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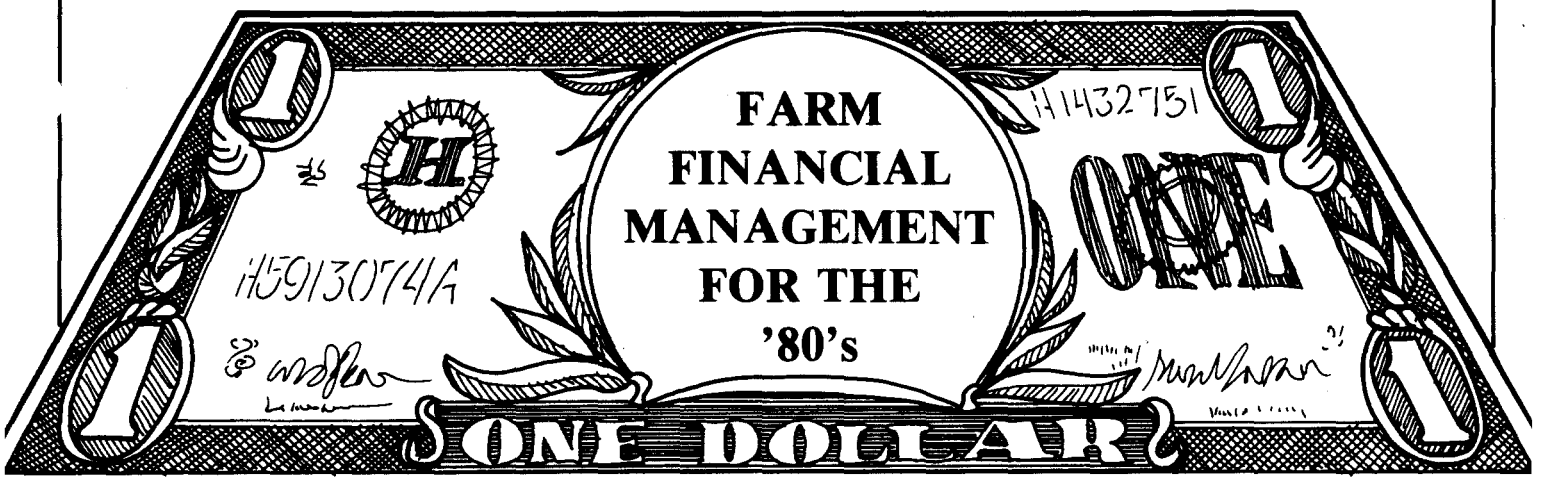
The Time Value of Money

Wallace C. Hardie and **Arlen G. Leholm**
Extension Farm Management Economists
David M. Saxowsky, Assistant Professor
Agricultural Economics Department
North Dakota State University



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The Time Value of Money

Introduction

Time has a significant impact on the costs and returns of a farm business and should be recognized as a key factor in making financial management decisions. This circular deals with the concept of time and how it effects the "bottom line" of your farm or ranch operation. Five economic concepts related to time are discussed.

1. The opportunity cost of capital.
2. Amortization - The effects of alternative loan terms.
3. Compounding - The future value of a present payment.
4. Discounting - The present value of a future payment.
5. Economic costs versus out-of-pocket cash costs.

Three examples of farm management decisions are used to illustrate these concepts. A grain storage example is used to explain the concept of **opportunity cost**. The possible purchase of an additional tract of land is used to explain the concepts of **amortization, compounding and discounting**. A combine purchase example is used to explain the determination of **economic costs** through the cost engineering approach. The same example is then evaluated according to the out-of-pocket method of estimating costs.

The reason why time has value is stated in the axiom: **A dollar you receive today is worth more than a dollar you are promised to receive at some future time.** The main reason for preferring payment today is the opportunity to earn interest on the dollar. Other reasons would include the preference to spend the dollar now instead of delaying the purchase of a desired item, the lack of certainty that the future payment will occur, and the possibility that today's dollar will have less purchasing power in the future due to inflation.

Opportunity Cost How Time Influences a Marketing Decision

The opportunity cost of capital is the dollar amount that could have been earned had the capital been used for an alternative investment. An example would be storing grain. Placing grain in storage has an "opportunity cost" because by deciding to store you give up the **opportunity** to convert the grain into cash and pay off an existing loan or earn money in another investment. The amount of opportunity cost depends on the value of grain in storage and, more importantly, the length of **time** it is in storage.

