

Machinery Replacement Strategies



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Abstract

Farm machinery is typically the second largest asset category on a farm (after land). Farmers often appear to manage their machinery purchases in order to minimize cash flow variability, which usually leads to lower overall taxes. To test this hypothesis, farm income in the current year is compared to the previous two years to determine if farms had a “good” year. Results of a correlation analysis show that there is a strong correlation between having a relatively “good” year and machinery purchases.

INTRODUCTION

The current farm financial climate that started in the mid-2010s has many but not all of the same characteristics of the 1980s farm crisis. Then, as now, net farm income leading up to the farm crisis was near record levels but quickly dropped. During the 1980s farm crisis, net farm income was below zero for many

farms. Net farm income has not approached such low levels until the past few years.

Despite the difficulty of the 1980s farm crisis, many farms managed to survive. These farms made machinery adjustments that greatly helped their cash flow. Kansas Farm Management Association (KFMA) data show that farmers reduced their machinery investment from \$150 per acre to less than \$50 per acre over the course of the 1980s farm crisis. Once the 1980s farm crisis was over, machinery investment returned to pre-crisis levels.

The farm management strategy of drawing down the machinery investment level during difficult times by delaying equipment purchases can affect both profitability and cash flow, with cash flow expected to improve more than profitability. Farmers can survive a limited period of low profitability if cash is available to meet expenses and contribute to family living. However, running out of cash can bankrupt a farm business. This is especially true in times of farm financial stress when agricultural lenders may be reluctant to provide operating loans to farmers.

This paper examines whether farmers follow the strategy of purchasing more (or less) equipment in more (or less) profitable years to minimize their cash flow variability. Reduced cash flow variability translates into farmers having more cash during relatively low profitability years when cash available to meet family living and debt payment may be limited. In the years leading up to the current farm crisis, farmers increased their machinery investment by nearly 50% from the period prior to 2007. The result was that farmers’ “machinery bank” was built up, which should improve their cash flow during the current farm crisis.

BACKGROUND

The data for this study comes from the KFMA. The net farm income by the KFMA is based on management depreciation as opposed to tax depreciation. KFMA “management depreciation” or economic depreciation uses a formula that attempts to match the actual asset value to the value reported on the balance sheet. Therefore, depreciation reported by KFMA is perceived to be at a slower rate than the rate farmers typically use. For tractors and combines, KFMA uses a 10-year

declining balance method at a 10% rate and with a 35% salvage value.

Modified Accelerated Cost Recovery System (MACRS) depreciation and Section 179 expensing tend to reduce the value of machinery assets much quicker than their actual decline in market value. Wu and Perry (2004) and Hulten and Wykoff (1981) show that several functional forms can be used to represent the actual decline of asset value. They show that a Box-Cox function, the sum of the year's digits, and a double square root approach to depreciation can provide a better match to actual asset values than the use of MACRS. Thus, methods that provide slower depreciation than the tax methods give a better estimate of true net farm income.

The KFMA program has been collecting computerized financial and production data since 1973. It currently includes approximately 2,500 farms across Kansas. Each farm works with a KFMA economist to collect and verify data. The economist provides not only tax advice but also management advice for a farm. Typically, a KFMA economist will work with 100 farms. The data collected from this program is more accurate than that collected by a typical tax preparer because KFMA economists meet with their clients multiple times during the year. Data from these farms is certified before it goes into the research database, and approximately 1,000 of these 2,500 farms were deemed usable for advanced economic analysis. The KFMA publishes accrual net farm income, which is similar to a typical farmer computed accrual net farm income—with the main difference being the use of management depreciation instead of tax depreciation.

EQUIPMENT REPLACEMENT STRATEGIES

There are at least five replacement strategies farmers can follow with their farm equipment. From a profitability perspective, the best strategy is to minimize the long-run cost of the equipment by replacing equipment when the annual cost of the equipment in a given year begins to exceed the equipment cost from replacement (Perrin, 1972). By minimizing the cost of equipment, farmers are maximizing long-run profits. However, from a cash flow perspective, this strategy may not be optimal because some equipment might be replaced in years of low profitability, resulting in cash flow problems for farmers.

The four other strategies as outlined by Edwards (2019) are to replace frequently, replace something every year, replace when cash is available, or keep the

equipment forever. Replacing frequently is a strategy of minimizing breakdowns, repairs, and maintenance by trading machinery every few years or less. Repairs, if needed, would likely be covered by warranty and thus not cost the farmer anything. However, the farmer is replacing equipment before it reaches its cost minimization point, so it is probably not the most profitable option or the best for cash flow. Farmers who practice this strategy likely value reliability and want to minimize the opportunity cost of downtime.

