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How do tax loss benefits and asset appreciation affect the returns to farming for U.S. farm households?

Daniel Prager, Economic Research Service
Sarah Tulman, Economic Research Service
Ron Durst, Economic Research Service

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Abstract

Net farm income and net cash farm income, as well as the farm household's income or loss from the farm business, are commonly used measures of farm financial performance. However, other factors may affect the household's economic return from farming. Almost half of all farm households face a loss from the farm business in any given year, and those households can benefit from offsetting these tax losses. Households may also gain from appreciation of their assets, particularly farmland, depending on how much of their operated land is owned. This paper analyzes farm returns after adjusting for these factors, estimating the additional gains households receive from offsetting tax losses and asset appreciation. Economic returns are found to be higher for larger farms, and those with higher debt.

The views expressed are those of the authors and should not be attributed to the Economic Research Service or USDA

Introduction

Each year, slightly more than half of the roughly 2 million farm households in the United States report a loss from their farming operations. While many of these farms do earn positive income in certain years, this negative return raises the question of whether the time, labor, and capital required to run the farming operation is justified. These households could use the labor and capital to pursue off-farm jobs and other investments.

Nevertheless, despite modest declines in the number of farm operations in the decade leading up to 2015, the vast majority of these households continue farming each year. They may have other reasons for operating a farm beyond the income received in the current year, or even over a string of years. Some families may derive non-pecuniary benefits from operating a farm, and accept lower wages in order to maintain a farming lifestyle (Key and Roberts, 2009). Others may value the social and lifestyle aspects of a farm community or enjoy farm labor over other vocations (Howley, 2015). Especially in agriculture, there is a long-standing desire to maintain the farmstead to pass down to future generations (Laband and Lentz, 1983).

However, measures of the returns to farming that do not include farmer's response to tax policy can also understate real net farm income and overstate expenses. These measures fall short because of non-cash charges such as the depreciation and expensing of capital equipment, which do not involve cash outlays but are nevertheless counted as expenses. Additionally, a farmer may experience a net farm loss in most years, but still be economically rational in continuing to farm when total returns are considered. For example, a farmer may have negative net farm income but anticipate substantial capital gains from land appreciation in the long run, and use farm losses in the short run as a tax write-off to increase the return from other sources of income. Both options contribute to the economic well-being of the farm household but are not captured by the annual net farm income measured on a pre-tax basis.

Several other studies have addressed the effect of real estate appreciation on farm financial conditions. Grove (1960) examined capital gains from farm real estate appreciation as a supplement to farm income during a time, not unlike the mid-2010s, in which farms faced a combination of declining farm income and rising land values. Plaxico and Kletke (1979), Lowenberg-DeBoer and Boehlje (1986), and Weber and Key (2014, 2015) address the issue of how farms benefit from land appreciation when capital gains from farm real estate appreciation are not realized unless the land is sold. One way in which appreciation affects a farm's financial condition is through its use as collateral, and thus a farmer's access to credit. As land appreciates, more collateral is available to secure loans that can be used to operate, maintain, or expand the farm. The size of this effect also depends upon (among other factors) the amount of land that is owned or rented.

However, there is a gap in the literature when it comes to tax losses and asset appreciation—ancillary benefits to households for operating a farm. This paper takes a step towards filling that gap. A modified measure of the ROA, which takes into account these adjusted returns, is also presented.

Managing Cash Losses

Even though the farm may realize an economic return in the long run, cash flow can be a problem in some instances. In those instances where the farm experiences a net farm loss and a negative cash flow, the farmer must have enough off-farm income or other resources to absorb any negative cash flow from the farm operation. For many households operating smaller farms, the losses are relatively small and these households have sufficient savings or income from nonfarm sources to cover any negative cash flow.