The amount of interest lost by holding a bushel of grain for one month at various market prices and interest rates is shown in Table 1. Monthly cost is determined by multiplying the price times the interest rate and dividing by 12. For example, disregarding government program provisions, suppose wheat is priced locally at $3.50 per bushel at harvest. Let's assume that if you sold your wheat off the combine rather than storing it on the farm you would pay off a loan bearing 12 percent interest or you would receive 12 percent interest from an outside investment. The opportunity cost of storing is $3.50 × .12 ÷ 12 = $.035 or 3.5 cents (plus actual storage costs) per month. To justify the decision to store, you must be convinced prices will rise

Table 1. Monthly Interest Cost of Holding Grain at Various Prices and Interest Rates.

Price per bushel ($)	Interest Rate 8% ($/bu.)	10% ($/bu.)	12% ($/bu.)	14% ($/bu.)
$1.50	.010	.013	.015	.018
2.00	.013	.017	.020	.023
2.50	.017	.021	.025	.029
3.00	.020	.025	.030	.035
3.50	.023	.029	.035	.041
4.00	.027	.033	.040	.047
4.50	.030	.038	.045	.053
5.00	.033	.042	.050	.058
5.50	.037	.046	.055	.064
6.00	.040	.050	.060	.070

more than 3.5 cents per month during your typical storage period.[1]

How you should evaluate the cost of holding grain is illustrated in Table 2. If you hold the wheat from September 1 through March 1 (six months) you will give up $.21 worth of interest (.035 × 6). Your local wheat price must exceed $3.71 per bushel on March 1 just to recover the opportunity cost of capital (see Table 2).[1]

Each year you should complete a table similar to Table 2 for the crops you raise. Use a realistic range of prices and the opportunity cost of capital that applies to your situation. This set of numbers will help guide you in your marketing decision.

Table 2. The Price Needed Three and Six Months in the Future to Equal Various Current Prices.

Current price per bushel ($)	Time Perid: Three months 8% Int.	Three months 12% Int.	Six months 8% Int.	Six months 12% Int.
$1.50	$1.53	$1.55	$1.56	$1.59
2.00	2.04	2.06	2.08	2.12
2.50	2.55	2.58	2.60	2.65
3.00	3.06	3.09	3.12	3.18
3.50	3.57	3.61	3.64	3.71
4.00	4.08	4.12	4.16	4.24
4.50	4.59	4.64	4.68	4.77
5.00	5.10	5.15	5.20	5.30
5.50	5.61	5.67	5.72	5.83
6.00	6.12	6.18	6.24	6.36

[1]Other storage costs including shrinkage, insurance, and insect damage, or rental storage are not covered in this discussion.

Amortization, Compounding, Discounting How Time Influences Investment Decisions

Amortization

The ability to meet the cash needs of any investment (farm or nonfarm) depends largely on the terms offered in the proposed transaction. These include selling price, amount of downpayment, interest rate, and **number of years** specified in the contract to repay the loan.

The term "equally amortized loan" is a type of loan whereby the total payment in each period remains constant over the term of the loan, with varying proportions allocated to interest and principal as each payment is made. Annual cash requirements of a $50,000 equally amortized loan under various loan terms are shown in Table 3.

Extending the term of the loan (that is, the time period over which repayment is required) decreases the annual payment. However, the longer the term is extended, the less the annual payment decreases. For example, the annual payment for a loan with a 12 percent rate of interest and a term of 10 years will be approximately two-thirds of the annual payment needed if the term of the loan is only five years. Extending the loan from 25 years to 30 years, however, will decrease the annual payment by only 3 percent. Likewise, extending the term of a loan decreases the annual payment more for loans with a low rate of interest than extending the term for a loan with a high interest rate.

The disadvantage of shortening the term of a loan is that the debtor is legally required to make the somewhat larger annual payments and this added outflow may be just the amount by which the borrower is experiencing a cash shortfall. Therefore, it is probably best to retain an extended term for the loan but be able to make prepayments without penalty to realize the advantage of a shorter term without being legally committed to the larger payments. It is important, in all cases, to negotiate for loan terms you can afford.

An increase in the interest rate from 10 percent to 12 percent would increase the annual payment by $711.94 (Table 3 col. 5 line 2 minus

Table 3. Annual Cash Payments of a $50,000 Equally Amortized Loan with Varying Loan Terms.

