Replacing Assets Under Accelerated Depreciation Laws

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Most capital purchases by businesses must be expensed over several years rather than expensed all at once when purchased. Depreciation is the tool used to expense capital purchases over a multi-year timeframe. Because most assets have a multi-year life, it seems natural to account for the purchase price in the same manner. A truly accurate expensing of an asset would compare the beginning and ending values and use this difference as the economic depreciation for that year.

Calculating the economic depreciation of an asset is somewhat subjective given that most assets are not actually bought and sold each year. The process would also be time consuming even if accurate appraisals were possible. To eliminate having to estimate asset values each year, the government has established depreciation rules to calculate the depreciation expense for tax purposes.

Tax deprecation often does not reflect the actual decrease in asset value. Often, the tax life of an asset is shorter than the asset's actual life. In addition, many assets will have a salvage value when sold whereas tax depreciation methods often take the book value of the asset down to zero. Because depreciation reduces net farm income without affecting actual cash flow, any depreciation law changes can affect a farmer's tax liability and thus his or her after tax net farm income.

Accelerated depreciation laws give farmers more cash in earlier years at the expense of latter years. The net present value of profits is greater with accelerated depreciation laws due to the time value of money. The only time accelerated depreciation might not be beneficial is if the earlier depreciation is so large that a farmer's marginal tax bracket changes.

These accelerated depreciation laws seem to be designed to help stimulate the economy by encouraging farmers to purchase depreciable farm assets more often. Farmers do benefit because lower taxes this year are probably better than lower taxes in future years (as long as marginal tax rates are the same). Less clear, however, is whether farmers should actually purchase assets more frequently. In other words, is the optimal lifespan of an asset reduced due to new accelerated depreciation laws?

For cattle producers, the optimal life of a replacement heifer is critical to management and planning. Cow-calf producers often have a large investment in purchased breeding livestock. Therefore, any change in the expected lifespan of purchased breeding livestock will affect cash flow and profitability. In a business that often has low profit margins, not replacing breeding cows at the optimal time can cause a farm to become unprofitable. This paper analyzes the new accelerated depreciation laws to determine if the expected lifespan of a breeding cow should be reduced.

Background

The last several years have seen tax law changes that provide accelerated depreciation for farmers. The most recent tax law is the Job Creation and Worker Assistance Act of 2002. With this law, two methods of deduction have been increased. First, the 179 deduction has been increased from $24,000 to $100,000. In addition, the threshold for using the 179 deduction has increased from $200,000 to $400,000. Therefore, as long as a farmer does not acquire more than $400,000 in section 179 eligible property, he or she can take up to the $100,000 in 179 deduction expenses. Acquiring more than $400,000 in 179 eligible properties reduces the amount of 179 expenses a farmer can take. There are still limits on what property qualifies and whether a farmer can actually use this particular accelerated depreciation method.

The other major depreciation change is a special 50 percent depreciation allowance for qualified new property placed in service after May 5, 2003. New property placed in service before May 5th can still use the 30 percent special deprecation allowance that was enacted after 9/11. However, farmers cannot use both the 50 percent special depreciation allowance and the 30 percent allowance together. They can though use both the special 50 percent allowance and the 179 deduction together. The only caveat is that the 179 deduction is taken first and the 50 percent special allowance is applied to the remainder. In general, the special 50 percent depreciation allowance has fewer restrictions on its use than does the 179 deduction.

Most assets have an optimal lifespan. Financial theory has several ways to calculate the expected optimal lifespan of an asset. These methods examine the purchase price, yearly operating costs and profits, and final salvage value to determine the optimal asset life. These methods all assume that assets become less productive over time or that their operating costs increase each year. In general, as purchase price or yearly profit increases, the optimal lifespan should also increase. By contrast, higher operating cost each year or a lower purchase price should reduce the optimal lifespan. Accelerated depreciation laws, by lowering profits in later years and shifting the profits to earlier years, have the potential to reduce the optimal life of an asset.