When they exist, losses for intermediate and commercial farms tend to be larger while the off-farm income available to cover such losses is lower. Thus, unlike residence farms such losses could be difficult to sustain if incurred for an extended period of years. However, a net farm loss for tax purposes is not necessarily equivalent to a negative cash flow. For example, the recovery of investments in long-lasting farm machinery and equipment, a major expense for many farmers, can produce a negative net farm income without matching cash outlays. Thus, a net farm loss does not necessarily suggest that the farmer will be forced to shift funds from other sources to the farm business to continue operating.

Data

Data for this analysis are taken from the Agricultural Resource Management Survey (ARMS), an annual survey administered jointly by the Economic Research Service (ERS) and National Agricultural Statistics Service (NASS), two agencies within the United States Department of Agriculture. The survey has collected nationally representative data on farm finances, production, production practices, and on farm household attributes and finance. Data in this report are taken from the 2015 ARMS survey, which obtained information on 19,081 family farms. Probability weights, adjusted for non-response, are used for all calculations. More information on ARMS can be found at: <https://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/documentation/>

Supplementary data on farmland asset appreciation were downloaded from the NASS Quick Stats database (https://www.nass.usda.gov/Quick_Stats/).

ERS Farm Typology

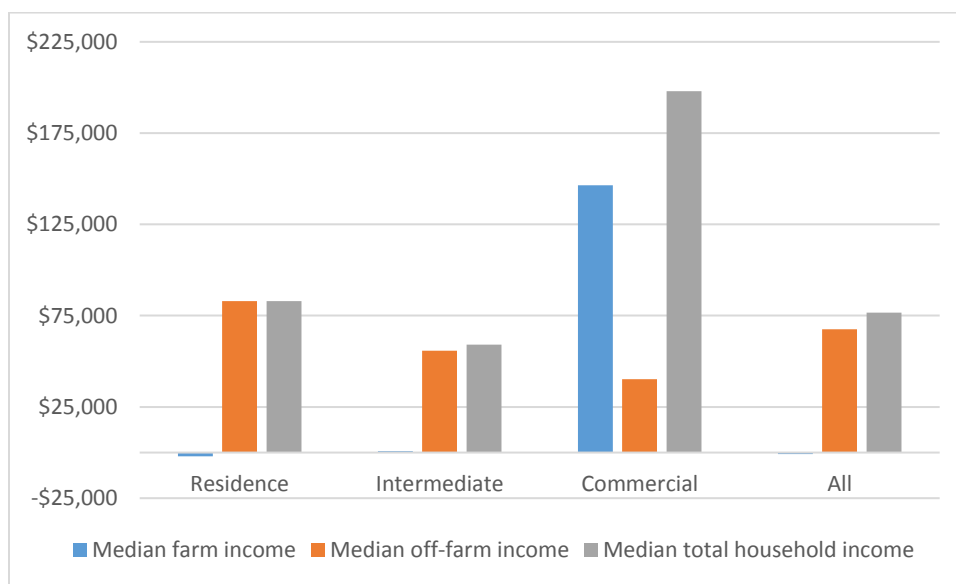
In order to compare different types of farms, it is useful to categorize them based on observable characteristics. Economic Research Service has developed a classification scheme that uses two measures to classify farms: the primary occupation of the principal operator and the gross cash farm income (GCFI) received by the farm during the calendar year (before expenses).

The typology used in this paper categorizes three types of farms: residence, intermediate and commercial. Residence farms are those farms with less than \$350,000 in gross cash farm income

(GCFI) where the principal operator has an occupation other than farming.¹ This includes work in off-farm occupations or if the principal operator is retired from farming. Intermediate farms are those farms where the principal operator’s primary occupation is farming and GCFI is less than \$350,000. Commercial farms include any operation where the GCFI is \$350,000 or higher. (Hoppe and MacDonald, 2013)

In 2015, although they constituted just 9% of all family farms, approximately 65% of agricultural production (by value) took place on commercial farms. With substantially more annual gross cash income and farm assets, these farms have different characteristics from residence and intermediate farms. In this analysis, we discuss only “family farms,” those farms where one extended family owns more than half of the farming enterprise. While the 27,000 non-family farms provide important income for many U.S. households, we do not discuss them here.