	1 Price	2 Interest rate	3 Term	4 Downpayment	5 Annual payment	6 Total amount paid
	($)	(%)	(Year)	($)	($)	($)
1.	$50,000	10	10	0	$8,137.27	$ 81,372.70
2.	50,000	12	10	0	8,849.21	88,492.10
3.	50,000	10	10	22,000	4,556.87	67,568.70
4.	50,000	10	20	0	5,872.98	117,458.60

col. 5 line 1). A downpayment of $22,000 would reduce the annual payment by $3,580.40 (col. 5 line 1 minus col. 5 line 3). However, the opportunity cost of the $22,000 must be accounted for. This $22,000 could earn some rate of return elsewhere. By doubling the length of the loan from 10 years to 20 years, the annual payment is reduced by $2,264.29 (col. 5 line 1 minus col. 5 line 4) but the investment will cost an additional $36,086.90 (col. 6).

Compounding

Time also must be considered when deciding whether to purchase a capital asset. A plan that conserves dollars today so that extra dollars can be put to work earning more dollars has an advantage over a plan that ties up available dollars. The advantage is mainly due to the principal of **compounding**. If you were to deposit $1,000 in a savings account for one year at 10 percent interest, your account balance would be $1,100 at the end of the year ($1,000 invested plus $100 interest). At that point, interest is converted into principal and also earns interest. At the end of the second year your account balance would be $1,210 ($1,100 plus $110 interest). If this were to continue for seven years, your account balance would be $1,945 (almost double the initial investment). Whenever the interest accrued during a period is converted into principal, compounding occurs. The fact that money subject to compounding grows rather rapidly over time can be a powerful friend or foe for your farm operation.

Figure 1 illustrates the growth over a 25-year period of $10,000 of principal invested at an annual after-tax interest rate of 9 percent compounded annually.

If you are receiving interest, compounding works in your favor. However, suppose you are paying interest on land or machinery debt and

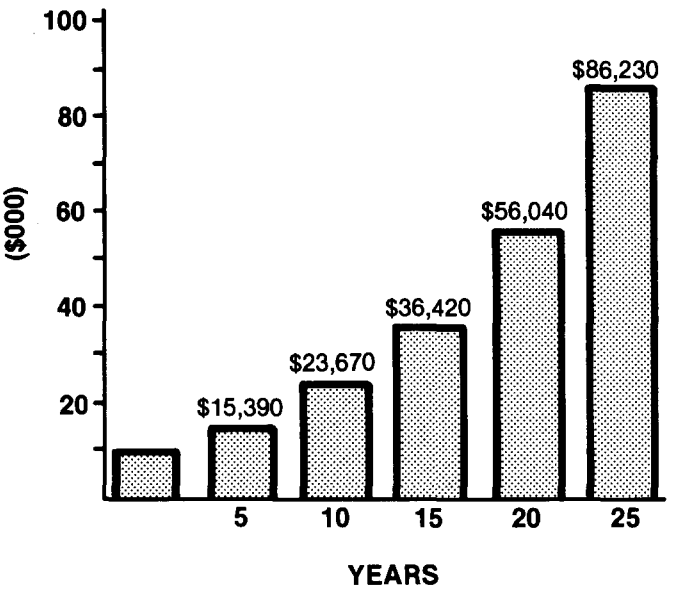

Figure 1. The Growth of $10,000 Earning an After-Tax Return of Nine Percent Compounded Annually.

cannot pay the annual interest payments this year. By renegotiating the loan and converting interest into principal, the law of compound interest will work against you because you will be paying interest on an enlarged debt load. This is a reason why renegotiating a loan may lead to more serious financial difficulties in the future.

Land Purchase Example

Suppose you were considering the purchase of 160 acres of farmland. The asking price is $80,000 ($500 per acre); terms are 25 percent down, 9 percent interest, and equal annual payments for a 10-year period. Annual property taxes will be $500 and your typical income tax bracket is 25 percent. Annual out-of-pocket cash costs (accounting for income tax savings)

resulting from this purchase are calculated and recorded in Table 4, column 10. After the initial downpayment of $20,000, annual payments vary from $8,374 in year one to $9,531 in year ten.

Suppose it is possible to cash rent similar farmland for $35 per acre this year with the rent increasing 3 percent per year for the next 10 years. The after-tax cash outflow of this alternative is calculated and recorded in Table 5, column 13. By subtracting the annual cash outflows of the cash rent alternative from the annual cash outflows of the ownership alternative (column 14 minus column 13), the **added cash cost of ownership** can be determined (column 15). This includes the $20,000 down payment plus an amount each year which ranges from $3,993 to $4,174.

