Costs and Returns: Economic and Accounting Concepts

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Abstract

This article reviews economic and accounting bases for costs-of-production (COP) calculations It finds that the problems of circularity of arguments, potential cost-price spirals, and escalating land values are inherent in all full COP methods of setting support prices Inflation, income tax regulations, and credit usage interact to distort the traditional relationships between cash costs and cash returns, thus requiring explicit correction in COP calculations

Keywords

Costs of production, opportunity costs, inflation, credit, income taxation, land values

Introduction

The U S Department of Agriculture is required to calculate costs-of-production (COP) indicators that the Secretary of Agriculture may use to set support prices for major crops and must use to adjust price supports for peanuts

COP statistics rely heavily on economic theory because over half of production costs are imputed from returns to labor, management, and land—which should be justified by theory But, what does economic theory say about imputing returns? In general, the return to an input should equal the return it would earn in its next best use—its opportunity cost However, what is the next best use of a specialized input, such as agricultural land? Economic theory also says that costs of specialized inputs cannot be determined independently of the demand for the product (*2, 6*) [1] The opportunity cost concept is difficult to apply to all specialized inputs, including those specialized to agriculture

If the difficulties inherent in the imputation lead to cost estimates that are too high or too low and if these estimates influence target prices, artificially induced price spirals may result In this article, I discuss common accounting and economic frameworks used in COP work, illustrate some of the general problems that can result from miscalculating or misusing estimates, and illustrate how inflation and taxation create specific problems that must be corrected in COP calculations

Accounting and Economic Costs of Production

To illustrate the accounting concepts underlying both the accounting and economic approaches to COP analyses, I use as an example a 300-acre corn farm with yields and costs representing the 1980 corn COP estimates The yield was set at 90 5 bushels per acre, operator and family labor input was assumed to be exactly 971 hours, the price received per bushel was $3 82, exactly equal to costs for an owner valuing land at current value, and the owner was assumed to withdraw only the labor and management returns

Accounting Costs of Production

Costs and returns in an accounting sense arise in the operating statement and in the book- and market-value balance sheets Table 1 forms a single account using summary information from these three statements The consolidated account is composed of inflow items (not necessarily returns) and outflow items (not necessarily costs) The entries correspond to the COP methodology established in the 1973 Agriculture and Consumer Protection Act

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[1] Italicized numbers in parentheses refer to items in the References at the end of this article

Table 1—Accounting costs and returns framework, 300-acre corn farm, 1980 hypothetical data

Inflow items	Dollars	Outflow and residual items	Dollars
Cash items		Expense items	
Farm marketings	103,713	Cash production expenditures	35,175
Government payments	—	Business taxes paid	1,119
Borrowings	—	Interest paid	47,379
Sales of capital assets	—	Subtotal, cash expenses	83,673
Owner contributions	—	In kind payments	—
Subtotal, cash inflow	103,713	Capital consumption allowances	10,266
Noncash items		Subtotal, noncash expenses	10,266
In-kind receipts	—	Total production expenses	93,939
Net inventory change	—	Owner withdrawal items	
Total value of capital assets purchased	—	Consumption	9,774
In-kind investments	—	Income taxes paid	—
Undistributed capital appreciation	—	Off-farm investment	—
Subtotal, noncash items	—	Subtotal owner withdrawals	9,774
Grand total inflow	103,713	Residual investment items	
		Principal payments	—
		Net capital asset purchases	—
		In-kind investments	—
		Undistributed capital appreciation	—
		Undistributed return to equity	—
		Subtotal, residual investment	—
		Grand total outflow and residual investment	103,713

— Indicates items not considered in the COP methods from the 1973 act

In this accounting framework, the cost of production would be the total production expenses line divided by the appropriate production unit divisor ($93,939/300 acres = $313 13 per acre or $93,939/27,150 bushels = $3 46 per bushel) The net returns to the business owner are, correspondingly, the sum of residual investment and owner withdrawal items ($9,774/300 acres = $32 58 per acre, or $9,774/27,150 bushels = $0 36 per bushel)

Half the cells in table 1 are not filled or, as required by the 1973 act, are filled with values appropriate only for an operator with zero equity and using "interest only" loans Some of the problems in the methods have been corrected (see Gustafson and Hoffman's article in this issue), but some have not Ownership and benefits of capital asset appreciation are ignored, as are principal payments, in-kind receipts, and income taxes The COP methods do not consider the inventories held by operators Unfilled data cells and unrealistic assumptions mean that true economic costs and economic returns cannot be identified For example, if the interest paid specifically allows a farmer to own land that is appreciating in value, is the interest payment a cost, an investment, or both?