Figure 1, Median pre-tax income from farm, off-farm, and total household income 2015



Source: ERS analysis of Agricultural Resource Management Survey, 2015

Along with the value of production, the only farm typology that earns substantial pre-tax income (at the median) from their farm operations are commercial farms. 63% and 48% of residence and intermediate farm households, respectively, lost money on their farming operations. Thus, intermediate and, especially, residence farm households have significantly more off-farm income

¹ Gross cash farm income (CFFI) is defined as cash receipts (before expenses) and other income from farming, including renting of farmland, custom work, and government payments, such as commodity or conservation payments, and net crop insurance indemnities.

to offset with negative farm losses (figure 1). Those farms with substantial off-farm income may be in higher tax brackets, increasing the value of tax loss benefits.

Expensing and Depreciation's Effect on Taxable Income

Net cash farm income (profit or loss) and net farm income (a broader measure of returns that includes non-cash elements) are both designed to measure profitability, but they differ in a number of important aspects with respect to federal income tax liability. Profit or loss for federal income tax purposes is a tax-defined measure that does not include all types of farm income and also may be reduced by several exclusions and deductions that are not considered in determining net farm income.

Farming is a capital-intensive business with most operations requiring significant investments in farm machinery and equipment. These assets can be productive for several years and the cost of these assets is generally recovered through depreciation, which is an expense meant to capture the deterioration of these capital assets over time.² In 2015, the average value across all farms of farm machinery and equipment was \$107,000. This capital intensity, combined with the tax regulations used to calculate business income, often overstate actual farm expenses in the early years of depreciable asset ownership.³

While economic depreciation spreads the recovery of the value of the asset over its useful life in the production process and could extend over a relatively long period of time, tax depreciation allows for a faster recovery of capital investments through accelerated rates and shorter capital cost recovery periods that are often much shorter than the economic life of most assets. Because farm businesses can choose when to claim expensing and the value of the depreciation generally decreases over time, this is advantageous to farm owners.

Furthermore, in an effort to stimulate investment, the tax law allows farmers (like other business owners) to consider part or all of their investment in farm machinery and equipment as a deductible expense for tax purposes in the year in which it is purchased. Since 2000, the amount that can be deducted for tax purposes in the current year has increased from \$20,000 to \$500,000. The Protecting Americans from Tax Hikes (PATH) Act of 2015 made the \$500,000 expensing limit permanent. As a result of this increase, total annual depreciation (including capital expensing) reported by farms in ARMS data has increased by over \$10 billion since 2000, to \$27.1 billion in 2015. Because the farm income that accrues to the household is net of depreciation, the increase in expensing has lowered farm household income from the farm business. In 2015, the average farm earned \$39,493 in net cash income, which does not include

² In this paper, we report tax depreciation as collected in ARMS. Specifically, respondents are asked to record the “depreciation expense claimed by this operation in 2015 for all capital assets.”