These dollar amounts do not, however, take into account the opportunity cost of these larger payments; that is, they do not include the amount of interest these dollars would have earned had they been invested in something which pays compound interest. Accordingly, the added cost of ownership must be adjusted upward to determine its future value. This is accomplished by multiplying each added cost of

Table 4. Computation of After-Tax Outflow, Land Purchase

End of Year	1 Principal payment	2 Interest payment	3 Added Operating expense*	4 Total Cash outflow	5 Salvage Value (sale)△	6 Depreciation△	7 Total Deductible expense	8 Reduced taxes	9 Investment credit○	10 After tax Cash outflow
				(1 + 2 + 3)			(2 + 3 + 6)	(7 × tax rate)		(4 – 5 – 8 – 9)
At purchase	$20,000			$20,000						$20,000
1	3,949	$5,400	$500	9,849			$5,900	$1,475		8,374
2	4,305	5,044	500	9,849			5,544	1,386		8,463
3	4,692	4,657	500	9,849			5,157	1,289		8,560
4	5,114	4,235	500	9,849			4,735	1,184		8,665
5	5,575	3,774	500	9,849			4,274	1,069		8,780
6	6,016	3,273	500	9,849			3,773	943		8,906
7	6,623	2,726	500	9,849			3,226	807		9,042
8	7,219	2,130	500	9,849			2,630	658		9,191
9	7,869	1,480	500	9,849			1,980	495		9,354
10	8,577	772	500	9,849			1,272	318		9,531

*Real Estate Taxes
△Farm Buildings
○Grain Storage Structures

Table 5. Cash Rent Alternative and Comparison

End of Year	11 Cash rent payment*	12 Reduced taxes	13 After tax cash outflow	14 After tax outflow from purchase	15 Added cost of ownership	16 Future value factor○	17 Adjusted added cost of ownership
		(11 × tax rate)	(11 – 12)	(col. 10)	(14 – 13)	(Table 6)	(15 × 16)
At purchase					$20,000	2.367	$ 47,430
1	$5,600	$1,400	$4,200	$8,374	4,174	2.172	9,066
2	5,773	1,443	4,330	8,463	4,133	1.993	8,237
3	5,952	1,488	4,464	8,560	4,096	1.828	7,487
4	6,136	1,534	4,602	8,665	4,063	1.677	6,814
5	6,326	1,582	4,744	8,780	4,036	1.539	6,211
6	6,521	1,630	4,891	8,906	4,015	1.412	5,669
7	6,723	1,681	5,042	9,042	4,000	1.295	5,180
8	6,931	1,733	5,198	9,191	3,993	1.188	4,744
9	7,145	1,786	5,359	9,354	3,995	1.090	4,355
10	7,366	1,842	5,524	9,531	4,007	1.0	4,007
TOTAL							$109,200

*Increases 3% per year
○9% Interest

ownership by a factor based on 1) the interest rate and 2) how long from when the added cost is incurred until the future date. In this example, the future date is 10 years after the purchase. Table 6 on page 5 is used to locate various interest rates and time periods.

An assumption in this example is that the added cost of ownership could have been invested in an instrument that would yield an after-tax return of 9 percent. To determine the future value of the downpayment ($20,000) at the end of 10 years, find 10 under "Number of Years" in Table 6 and go across to 9 percent interest. The factor is 2.367. Twenty thousand dollars earning 9 percent per year for 10 years will grow to $47,430 (20,000 × 2.367). The factor 2.367 is entered in Table 5 column 16 and $47,430 is entered in column 17. At the end of the first year (nine years remaining) the factor is 2.172 (from Table 6). By multiplying the added cost for each of the 10 years (column 15) times the appropriate future value factor in column 16, the real added cost of ownership can be determined (column 17). For the 10-year purchase period, this added cost amounts to $109,200 (total of column 17). If you were faced with a decision of this nature you would need to decide whether to invest $80,000 and give up possible extra earnings of $29,200 at the end of a 10-year period for the privilege of owning the property free and clear at that time.

Restated, the cost of land is more than just the purchase price. It also includes earnings foregone which would have been received had the funds used for the purchase been invested in something else (i.e., opportunity cost). Of course once the land is paid for, the owner has the right to use it and upon resale realize any appreciation in its value. In this case, land must appreciate at a rate of 3.7 percent per year over the next 10 years to equal the earnings foregone ($29,200).