Model

Previous work by both Perrin and Barry show how net present value rules can be used to evaluate a replacement decision. Assets must be replaced when they wear out but often the optimal replacement occurs earlier because either the productivity drops off or the repairs and maintenance become increasing prohibitive. The model presented in Barry uses the asset cost, yearly asset value, and yearly returns or costs to analyze the replacement decision. The model in Barry is shown in equation 1.

$$(1) \qquad V_0 = \frac{1}{1-(1+i)^{-S}} \cdot \left[\sum_{n=1}^{S} \frac{R_n}{(1+i)^n} + \frac{M_S}{(1+i)^S} - M_0 \right]$$

This model does not specify taxes or how the tax shield of depreciation would affect the decision. Modifying the model to include taxes and deprecation is given in equation 2.

$$(2) \qquad V_0 = \frac{1}{1-(1+i)^{-S}} \cdot \left[\sum_{n=1}^{S} \left(\frac{R_n \cdot (1-t) + D_n \cdot t}{(1+i)^n} \right) + \frac{M_S - (M_S - B_S) \cdot t}{(1+i)^S} - M_0 \right]$$

where

V_0 = present value of perpetual annuity received every S years

S = year of replacement

R_n = return (cost) in year n

M_S = asset value in year S

M_0 = original asset value or purchase price

i = discount rate

t = ordinary income tax rate

D_n = tax depreciation in year n

B_S = asset basis in year S

To find the optimal lifespan of an asset in either equation 1 or 2, the equation must be solved for each possible year (i.e., S = 1 to maximum possible asset life). The year that provides the greatest present value is the year the asset should be replaced.

There are three differences between equations 1 and 2. First, equation 2 allows for taxes on the yearly return provided by the asset, $R_n \cdot (1-t)$. This income tax term is independent of depreciation and may have been implied in Equation 1. Next, Equation 2 provides for the tax shield of depreciation, $D_n \cdot t$, in each year. Depreciation varies each year and in dependent upon the depreciation method used. Finally, the term, $\left(M_S - B_S\right) \cdot t$, represents the recovery of depreciation if the asset is sold for more than the asset basis or book value. This gain is taxed as ordinary income as long as the asset ending value is not above the original purchase price.

The basis, B_S, in a given year can be defined as:

(3) $$B_S = M_0 - \sum_{n=1}^{S} D_n .$$

Specifying the model in Equation 2 requires two assumptions. First, the asset does not appreciate in value. If depreciation did occur, then capital gains would need to be added to the model to account for the asset value increase. Because purchased breeding livestock often does not appreciate in value, appreciation was not specifically modeled in Equation 2. The other assumption is that market value is always greater than the asset basis (i.e., $M_S > B_S$).

Data and Methods

To use the model in Equation 2 to evaluate the lifespan of a beef cow, information is needed about the price of a replacement heifer, the calf value, the value of the cow at the end of each year, the cost of cow maintenance, the interest rate, the marginal tax rate, and the tax depreciation method. The yearly calf value and cow maintenance combine to give a yearly net return. Information about the 5 to 6 weight steers and heifers come from the USDA-AMS. The price of a replacement heifer is harder to locate but a data series from Kentucky exists that has the prices each year for bred replacement heifers. These bred heifer prices represent the cost of a new cow. Cow maintenance costs come from Kentucky Farm Business Management (KFBM) data and from USDA alfalfa costs. A discount rate of 6% is assumed along with a marginal tax rate of 25%.

The only data difficult to find is for cow values at the end of each year. Cull cow prices exist but they represent older cows being sold for meat. The model requires knowledge about potentially younger cows that would potentially have value for future breeding.

Because of the difficulties with finding actual cow value data in most years of the cow's life, some of the cow values are calculated. We assume that most cull cows in the market place are eight years old. The readily available market cow price is then used to represent the cow value in year eight. From years one through seven, estimates are made of the cow values by using the sum-of-the-years-digits depreciation method. This representation of economic depreciation accounts for the difference between the new cow price and the cull cow price in year eight. After year eight, the value continues to decrease by reversing the sum-of-the-years-digits depreciation values for the earlier years. The sum-of-the-years-digits method provides for more depreciation in earlier years which should represent how cows actually decline in value.

