form of a greenbelt tax law in which agricultural land is taxed at its agricultural use value.

The **maintenance costs** of holding a capital asset such as land are the expenses required to maintain the service potential of the asset at a reasonable level and to extract services for a single time period. Maintenance costs for land are thus those costs required to restore land to its approximate service potential at the beginning of the period or to prevent its deterioration during the period. Whether or not they are actually incurred is immaterial. They represent costs associated with actual deterioration or the cost of preventing deterioration of land and should be accounted for in cost estimates of using and controlling land. Land incurs **service reduction costs** because the **service capacity of land is altered** as a result of use or the passage of time. Costs required to restore service capacity as a result of use are referred to as **user costs**. Losses in service capacity as a result of the **passage of time** are referred to as **time costs**.

ESTIMATING THE VALUE OF LAND'S AGRICULTURAL CONTRIBUTIONS

In practice, it may be difficult to estimate separately the opportunity costs, user costs, time costs, property taxes associated with agricultural use value, and other overhead costs (general liability insurance, irrigation district assessments independent of water use, etc.) of holding land (Robison and Koenig). Property taxes associated with the agricultural use value of land require precise measurement of land's agricultural use value, which is not easily obtained. For the same reason, we are often unable to estimate precisely opportunity costs associated with land. Finally, use or time costs are difficult to measure when land markets are thin and do not provide a sufficient number of observations to make reliable estimates. At the same time, there are active land markets in many areas, and in areas with less active markets, rural appraisers, farm management consultants, and local producers may be able to approximate the agricultural value of land currently being used for agricultural production.

A problem similar to separating land's agricultural use value from its market value is encountered when decision makers desire to construct enterprise CAR estimates when more than one enterprise share the use of the land. Because land costs are frequently calculated as a residual measure, any attempt to allocate returns from enterprises using the same land allocated between the several factors of production including labor, management, risk, capital, and land will be arbitrary.

Land Tenure Considerations

Access to rights to use of land may be gained through alternative tenure arrangements. These may be acquired through ownership, cash rental for a specified period, or share rental for a specified period and use. The tenure method used to acquire rights to use of land affects production risks, production costs, and production returns to both the entrepreneur and land owner. Modal tenure patterns for rights to land use differ greatly among geographic areas and among land quality within areas as well as among production enterprises within areas.

The owner-operator receives the full return from production of the enterprise, experiences all cash costs associated with production, bears all production risks, and experiences both cash and noncash costs of land ownership and maintenance. The owner-operator views the costs of land as a fixed residual cost, and treats them as such in production decisions. These land costs include all land directly associated with production enterprises as well as land associated with the firm as an entity used for service areas and waste lands not suitable for production.

The cash rent tenant-operator receives the full return from production of the enterprise, experiences all cash costs associated with production, including a cash cost for land use, and bears all production risks. The land use cost is thus a variable cash cost to the cash rent tenant-operator and is treated as such in production decisions. The cash rental charge may reflect only production acreage or total land area in the farm unit, depending on whether the contract was for production of a specific enterprise or for the farm unit including service areas. **It is extremely important to determine whether a cash rental rate is for tillable (and expected to be planted) acres or for total acres including acres not devoted to production because this will affect the cost of land per productive acre.** The landowner renting the use of land on a cash rent basis experiences no production risks and receives a fixed rate of return for the time period specified in the rental contract, subject to variations in

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supplemental returns associated with program payments for government-supported crops. The costs of land to the landowner who cash rents production rights to a tenant are reflected as a fixed residual cost to the landowner, subject to variations in maintenance costs that may be specified in the cash rental contract.

Share rental tenure arrangements are much more complex and vary greatly among production enterprises, land quality, and geographic areas. Share rental arrangements substantially alter both cost structure and production risk for both landowner and tenant. Both landowner and tenant share production returns and production risks, the proportionate shares for each varying by production enterprise, land quality, and proportion of cash production expenses shared. Production risk may be altered by the proportionate shares of selected cash production costs borne by each. Thus the share tenant-operator receives only part of the production returns and experiences land use costs as a variable reduction in receipts. The tenant-operator bears all or part of the cash production expenses, dependent upon terms of the share rental contract, and faces a substantially altered marginal cost–marginal returns structure compared to the owner-operator or cash tenant-operator. The landowner in a share rental tenure arrangement is a much more active participant in agriculture production activities than the landowner in a cash rental tenure arrangement. The costs of land use are reflected to the landowner in a share rental tenure arrangement as a fixed residual cost, and are treated as such in production decisions.