Economic Costs of Production

To adapt this accounting framework to an economic analysis of responses and price relationships, economists have substituted the opportunity cost princi-

ple (what the asset could earn in its next best alternative use) for the accountant's use of receipts, expenditures, and market values Using the same 300-acre corn farm portrayed in the accounting framework and in the 1980 corn COP estimates, we obtain the total COP estimates in table 2

Table 2—Economic cost of production framework, 300-acre corn farm, 1980 hypothetical data

Item	Dollars
Cash production expenses	35,175
+ Capital cost allowances	10,266
+ Business taxes paid	1,119
+ Opportunity cost of 971 25 hours of labor @ $4 00	3,885
+ Opportunity cost of management	5,889
+ Opportunity cost of $473,790 capital invested @ 10 percent	47,379
= Total cost	103,713
Full cost of production (including return to operator)	
$103,713/300 acres =	345 71 per acre
$103,713/27,150 bushels =	3 82 per bushel

Viewed another way, farmers and economists use these same assumptions and procedures to determine the value of the assets used in farming Table 3 uses the same example, assumes the price received per bushel of corn was exactly $3 82, and derives the value of the assets used by this farm

Table 3—Valuation of assets, 300-acre corn farm, 1980 hypothetical data

Item	Dollars
Total revenue	103,713
− Business taxes paid	−1,119
− Capital cost allowances	−10,266
− Cash production expenses	−35,175
= Gross margin	57,153
− Opportunity cost of farmer's labor	−3,885
− Opportunity cost of management	−5,889
= Annual cash return to assets	47,379
Capitalizing this annual cash return at 10 percent [1]	
$47,379/ 10 = Value of assets	473,790

[1]Assumes the opportunity rate of return on capital is 10 percent

Some General Problems

Three considerations render this economic COP framework problematic for policy formulation (1) the circularity of the calculations, (2) the potential for price spirals, and (3) the incidence of any price spirals primarily on land values (regardless of their source)

Circularity

Tables 2 and 3 show that, if one uses the same assumptions in valuing assets as in calculating costs of production, then the costs of production will *always* exactly equal the price received for whatever period of time one uses—1 year, 5 years, or any other period Teigen (*7*) most recently demonstrated this relationship Others stated it as far back as 1919 (see (*1*), p 251, (*3*), p 421)

Price Costs Spirals

If COP calculations use different assumptions than farmers (or investors in farm assets) use in valuing their time and assets, then the COP estimates will necessarily differ from the price received for the product If a higher COP estimate is then used to set prices, continuous price spirals are possible For example, suppose that farmers (possibly because of tax shelter benefits or expected future increases in the net returns to invested capital) are willing to accept a 5-percent return on their capital instead of the 10-percent return assumed in the COP methods; then, in the asset valuation calculations in table 3, the $47,379 annual cash return to assets becomes capitalized into a value of assets of $947,580 The market value of assets would rapidly adjust to this new level If the $947,580 value of assets is then used in COP calculations for a subsequent year, production costs, as calculated by the formula, will rise to $5 56 per bushel If price is then set at the $5 56 per bushel cost of production, the farmer's annual cash flow attributable to assets will rise to $94,758, which again capitalized at 5 percent would yield asset values of $1,895,160 Again, the market value of these assets would rapidly adjust toward this figure If price is again set according to the new value of assets in the COP formula, the cost of production will be $9 05 This is the price escalator that can result from employing *any* unwarranted assumptions about desired rates of return or asset

values—not just the desired rate of return on land or physical assets

Incidence on Land Prices

Finally, if any unwarranted assumptions are made—in valuing labor, management, durable inputs, or any other inputs—the resulting price spiral will overwhelmingly come to rest in increased prices for land (unless some durable, transferable pseudo factor, such as a quota or production license is established) This situation results because land is the most durable, least reproducible, and most inelastically supplied factor of production Indeed, if the longrun supply of other factors is perfectly elastic, *all* the price adjustments will accrue to land values