The next option is to replace something every year so that the amount spent each year is approximately the same. This strategy avoids farmers having to make large cash outlays in any given year. The disadvantage of this strategy is that machinery might be replaced before it has reached its cost minimization point and thus long-run profitability might be less than optimal. However, from a cash flow perspective, farmers might be able to finance purchases from earnings rather than using debt financing because the amount of cash outlay is consistent from year to year. Still, overall cash flow for a farmer could be a problem since there may be some years of low profitability when enough cash may not be generated to pay for any equipment purchases.

The option practiced by many producers in Kansas is to replace when cash is available. This approach has the advantage of flattening cash flow by buying and expensing farm machinery when more cash is available and then not buying in years when cash is tight. Although this approach might even out cash flow from year to year, long-run profitability is less than optimal because some equipment might be replaced before or after the optimal timing (i.e., when the cost per year is lowest).

The final option for machinery replacement is to keep a piece of machinery forever. In other words, farmers would keep the machinery until it no longer functions and cannot be repaired. This approach might maximize cash flow, but long-term profitability is likely to be less than optimal if machinery is kept beyond its optimal replacement. However, as shown in Perrin (1972), the long-run cost curve for a piece of machinery shows a long period of nearly flat costs. Thus, keeping the machinery longer than normal likely has minimal effect on profitability. The real danger with keeping machinery for a long time is the reliability factor. Older machinery will require more repairs and be less reliable. Producers who follow this strategy likely have other options should equipment break at a critical time. Such options might include extra machinery, quick availability to rental machines or custom operators, or the necessary mechanical skills to handle on-farm repairs.

DATA AND MODEL

Even though the approach of replacing farm equipment when cash is available likely results in the most even distribution of cash, it is very hard to predict when extra cash will be available. The optimal method of purchasing equipment to minimize variance in cash flow would be to make purchases in proportion to the amount of net farm income relative to the long-run net farm income (including future years). Given uncertainty about the future, farmers have difficulty deciding how to treat a particular year. For example, 2007 was a good year for farm profitability but farmers did not have knowledge that the next five years were going to continue to be very profitable. Thus, farmers who thought in 2007 that 2008 might revert to lower profits might have overpurchased machinery in 2007. In the same way, when grain prices began declining after 2012, farmers may have delayed some purchases—assuming the following years were going to be more profitable when those following years were in fact less profitable.

In this paper, data from the KFMA is used to test whether farmers purchase more (or less) equipment in more (or less) profitable years. As discussed, what a farmer considers a “good” year may vary depending upon the profitability of previous years. To control for this, we average net farm income over the previous two years and compare to net farm income in the current year to estimate whether a farmer perceives the current year is going to be a “good” year. By the time fall harvest comes along, most farmers have a reasonable estimate of what their net farm income is likely to be because they can predict yields and prices with a high degree of accuracy.

The ratio of the current year’s net farm income is then computed compared to the average of the past two years’ net farm income:

$$\frac{NFI_t}{(NFI_{t-1} + NFI_{t-2})/2}$$

A value above 1 would indicate that the current year is perceived as a “good” year relative to the recent past, whereas a ratio below 1 means the farmer likely views the year as “bad.” If the strategy to purchase more equipment when net farm income is higher is true, farmers will purchase more equipment in these “good” years.

Equipment is examined in the same way as net farm income. The average purchases of equipment in the previous two years is averaged together to provide a baseline and then equipment purchased in the current year is compared to this baseline. A ratio above 1 indicates that farmers bought more equipment than normal, whereas a ratio less than 1 indicates farmers bought less than normal.

To test whether the equipment buying strategy of controlling cash flow by making more purchases when net farm income is higher is true, a higher ratio of current net farm income to the recent past net farm income should correlate to higher purchases of machinery in the current year relative to the recent past. In this paper, a 10-year balanced panel dataset of 450 KFMA farms was used in the analysis. The ratios of current net farm income compared to the previous two years of net farm income were calculated for the 10-year time frame. The requirement to examine the current year relative to the previous two years meant that there were eight net farm income ratios calculated for each farm.

The same procedure was used to calculate the machinery purchase ratios for the 10-year time frame. The final step was to calculate the correlation between the ratio of net farm income and the ratio of equipment purchases. A validation of the equipment purchase strategy of purchasing more in “good” years would result in relatively higher correlation between these ratios.

RESULTS AND DISCUSSION

A key point to consider is what defines a “high” correlation to validate the machine purchase strategy of purchase when cash is available. If a correlation of 0.5 or higher is strong, then 16% of farms followed this strategy. If a strong correlation is 0.25 or higher, then 32% of farms followed this strategy. A correlation above 0 results in 56% of farms following this strategy.

One difficulty with the approach in this paper is trying to determine how farmers consider the current year relative to the past. We used a two-year history, but it may be possible that farmers are looking at a longer time horizon when considering if the current year is “good” or “bad.” Our analysis has shown that farmers do follow the equipment purchase strategy of purchasing more in more profitable years and less in less profitable years.

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