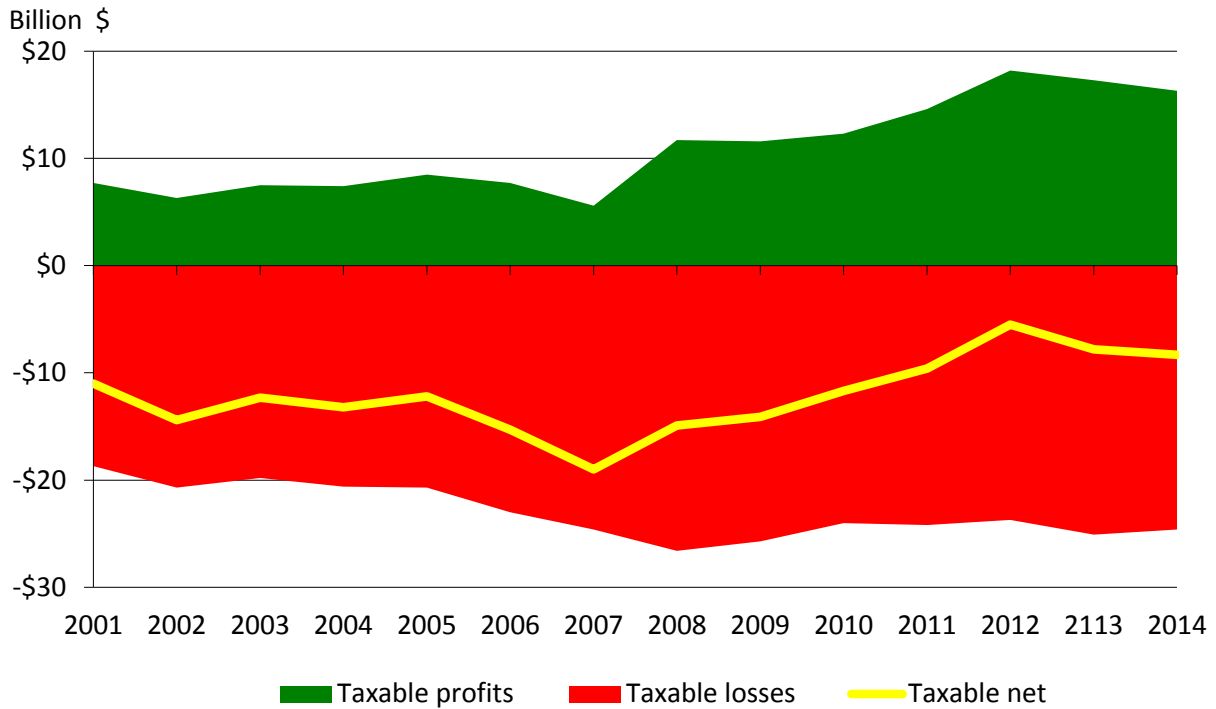
³ Over the life of an asset used in production (except land), the value of that asset diminishes and the economic depreciation and tax depreciation should become equivalent. If the asset is sold, the salvage value is reported as income in a later year.

depreciation. At the same time, farmers claimed an average depreciation expense of \$12,587, reducing taxable farm business income by about 30%.

As evidence of the relative importance of this expense for residence farms (roughly 60% of all farms), tax depreciation expenses accounted for 40% of the total value of their reported crop and livestock farm receipts (excluding government payments) in 2015, compared with only about 17% of farm receipts for commercial farms, according to ARMS data. Nevertheless, the increased expensing limit has had a much larger impact on commercial farms' income, since they regularly invest amounts well above the prior \$20,000 limit. Since 2000, depreciation expenses for commercial farms more than doubled while the amount for residence farms only increased by about one-third and actually declined slightly for intermediate farms.

The tax treatment of farm income is reflected in the size of farm profits and losses reported for income tax purposes. Nearly all farms and a majority of commercial farms are organized as sole proprietorships or partnerships. These are considered pass-through entities by the IRS, so taxes on farm business income is reported and paid by the farm household. Since 2001, IRS tax data indicate that farm sole proprietorships have reported negative aggregate net farm income for tax purposes (net cash farm income after depreciation and capital expensing). In 2014, about two-thirds of all farm sole proprietors reported a net farm loss (figure 2). The average loss was \$20,588 for an aggregate loss of \$24.6 billion. These farm losses have generally been used to reduce current Federal taxes by offsetting taxable income from nonfarm sources.