Some Specific Problems: Inflation and Taxation

By the late seventies, farmers believed inflation was a relatively permanent part of the economic environment facing agriculture The interaction of inflation, credit use, and taxation provided economic opportunities that changed the behavior of investors in farmland These behavioral changes alter the way the economic system performs and have strong implications for COP analysis methods (*5*)

The interaction of inflation, credit use, and taxation has recently been found to

1 Create a permanent split of returns between current cash income and capital asset appreciation (*4*),
2 Depress the apparent current cash returns to farmland ownership (*5*), and
3 Reduce reportable and taxable incomes in agriculture

Land Value Capitalization Formula

I derived the capitalization formula used in this analysis from Melichar (*4*) by considering tax savings as equivalent to increases in annual net returns to land The Melichar formula for maximum bid price is

$$V_o = R_o \frac{1+f}{r-f} \qquad (1)$$

where

V_o = the value of the asset in year o,
R_o = expected net return to the asset in year o,
f = expected rate of growth of net returns (equals expected inflation in this example), and
r = required rate of return

Under the simple and realistic assumption that investors hold the land until death (thereby escaping capital gains taxation), both the capital gains and the annual net return from land investment escape taxation The former escapes through the "stepped-up basis," and the latter escapes through cash basis accounting for tax purposes and negative net cash flows Beyond sheltering its own income from taxation, the negative net cash flows also reduce tax liability on other income

The annual tax savings ($\triangle t$) per dollar of investment (V) is

$$\frac{\triangle t}{V} = m\, d\, i \qquad (2)$$

where

m = the marginal tax bracket,
d = the proportion of purchase price financed, and
i = the interest rate on borrowed funds

These annual tax savings decline as the loan principal is paid off Total tax savings are thus limited by a parameter, θ, which reflects the terms and length of the loan and the rate at which it is paid This parameter may require approximation of complex amortization schedules and discount formulas In this example, *we* simply assume θ to be 10 0 (implying total benefits are 10 times annual benefits) Combining the total tax savings benefit with the Melichar formula gives

$$V = (1 + m \cdot d \cdot i \cdot \theta) R_o \frac{1+f}{r-f} \qquad (3)$$

which describes the maximum bidding potential of rational investors expecting constant inflation, expecting to keep their land until death, and valuing each $1 of estate passed on to their heirs the same

as each $1 of wealth accumulated during their lifetime

Inflation, Credit, and Taxation Interactions

Throughout this section, I use this model of land valuation to successively illustrate the effects of inflation, credit, and taxation on land values and apparent rates of return Table 4 depicts six ownership situations illustrating different combinations of inflation, debt financing, and tax rates for an identical acre of farmland, and it displays the resulting returns to prospective purchasers, and hence the capitalized value of the land under each ownership situation For example, an operator (situation 5) with a 20-percent marginal tax rate who financed 80 percent of an acre's value would capitalize it at $1,248, using equation (3) Applying the 5-percent inflation rate yields a $62 40 annual capital appreciation for a total economic return of $162 40, given the expected $100 net cash return However, interest payments of $154 75 exceed the cash return by $54 75 Applying the 20-percent tax rate to the excess payment yields tax benefits of $10 95 If only the annual net (cash) return to land were considered, the apparent annual rate of return to land would be 8 01 percent ($100/$1,248) In each situation, the effective rate of return from the income sources considered is assumed to be 10 percent

The ideal situation—how the capital, credit, and taxation systems are supposed to work—is illustrated by comparison of situations 1 and 2 [2] With no inflation, all the net return to land would be taxable and would cover the interest on debt-encumbered land The difference in taxable cash flows for debt-free versus indebted farm operators would accurately reflect their net incomes The value of the land to each potential purchaser would be the same, and the current apparent rate of return on farmland would equal the interest rate on borrowed funds—all just as economic theory says they should be Under these circumstances, a COP accounting system based solely on market returns would accurately reflect the costs and income positions of various farm owners and operators

[2] In each situation, it is assumed that all potential purchasers of land are as described

Inflationary Growth in Net Returns. One economic effect of general inflation is that it raises the interest rates required by rational savers and investors by the expected amount of general inflation Higher expected rates of inflation thereby increase the interest rates lenders charge We can compare situation 1 with situation 3 to isolate the effects of an expected 5-percent inflation rate Farmers (and investors) will likely raise their required rate of return to account for expected inflation (to (1 05) (1 10) − 1 0 = 0 155 = 15 5 percent)