Three depreciation methods are tested. One is the standard five-year tax depreciation. Typically, assets are considered to be put into service at the midpoint of the year. Thus, normal five-year tax depreciation actually results in six years of depreciation. The first and last years are only one-half of normal. The second tax depreciation method uses the 50% special depreciation allowance in the first year with the remaining value deducted following the typical depreciation schedule. Because the only difference between normal and the 50% special depreciation is an extra first year deduction, the cow is still depreciated over six years.

The last depreciation method tested is the 179 special depreciation allowance. The entire cost of the cow could be depreciated in year one if all the requirements are meant. Because the limits have been raised on 179 deductions, more farmers can use this method than before. In this paper, we assume the use of the 179 deduction takes the cow's value to zero in year one. Depending upon the total assets purchased, the 179 deduction could be eliminated or reduced.

Each set of prices from each year of data are tested to see if the tax depreciation method does make a difference in the cow the cow should be sold. The data set is somewhat constrained by the lack of good long-term information about new cow prices. However, there are still nine years of data where information exists about new cow, calf, cull cow, and feed prices. Prices from November are used to represent the cow and calf prices for the year. This is a realistic assumption as the animals are sold around this time each year. Table 1 lists the prices used to test the model.

Results

Table 2 shows the results of which year to sell the cow at each depreciation method at a 6% interest rate. Table 3 shows the same thing but at a 5% discount rate. Table 2 indicates that the optimal year for selling a cow is most likely year 10. Only in case 2 was there a different year (year 11). However, in case 2, the depreciation method did make a difference in how long farmers should plan to own a cow.

Table 3 shows similar results to Table 2 in that the optimal year for selling a cow remains at year 10. Now, though, the lower interest rate pushes the optimal year down to year 9 in some cases. Also, cases 1, 3, and 9 illustrate situations where the choice of a depreciation method does affect the optimal year to sell a cow.

Figure 1 shows the value of selling the asset in each year for each depreciation method for case 6. The value of selling each year slows down dramatically after year 7. As the figure shows, the earlier depreciation is beneficial to farmers even if the optimal year to sell the cow does not change.

Conclusions

Despite the potential advantages of accelerated depreciation, selling an asset earlier than under the typical 5-year deprecation rule is not often optimal. There may be some cases where this is not true but in all the cases examined in this paper, the optimal year to sell was only shortened by one year.

The accelerated depreciation laws did add value to farms though. In all cases, time value of money concepts make it beneficial to receive the depreciation benefits earlier. The only case where this might not be true is for situations where the marginal tax bracket might change. These situations were not examined in the paper.

Table 1. Data of Prices Used in the Model

New Cow	Calf	Cull Cow	Cow Maintenance
$940	$435	$432	$244
$630	$299	$308	$244
$803	$401	$336	$231
$795	$358	$291	$229
$1,069	$428	$331	$244
$984	$476	$369	$266
$972	$430	$358	$244
$928	$410	$336	$244
$1,127	$490	$436	$222

Table 2. Optimal Year to Sell Cow with 6% Interest Rate

Case	Normal depreciation	50% depreciation allowance	179 deduction
1	10	10	10
2	11	11	10
3	10	10	10
4	10	10	10
5	10	10	10
6	10	10	10
7	10	10	10
8	10	10	10
9	10	10	10

Table 3. Optimal Year to Sell Cow with 5% Interest Rate

Case	Normal depreciation	50% depreciation allowance	179 deduction
1	10	9	9
2	10	10	10
3	10	10	9
4	10	10	10
5	10	10	10
6	10	10	10
7	10	10	10
8	10	10	10
9	10	9	9

Figure 1. Value of Asset by Selling in Each Year – Case 6 Example