ESTIMATING LAND COSTS

All the land cost estimation complexities described in the previous section lead us to look for alternative ways to estimate costs associated with the use of land in agricultural production. Since land tenure patterns differ substantially among regions and type-of-farming situations, it may be appropriate to use different procedures for estimating land costs in order to minimize bias in land cost estimates among situations.

Alternative 1 for Estimating Land Costs

Cash rent paid for land used to produce an agricultural product best measures the sum of opportunity costs, time costs, user costs, property taxes, and other overhead costs associated with land's agricultural use value in those situations where a significant proportion of the agricultural land is farmed under cash rental tenure. Cash rent paid for the use of land in agricultural production is the amount of compensation the land owner requires from the tenant to pay for property taxes on the agricultural use value of the land, opportunity costs, time costs, and user costs. Because the tenant does not receive capital gains on the land, cash rent does not include the value of anticipated gains (losses) due to inflation or potential future nonagricultural use of the land. Rental rates also reflect what tenants are willing to pay to avoid the payment of property taxes on the land they intend to use for producing agricultural products and to avoid the payment of opportunity costs (on the agricultural value), time costs, and user costs.

Cash rent does not include payments to financial capital, risk, and management, because in most cases the tenant is not acquiring them and would not be willing to pay for them. Only if the landlord absorbs some of the production risk, supplies capital, or provides management does the rental rate

include charges for these factors of production. In a share rental agreement, for example, the landlord is sharing in the production risk and the payment he/she receives must compensate for the risk. But in a typical cash rental agreement, the tenant is acquiring only the temporary use of the land to produce an agricultural product and therefore is willing to pay for only the land's services used in agricultural production during the production period. Thus, the rental rate willingly paid by the tenant and accepted by the landlord is the best estimate of land's agricultural use for use in CAR estimation.

Cash rental rates are probably the most reflective indicator of current market conditions in agricultural production areas where a significant proportion of the agricultural land is farmed under cash rental tenure. However, these estimates suffer bias resulting from a number of factors. Cash rental rates usually apply to the use of the land for a specific agricultural production enterprise, with the rental charge differing among enterprises. All agricultural production enterprises do not share proportionately in the land rental market, whether it be cash or share rent. Some enterprises are predominantly cash rent whereas others are predominantly share rent, differing by geographic area. In some geographic areas the cash rental market represents such a small portion of the agricultural land that cash rental rates do not reflect production values of land, but rather tend to reflect land of marginal quality or, frequently, favorable treatment in family land use transactions. As mentioned previously, it is important to determine what is included in "one acre" of land. The effective cost to the production enterprise will differ depending on the whether this acre contains grass waterways, extensive headlands, irrigation ditches, buffer strips, or windbreaks, power lines (or substations), and/or barren hilltops.

Alternative 2 for Estimating Land Costs

In some situations, share rentals may provide the most accurate reflection of current market use value for land, particularly in areas where share rental is prevalent for particular production enterprises. Because share rental arrangements are quite flexible, differing among individuals in the proportions and specific production costs shared, modal or typical rental rates are more difficult to identify and quantify. Estimates will suffer from bias because, frequently, the cost sharing consists of cash costs for the landowner and both cash and noncash costs for the tenant. While share rental rates can be converted to a cash-equivalent value, they should not be treated as cash rents because they affect CARs for both the tenant and the landlord.

The following example illustrates the calculation of a cash-equivalent value for a share rental arrangement. Assume a two-fifths crop-share agreement for soybean production where the landlord receives 40% of the receipts and pays 40% of the cost of seed, pesticide, and insurance. Further assume a soybean yield of 42 bushels per acre valued at \$5.50 per bushel, and seed, pesticide, and crop insurance expenditures amounting to \$27.08 per acre. The calculated cash-equivalent land rental value would then be \$81.57 $[(0.4)(42)(\$5.50) - (0.4)(\$27.08) = \$81.57]$. In this situation the share tenant experiences a reduction in cash receipts of \$92.40 and a reduction of \$10.84 in cash operating costs in lieu of a cash rental payment.