Now, in addition to the $100 annual net return to land, owners receive an additional $50 in capital appreciation on the value of the land they own This amount is an "unrealized capital gain", it is not received in cash, it does not show up in a cash accounting system, nor is it taxed as income But, it does add to the owner's wealth, and it can be used as collateral for borrowing to expand the farm or to weather a period of adverse prices or production Because the unrealized capital gain exactly offsets the deterioration in purchasing power of the dollar, the first-year value of the land under this situation would remain at $1,000 for a rational investor, and the current (apparent) rate of return of this acre of farmland would remain at 10 percent But, the land would appreciate each year at exactly the 5-percent inflation rate

Negative Cash Flows. Comparing situation 3 with situation 4 shows another impact of inflation—namely, negative cash flows If a parcel of land which returns $100 per year is purchased for $1,000, of which 80 percent ($800) is debt-financed at 15 5-percent interest, then the cash outflow ($124) for this acre would exceed its cash inflow ($100) The overall economic rate of return would still be favorable because the value of the land will increase $50 per year, for a combined return of $150 Thus, although the transaction would be profitable, it would have to be subsidized from other income sources, such as off-farm income or income from land already owned for which the cash flow was positive Observe that the cash flow accounting system is no longer applicable, it shows a negative $24 net income for the transactions even though the transaction is still profitable A cash accounting system which uses the purchase price of assets as an opportunity cost and actual interest payments as cash costs would translate these negative cash flows into higher costs of production

Table 4—Components of annual returns of farmland and capitalized value of land to different classes of owners, hypothetical data[1]

Ownership situation	Expected annual net return to land	Capitalized value of land[2]	Expected annual capital appreciation of land	Expected annual economic return, excluding tax benefits	Annual interest payments	Expected taxable annual net cash flow	Expected net annual tax benefits	Current apparent annual rate of returns to land
	Dollars per year[3]							*Percent*
(1) No inflation, debt free purchase	100	1,000	0	100	0	100	N A	10
(2) No inflation, 80-percent debt purchase @10-percent interest	100	1,000	0	100	80	20	N A	10
(3) 5-percent inflation, debt-free purchase	100	1,000	50	150	0	100	N A	10
(4) 5 percent inflation, 80 percent purchases @15 5-percent interest, disregarding tax benefits on valuation of land[4]	100	1,000	50	150	124	−24	N A	10
(5) 5-percent inflation, 80 percent debt purchase @15 5 percent interest, 20 percent marginal tax bracket[4]	100	1,248	62 40	162 40	154 75	−54 73	10 95	8 01
(6) 5-percent inflation, 80-percent purchase @15 5 percent interest, 50 percent marginal tax bracket[4]	100	1,620	81 00	181 00	200 88	−100 88	50 44	6 17

N A = Not applicable

[1]Based on a simplified capitalization formula for land that is assumed to be held until death of owner

$$V = (1 + m\ d\ i\ \theta)\, R_o \frac{1+f}{r-f}$$

where m = marginal tax bracket of purchaser (0, 20 percent, 50 percent),
V = present value of asset,
f = expected inflation rate of net returns to land (0, 5 percent),
r = discount rate (required rate of return, 10 percent),
θ = factor that represents length of loan rate at which it will be paid off (10 0),
d = percentage of purchase price financed (0, 80 percent),
R_o = first-year annual net return to land ($100), and
i = interest rate on borrowed funds (10 percent, 15 5 percent),

[2]Stated as capitalized (present) value of an additional acre of land, assuming all potential purchases are as described in the situation in the table stub

[3]Stated as first year values Under inflationary conditions, returns grow each year at the assumed inflation rate, annual interest payments decline as loans are paid off, and taxable cash flows consequently increase faster than the inflation rate

[4]Because of expected future inflation, rational savers and lenders increase the interest rates they demand, this is the "Fisher Effect" Similarly, rational investors raise their required rates of return by the same amount

Tax Effects. Income tax effects are a fourth result of inflation and credit use Because of (1) the deductibility of interest payments in deriving taxable net incomes and (2) the negative cash flows that occur with debt-financed farm expansion, tax reduction benefits may result from expanding a farm with debt financing Furthermore, the higher the marginal tax bracket of the investor, the larger the benefits