Figure 2: Taxable losses exceeded taxable profits each year for farms organized as sole proprietorships



Source: ERS analysis of Internal Revenue Service (IRS) Federal income tax data, Schedule F, 2001-2014

The increased tax depreciation expense reduces net farm income and farm income variability since investment and expenses are often larger in high income years and lower in low income years when investment may be deferred and the costs of existing farm machinery and equipment may have already been recovered due to the capital expensing option. It also increases both the number of farms reporting a loss and the size of their loss. The losses often contribute to farm household income by reducing the taxes that would otherwise be due on nonfarm income. This economic benefit to the farm household can be significant. This paper uses a federal income tax estimation model to calculate farms’ tax loss benefits, as well as an adjusted measure of farm returns that accounts for this tax loss benefit and for farmland appreciation.

Asset appreciation and farm returns

Assets also contribute to the overall returns for farms and farm households. Farmland represents about 84% of total farm assets. Annual returns to farmland include both annual cash returns and

the change in market value. Over the years farmland investments have yielded a very competitive rate of return: about half of the total return has come from the appreciation in land market value. However, the annual net cash farm income measure only reflects the cash return component. At the same time, the cash return measure includes most land ownership costs such as interest and property taxes—two of the primary expenses associated with land ownership—that reduce the annual cash return. While low interest rates, reduced leverage and preferential assessment for farm real estate have lowered these expenses, they continue to represent significant annual expenses, especially for residence farms. Combined, these two expenses are nearly half of the income for residence farms.

Federal Income Tax Estimation Model

The tax benefits that accrue to the farm operator as a result of farm losses are based on estimates from a Federal income tax simulation model developed by ERS. The model is unique in that it is designed to utilize farm survey data from the Agricultural Resource Management Survey (ARMS). The estimates presented are based on 2015 tax provisions and 2015 ARMS data. The ARMS data provides information on household income and its components, filing status (married or single; if married, we assume their filing status is “married filing jointly”), household size, and characteristics of the farm and the farm household. Farm business income to the household is defined as the household’s share of farm profits (net cash farm income) less depreciation.

The model utilizes the most significant features of Federal income tax law applicable to farm operator households to estimate Federal income, Social Security and Medicare contributions, and self-employment taxes. These features include tax rates, including special rates on capital gains, the inclusion or exclusion of various types of income from the tax base, exemption and standard deduction amounts, and some credits including the earned income tax credit and the child tax credit. Due to data limitations, the model assumes that the farm operator household takes the standard deduction rather than itemizing. Because of this, the tax loss benefit that is generated by the model can be thought of as a lower bound on a farm’s tax loss benefit. Important omitted deductions include those for charitable donations, medical expenses, and state and local taxes. In addition, some households may experience a tax benefit from smoothing their income over multiple years; because ARMS is a cross-sectional survey, we do not account for this.

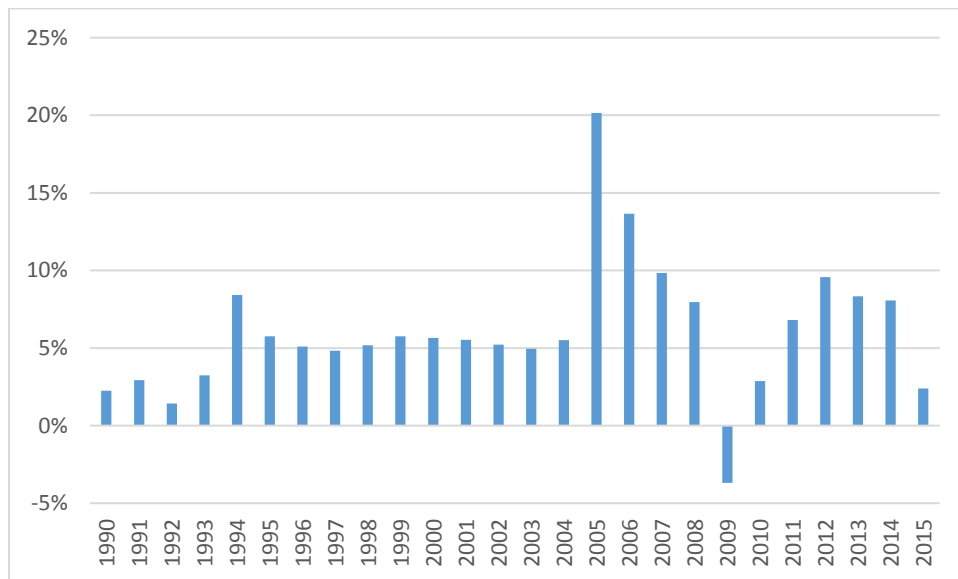
The tax loss benefit is calculated by taking the difference between the results of the calculations described above and a similar calculation of the households’ tax liabilities but without the tax benefit of the farm loss. For this paper, the model was extended to calculate farmland appreciation for each operation, using data on the value of land and buildings (ARMS) and the average rate of farmland appreciation in each state (NASS Quick Stats).