Discounting

The concept of discounting involves all the elements of compounding but from the opposite viewpoint. If you are willing to accept a 10 percent return, you will agree to invest $100 today for the right to receive $110 one year from now. The **present value** of the $110 payable in one year is $100. That is the amount of money

Table 6. Factors for Computing the Future Value of Present Payments

Number of Years	Annual After-Tax Interest Rate							
	7%	8%	9%	10%	12%	14%	15%	16%
1	1.070	1.080	1.090	1.110	1.120	1.140	1.150	1.160
2	1.145	1.166	1.186	1.210	1.254	1.300	1.322	1.346
3	1.225	1.260	1.295	1.331	1.405	1.482	1.521	1.561
4	1.311	1.360	1.412	1.464	1.574	1.689	1.749	1.811
5	1.403	1.469	1.539	1.611	1.762	1.925	2.011	2.100
6	1.501	1.587	1.677	1.772	1.974	2.195	2.313	2.436
7	1.606	1.714	1.828	1.949	2.211	2.502	2.660	2.826
8	1.718	1.851	1.993	2.144	2.476	2.853	3.059	3.278
9	1.838	1.999	2.172	2.358	2.773	3.252	3.518	3.803
10	1.967	2.159	2.367	2.594	3.106	3.707	4.046	4.411
11	2.105	2.332	2.580	2.853	3.479	4.226	4.652	5.117
12	2.252	2.518	2.813	3.138	3.896	4.818	5.350	5.926
13	2.410	2.720	3.066	3.452	4.363	5.492	6.153	6.886
14	2.579	2.937	3.342	3.797	4.887	6.261	7.076	7.988
15	2.759	3.172	3.642	4.177	5.474	7.138	8.137	9.266
16	2.952	3.426	3.970	4.595	6.130	8.137	9.358	10.748
17	3.159	3.700	4.328	5.054	6.866	9.276	10.761	12.468
18	3.380	3.996	4.717	5.560	7.690	10.575	12.375	14.463
19	3.617	4.316	5.142	6.116	8.613	12.056	14.232	16.777
20	3.870	4.661	5.604	6.728	9.646	13.743	16.367	19.461
25	5.427	6.848	8.623	10.835	17.000	26.462	32.919	40.874
30	7.612	10.063	13.268	17.449	29.960	50.950	66.212	85.850

necessary to invest today at 10 percent interest in order to have $110 in one year. Discounting is the process of calculating today's (present) value of a future payment. For our discussion the term "discount rate" is the opportunity cost of capital. Depending on whether you are paying interest or earning interest, your opportunity cost of capital will vary. Restated, the discount rate for persons who are borrowing is the interest rate on their loan, whereas the discount rate for persons who are not currently borrowing is the interest they could earn by depositing their funds in an interest-bearing bank account.

Present value is calculated by dividing the amount of the future payment by 1 plus the interest (discount) rate. For example, $1000 one year from now has a present value of $1000/(1 + .08) or $926 when the rate of discounting is 8 percent.

Table 7 has been developed to assist in computing present value of future payments. To use it, find in the first column the number of years until the payment will be received, then move across to the column providing the appropriate discount rate. Multiplying the amount of the future payment by the discount factor will yield the payment's present value.

You are probably familiar with the concept of discounting whether or not you realize it. You would not be willing to pay $100 today to receive $50 each year for the next two years. You know that those payments, though they total $100, are not presently worth $100 because the payments will be made over time. **The maximum amount you should pay for an investment is the present value of income that will be received from it.** Discounting should be used to determine the value of an investment. The present value of ear-

Table 7. Factors for Computing Present Value of Future Payments

Year (n)	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696
2	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561
3	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575
4	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718
5	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972
6	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323
7	0.6228	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759
8	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269
9	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843
10	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472
11	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149
12	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869
13	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625
14	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413
15	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229
16	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069
17	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929
18	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808
19	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703
20	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611
21	0.2415	0.1987	0.1637	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531
22	0.2257	0.1839	0.1502	0.1228	0.1007	0.0826	0.0680	0.0560	0.0462
23	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402
24	0.1971	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431	0.0349
25	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378	0.0304
26	0.1722	0.1352	0.1064	0.0839	0.0663	0.0525	0.0417	0.0331	0.0264
27	0.1609	0.1252	0.0976	0.0763	0.0597	0.0469	0.0369	0.0291	0.0230
28	0.1504	0.1159	0.0895	0.0693	0.0538	0.0419	0.0326	0.0255	0.0200
29	0.1406	0.1073	0.0822	0.0630	0.0485	0.0374	0.0289	0.0224	0.0174
30	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151

nings expected to be received in the future due to an investment is the value of that investment and also should be the maximum price you are willing to pay for that investment. A payment of $50 one year from now and another $50 two years from now has a present value of $87.95 when discounted by 9 percent [.917 × 50] + [.842 × 50] = $87.95 (from Table 7). Other tables have been developed (although not included in this publication) that simplify discounting a series of payments. An alternative is a modestly priced calculator designed to perform these and other computations.