Alternative 3 for Estimating Land Costs

In areas where farmland is operated almost exclusively by owner-operators, rental rates may not provide meaningful estimates of fair market value. When reasonable estimates of the market price of

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land for agricultural purposes can be obtained, an implicit annual rental fee can be obtained using standard capitalization techniques. The market price of land for agricultural purposes times the real interest rate (adjusted for risk), plus annual maintenance costs, plus annual net real estate tax will provide the least biased estimate of annual real use cost. A real interest rate is appropriate for capitalization because the Task Force suggests that all CAR estimates be in real (and nominal) terms as of the end of the production period, and that all CAR streams outside of the current period be estimated in real terms. The appropriate choice of a real interest rate is discussed in Chapter 2. Following the conventions established in Chapters 2 and 6, the land value used should be in end-of-year terms so that the implied annual payment represents the real end-of-year value for holding the land for one year. If the agricultural land value is in beginning-of-year terms, it should be multiplied by the current inflation rate to put it in end-of-year terms before computing the opportunity cost equivalent. As an example, consider an acre of land with an agricultural value of \$2,163 per acre as of the end of the year. If the real interest rate adjusted for risk in agriculture is 5%, then the implied opportunity cost is \$108.15 per acre. Charges for property taxes (say \$20 per acre) and maintenance (say \$3 for fence row weed control) would bring the annual cost of using the land to \$131.15 per acre. If the value of the land in beginning-of-year dollars was \$2,100, it should be adjusted to the end of the year by the inflation rate. If the inflation rate was 3% per year this would give an end-of-year value of \$2,163 and an implied opportunity cost of \$108.15.

Alternative 4 for Estimating Land Costs

When market sales of land that represent agricultural use value are not available, a more complex procedure is required to obtain reasonable estimates of agricultural use cost. This means that it is necessary to accurately assess land use in the areas by identifying the proportion of total land in farms that is used for production enterprises and identifying the proportion of production acreage devoted to each production enterprise. A relevant current period must be specified for defining yields and production costs to be used in calculating the annual returns to land for each production enterprise and computing a composite annual rent value. This composite per acre value would be equivalent to a cash rent value and would require no adjustments for taxes or maintenance costs because it represents agricultural returns to ownership. As was the case for alternative 3, the land use cost is a residual claimant for the owner-operator, even though it is composed of both cash and noncash components.

The following is an example of the procedure for computing a composite per acre cash rental value estimate. Assume an agricultural production region for which corn and soybeans are the two predominant crops. Further assume that 50% of the land area is planted to corn, 40% is planted to soybeans and 10% is devoted to service areas, drainage ways, and waste. Additionally assume that based on the most recent five-year period for yields and costs, CAR estimates provide estimated per acre annual net rents of \$85.00 for corn production and \$70.00 for soybean production. The calculated composite cash-equivalent annual rental value would be \$70.50 $[(0.5)(\$85) + (0.4)(\$70) + (0.1)(\$0)]$.

CONCLUSION

Several alternative methods for estimating the cost of land use in agricultural production have been presented. These include cash rental rates, cash-equivalent values based on share rental agreements,

estimating land's agricultural use value directly by summing opportunity costs, property taxes, time costs, and use costs, and a composite rental rate for all commodities in a certain geographic area.

The Task Force's preferred measure of the cost of land used in agricultural production is the cash rental rate where a significant proportion of the agricultural land is farmed under cash rental tenure.

Regardless of the method chosen for estimating user costs of land, it is imperative that appropriate adjustments be made to account for nonagricultural factors in value and/or cost; differentiation between land area directly devoted to production enterprises and land associated with the farm firm unit; and shared returns/costs associated with tenure arrangements, marketing agreements or contracts, and government program participation. Ignoring these factors or making superficial adjustments for their influence will result in substantially biased estimates that render comparative land user costs among regions and among tenure groups within a region meaningless.