Comparing situations 5 and 6 with situation 4 shows the effects of considering the tax avoidance benefits of investment in farmland The negative cash flows reduce the purchaser's current taxable income If the land is later sold, the seller then incurs a liability for capital gains tax (at 40 percent of normal income tax rates) Thus, investing in farmland can be used to defer taxes and convert current income into more favorably taxed capital gains Equally important, purchasers can use such investments to avoid any income tax by holding the land until their death The value of the land at death is "stepped up" to the fair market value of the land at the time of death, and no income taxes would be due The wealth accumulated (the higher value of land) would still be subject to the provisions of the Estate Tax (which are more liberal for estates consisting largely of farmland than for other types of estates), but both the income sheltered by negative cash flows and the capital appreciation of the assets will have escaped taxation as income

This method of reducing current income taxes by investing in farmland by use of debt capital helps explain why 91 percent of new land purchases involve debt financing and 78 percent of the value of such land purchases are encumbered by debt (1980 figures)

One can understand the overall impact of all of these forces—inflation, credit, and tax avoidance—by comparing situation 1 with situations 5 and 6 To a rational investor, the same acre of land increases in first-year value from $1,000 to as much as $1,620 if one successively considers inflation, interest deductions from use of credit, and the income tax-sheltering aspects of farmland investment for taxpayers in different marginal tax brackets [8]

[8] If investors expect real growth in net returns to land (that is, if the rate of growth of net returns is expected to exceed the inflation rate), then land values can increase from these figures (see (4))

Apparent Rates of Return. The last column of table 4 also illustrates why a cash receipts and expenditures accounting system is not reliable for estimating costs of production during inflationary periods Over this same progression, the current apparent rate of return to land (which would be reflected in a cash accounting system) drops from 10 percent to 6 17 percent, and the taxable net cash flow drops from $100 (equal to the net return to land) to *minus* $100 88 In each situation, the land resource, the present net return to land, and the required percentage return on investment (from all sources) are identical Thus, rational investors—considering expected inflation, interest rates, and tax avoidance benefits of investing in farmland—can bid over 1 5 times the initially apparent value for farmland and still achieve their target rates of return Furthermore, their bidding ability is greater the higher their marginal tax bracket, the higher the inflation rate, and the more additional unencumbered assets or other income they have that will cover any negative cash flows arising from purchasing farmland

If the COP framework ignores these noncash returns from asset appreciation and tax sheltering or ignores the in-kind investments associated with certain livestock or orchard operations, a number of unwarranted assumptions are built into the system In certain types of production units, these returns can overwhelm the cash returns—for example, the land appreciation on land-based enterprises, breeding herd expansion for dairy for beef enterprises, tax treatment of breeding and dairy livestock enterprises, and the "current expensing" of orchard development expenditures In any complete accounting system, these returns must be considered as additional income not realized from the marketplace As demonstrated, many of these nonmarket returns do not depend on the size or efficiency of the farm, but rather on the marginal tax bracket of the owner/investor Large expected capital gains reduce the economic costs of production, and expected capital losses increase the economic costs of production Under some circumstances, the existence of strong nonmarket returns can make market returns negative

Attempting to enforce the old desired rates of cash return, ignoring the inflationary and tax avoidance returns to farmland ownership, or ignoring in-kind

investments will compound the tendency of COP formulas to spiral upwards To be consistent and to prevent price spirals, if one excludes capital gains and losses from the COP framework, then one must also exclude the investments that support them Thus, both interest rates and desired rates of return used in COP calculations must exclude inflation One must also exercise extreme care in splitting costs into current production costs and implicit investments—especially in livestock production

Summary

In summary, one should remember the following general conclusions about all COP analyses

(1) They are essentially circular arguments, if one uses the same assumptions in determining the costs and in valuing the assets used, then the costs of production will *always* exactly equal the price received for the product

(2) Any unwarranted assumptions about the desired rate of return of farmers or investors will create a self-feeding price spiral, if one uses COP results to set prices

(3) Any price spirals will overwhelmingly come to rest in increased values of agricultural assets—especially land values

(4) Inflation taxation and credit interact to make cash accounting analysis unusable for full economic COP estimates under inflation

(5) If an incomplete COP framework is designed (that is, excluding net investments and capital appreciation), then the expenditures that contribute to the net investments and capital appreciation must also be excluded This situation generally means removing the inflation component from interest payments and required rates of return and explicitly identifying in-kind investments such as occur when one raises replacement livestock or establishes orchards

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