Adjusted Returns to Farming

Using the model described above and data from the 2015 ARMS on farm and household income, we explored the average effects of the tax loss benefit and farm real estate appreciation relative to the farm household's pre-tax loss from the farm business. Farming contributes little to the annual income of the typical farm household operating a residence farm, is a secondary source of income for the average household with an intermediate farm, and is the primary source of income only for those operating commercial farms. In 2015, only 34% of residence farm households had positive income from farming, compared to 48% of intermediate and 82% of commercial farms. However, this does not account for the effect of tax savings from farm losses and the increase in farmland values.

Farm households reporting a loss from the farm business in 2015 received an average tax benefit from these losses of \$2,178. Farmland appreciation, although it does not provide any cash for making loan payments or for paying property taxes or other ownership costs, still provides a significant economic benefit to the farmer that is not captured in net farm income. As shown in figure 3, average U.S. farm real estate values increased every year except for 2009. The increase in 2015 was 2.4%, the fourth-lowest increase during this period.

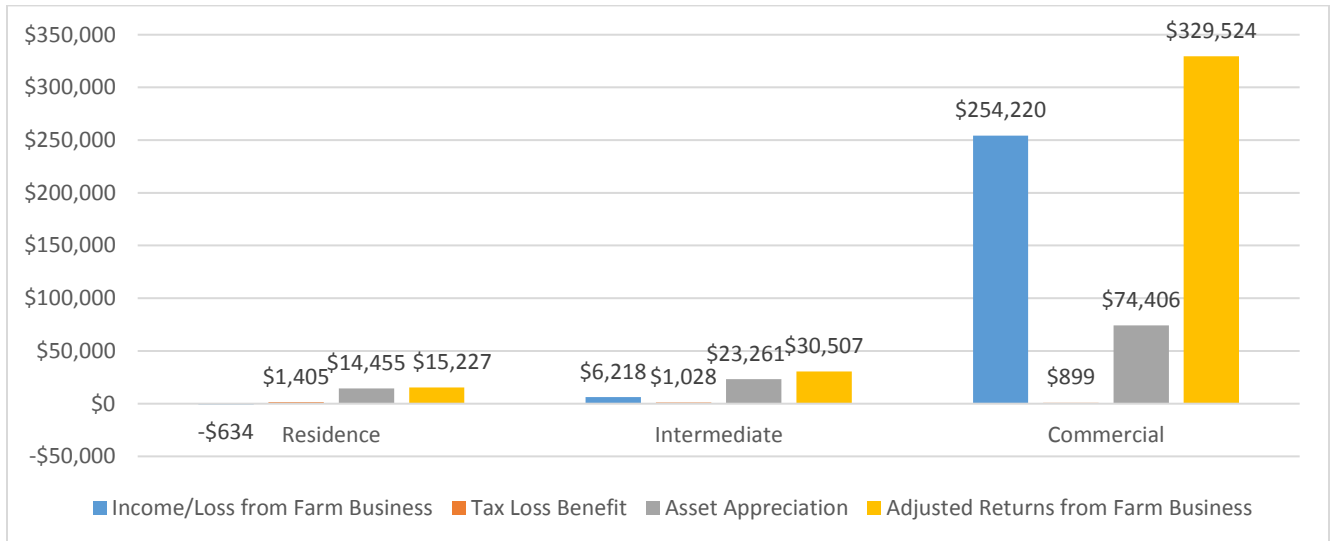
Figure 3: Farm real estate values have increased almost every year since 1990