An investment that will return a specified dollar amount each year for an infinite period of time is currently worth the annual return divided by the discount rate. For example, $50 per year for an infinite number of years discounted by 9 percent is worth $50/.09 or $555.55. This is the income capitalization formula often used to calculate the value of land. Land that earns $50 per acre with a discount rate of 9 percent would be valued at $555.55 per acre.

The Influence of Time on Machinery Purchase Decisions

To make good machinery investment decisions you should understand how to calculate the cost of owning machinery over time. Machinery is generally classified as a non-liquid asset because it is not easily resold. Its value is best reflected in productive worth; that is, the earnings derived from its use over a period of years.

Traditionally, the computation of machinery costs has been done using cost engineering (economic) methods which average the initial cost of the machinery over a number of years. Costs calculated by this method tend to be less than out-of-pocket machinery costs in the early years of a machine's life and greater than the out-of-pocket costs in the later years of a machine's life. In making a machinery purchase decision you should consider both the long term concept of **economic** costs and the short term concept of **out-of-pocket** costs.

Economic Costs

There are three components to estimating the annual **fixed costs** of a machine using economic cost methods:

- Depreciation
- Interest cost
- Insurance and housing costs

Depreciation is the reduction in market value of a machine due to age, obsolescence and wear. It is not necessarily the amount of depreciation taken for tax purposes. Annual depreciation costs may be calculated as follows:

$$\frac{\text{Investment amount} - \text{salvage value}}{\text{Years of useful life}}$$

Interest costs are the amount charged for the use of capital to be invested in the machine. For economic cost purposes the "real" interest rate should be used to make this calculation. The "real" interest rate is found by taking the rate actually charged for a machinery loan and subtracting the general rate of inflation. Suppose the interest rate charged is 13 percent and the general rate of inflation is 5 percent. The "real" interest rate is 8 percent (13 – 5). To calculate the average annual interest cost, the real interest rate is multiplied times the average investment in the machine over its life. This is determined by adding the salvage value to the investment amount and dividing by 2. Interest costs are calculated as follows:

$$\frac{\text{Investment amount} + \text{Salvage value}}{2} \times \text{Real interest rate} = \text{Interest per year}$$

Insurance and housing costs vary from farm to farm. They will typically cost 2 percent per year of the average investment in the machine over its life. Insurance and housing costs are calculated as follows:

$$\frac{\text{Investment amount} + \text{Salvage value}}{2} \times .02 = \text{Insurance and housing costs}$$

The economic cost method can be illustrated by the following example. Suppose you are considering trading your present combine (valued

at $20,000) for a new machine. The boot price is $40,000 and the expected life of the new combine is 10 years with a salvage value of $5,000. Your total investment in the combine would be $60,000 (20,000 + 40,000). The annual fixed depreciation costs would be:

$$\frac{\$60,000 - \$5,000}{10} = \$5,500.$$

The annual fixed interest costs per year with an 8 percent real interest rate is:

$$\frac{\$60,000 + \$5,000}{2} \times .08 = \$2,600$$

Annual fixed housing and insurance costs would be:

$$\frac{\$60,000 + \$5,000}{2} \times .02 = \$650.$$

The annual fixed cost of owning this machine (depreciation + interest + insurance and housing) is estimated to be $8,750 (5,500 + 2,600 + 650).

Variable costs of owning a machine fluctuate according to use. Major variable costs of our combine example include labor, repairs, fuel and lubrication. These costs of operation are listed below:

Labor	-	$ 5.00
Repairs	-	9.40
Fuel & Lub	-	7.60
Total variable costs per hour	-	22.00*
Total variable costs per acre	-	$ 2.75 (8 ac./hr.)

Several observations can be made from this information. First, annual fixed costs are $8,750 even if the machine is not used. Second, variable costs are $2.75 per acre. Third, we can calculate the number of acres we need to harvest annually in order to justify ownership of this combine rather than selling it and custom hiring to have our crop harvested. Assume the current custom harvest rate for a comparable machine is $15.00 per acre. The number of acres that you would need to harvest to recover the annual fixed cost (based on economic cost methods) is determined by the following formula:

$$\frac{\text{Annual fixed cost}}{\text{Custom rate} - \text{variable cost}} = \text{Breakeven acreage or}$$

$$\frac{\$8,750}{\$15.00 - \$2.75} = \frac{\$8,750}{\$12.15} = 714 \text{ acres}$$

If your annual harvested acreage is projected to be 714 acres or more, this purchase would be justified according to this approach.

Out-of-Pocket Costs

Although a machinery investment may be profitable in the long run, it is necessary to consider short run feasibility as well. If excessive principal and interest payments resulting from such a purchase place you in a negative cash position, other alternatives need to be considered. To evaluate a machinery purchase in a practical sense it is necessary to compute out-of-pocket costs to the business each year for a specified period of time and account for the effect this purchase may have on your income tax liability (after-tax cash outflow). The out-of-pocket method of cost estimation for the above combine example is illustrated in Table 8. The following information is necessary to compute Table 8.

1. Down payment	old combine ($20,000)
2. Amount financed	$40,000
3. Loan terms	4 years equal payments, 13% interest
4. Years of useful life	10
5. Method of depreciation for taxes	Straight line (10-20-20-20-20-10%)
6. Operating costs	$2.75 per acre
7. Marginal tax bracket	25%

The fixed cash outflow resulting from this purchase is $6,804 at the end of the first year (Table 8, column 10). This figure is $1,946 less than the cost estimate determined through the economic cost method. However, fixed cash outflows increases to $9,619 the second year and remains high through the fourth year. After the fourth year the note is paid. For the second, third and fourth years of ownership the number of acres you would need to harvest to recover fixed out-of-pocket costs would be:

*1985 Crop Production Costs, East Central North Dakota, Section VI, No. 3, Farm Management Planning Guide.

Table 8. Computation of Fixed Cash Outflow, Combine Purchase

End of Year	1 Principal payment	2 Interest payment*	3 Added Operating expense**	4 Fixed cash outflow	5 Salvage value (sale)	6 Depreciation△	7 Total Deductible expense	8 Reduced taxes○	9 Investment credit	10 Fixed cash outflow
				(1 + 2 + 3)			(2 + 3 + 6)	(7 × tax rate)		(4 – 5 – 8 – 9)
1	$ 8,248	$5,200	$138	$13,586		$ 5,800	$11,138	$2,785	$4,000	$ 6,804
2	9,320	4,128	138	13,586		11,600	15,866	3,967		9,619
3	10,532	2,916	138	13,586		11,600	14,654	3,664		9,922
4	11,901	1,547	138	13,586		11,600	13,285	3,321		10,265
5			138	138		11,600	11,738	2,934		– 2,796
6			138	138		5,800	5,938	1,485		– 1,347
7			138	138			138	35		103
8			138	138			138	35		103
9			138	138			138	35		103
10			138	138	$5,000		2,138	35		– 4,897

*13 percent interest
**Out-of-pocket insurance cost is computed to be .5 percent times the average investment $\frac{60{,}000 - 5{,}000}{2} \times .005 = 138$

△Straight line 10%, 20%, 20%, 20%, 20%, 10%
○Marginal tax rate = .25

Year 1 $\frac{\$9{,}619}{\$15.00 - \$2.75} = 785$ acres

Year 2 $\frac{\$9{,}922}{\$15.00 - \$2.75} = 810$ acres

Year 3 $\frac{\$10{,}265}{\$15.00 - \$2.75} = 838$ acres

If your annual harvested acreage is projected to be above these acreages, this purchase would be justified according to this approach.

Should You Buy or Custom Hire?

Another way of evaluating a purchase decision is to compare the total costs of ownership with an alternative over time. Instead of purchasing the above combine you might decide to use your old machine for half of your harvesting needs (allowing for higher repair costs) and custom hire the rest.

Let's assume you plan to harvest 1,000 acres per year and custom rates will increase by 3 percent per year for the next 10 years. The old machine can be operated for five more years (custom hire the entire 1,000 acres after five years).

The total cash outflow resulting from using the old machine for 500 acres and custom hiring 500 acres is calculated and recorded in Table 9, column 15 (repair costs are increased by 50 cents per acre - $2.75 + .50 = $3.25 per acre). Total cash outflow resulting from the purchase of a new machine is the fixed outflow (Table 8, column 10) plus after-tax operating costs. After-tax operating cost is computed as follows: 1,000 acres × $2.75 (cost per acre) = $2,750; $2,750 × .25 (marginal tax bracket) = $688 - reduced taxes; $2,750 – 688 = $2,062 after-tax operating cost. Comparing after-tax cash outflow of custom hire with purchase, the custom hire alternative conserves $2,022 the first year (Table 9, column 17) and more than $4,600 for the next three years. After that, the custom hire option proves more costly. The total cash outflow of the combine purchase is $48,499 (total of Table 9, column 16). The custom hire alternative results in an after-tax cash outflow of $105,191 (column 15). The long-run viewpoint would therefore favor ownership over custom hire. However, during the first four years of ownership, the extra cash required by machine ownership compared to custom hire is

Year 1 - $2,022
Year 2 - 4,669
Year 3 - 4,798
Year 4 - 4,963

If the added burden of these cash outflows results in a shortage of cash to pay off other debt or meet family living obligations, the machine should not be purchased.

Table 9. Custom Hire Alternative and Comparison

End of Year	11 Custom hire*	12 Operating expense△	13 Total deductible expense	14 Reduced taxes	15 After-tax cash outflow	16 After-tax outflow of purchase○	17 Added cost of ownership
			(11 + 12)	(13 × tax rate)	(13 – 14)		(16 – 15)
1	$ 7,500	$1,625	$ 9,125	$2,281	$ 6,844	$ 8,866	$ 2,022
2	7,725	1,625	9,350	2,338	7,012	11,681	4,669
3	7,957	1,625	9,582	2,396	7,186	11,984	4,798
4	8,194	1,625	9,819	2,455	7,364	12,327	4,963
5	8,441	1,625	10,066	2,517	7,549	– 734	– 8,283
6	17,390		17,390	4,348	13,042	715	– 12,327
7	17,910		17,910	4,478	13,432	2,165	– 11,267
8	18,447		18,447	4,612	13,835	2,165	– 11,670
9	19,000		19,000	4,750	14,250	2,165	– 12,085
10	19,570		19,570	4,893	14,677	– 2,835	– 17,512
Totals					$105,191	$48,499	

*Rate increases by 3 percent per year
△$3.25 per acre × 500 acres = $1,625.
○Fixed cash outflow (Table 7 column 10) plus after-tax operating cost – 1,000 acres × $2.75 = $2750.
$2,750 – $688 (reduced taxes, 25% bracket) = $2,062.

Worksheets

Worksheets A and B are provided to compare the estimated cost of ownership of machinery or land with other alternatives, such as custom hire or leasing. Often it is difficult to place a dollar value on the advantage of owning an up-to-date machine or quality piece of property. However, by following through the steps outlined in the worksheet you will gain perspective regarding the actual dollars involved in this type of investment and will make a better investment decision.

Summary

Time does impact on the key financial decisions you make throughout the production year. The **opportunity cost** of capital must be accounted for as you consider how to best utilize your farm assets, especially those that can be readily converted into cash. As you consider how to finance a capital purchase you must understand the concept of **amortization** - loan periods, down payments, and interest rates will have a great impact on your ability to cash flow the purchase. The realization that money subject to **compounding** grows rapidly over time will help you avoid tying up too much capital in lower performing assets. By understanding the concept of **discounting** you can better evaluate the real worth of an investment like farmland that produces income far into the future. Finally, an understanding of the long-term concept of **economic costs** and the short-term concept of **out-of-pocket costs** provides a solid basis for making the right machinery management decisions for your individual farm situation.

Worksheet A. Determining After-tax Cash Outflows of Purchase

End of year	1 Principal payment	2 Interest payment	3 Operating expense	4 Total cash outflow	5 Salvage value (sale)	6 Depre-ciation	7 Total deductible expense	8 Reduced taxes	9 Investment credit	10 After-tax cash outflow
At purchase				(1 + 2 + 3)			(2 + 3 + 6)	(7 × tax rate)		(4 – 5 – 8 –
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

Worksheet B. Determining After Tax Cash Outflow as an Alternative to Purchase

	11 Cash rent or Custom hire payment	12 Operating expense	13 Total cash outflow	14 Reduced taxes	15 After tax cash outflow	16 After tax outflow of purchase	17 Added cost of ownership	18 Future value factor	19 Adjusted added cost of ownership
Begin			(11 + 12)	(13 × tax rate)	(13 – 14)	(col. 10)	(16 – 15)	(Table 5)	(17 × 18)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Total									

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