Source: ERS analysis of data from NASS Quick Stats

Benefits vary by farm size. Figure 4 shows the average values of the farm household income or loss from the farm business, tax loss benefit, and farm real estate appreciation in 2015, across residential, intermediate, and commercial farms. Residence and intermediate farms' tax loss benefits and asset appreciation, although smaller in absolute terms than those received by commercial farms, are larger relative to the income/loss from the farm business.

Figure 4: Average adjusted returns from farm business markedly higher for all types of farms, 2015

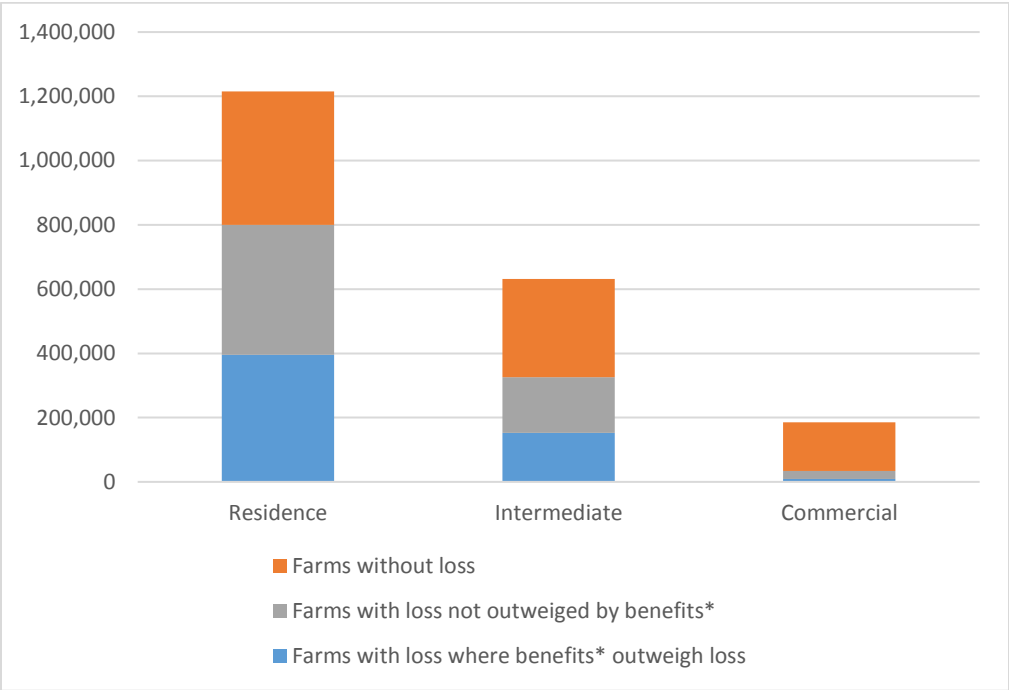


Source: ERS analysis of the 2015 Agricultural Resource Management Survey, USDA

However, the averages mask significant variation within each farm typology. The following analysis presents the distribution of farm households, according to whether or not they experienced farm losses in 2015 and, if so, whether the value of the tax loss benefit and real estate appreciation outweighed the loss from the farm business.

Figure 5 shows the breakdown across farm typologies between (from the bottom up) (1) farm households that experienced a loss from the farm business in 2015 and had tax loss benefits and real estate appreciation that were larger than the loss, (2) farm households that experienced a loss from the farm business that was not outweighed by tax loss benefits and real estate appreciation (adjusted returns were negative), and (3) farm households that did not experience a loss from the farm business in 2015.

Figure 5: Largest number and percentage of residence farm households experienced both a loss from the farm business and positive adjusted returns

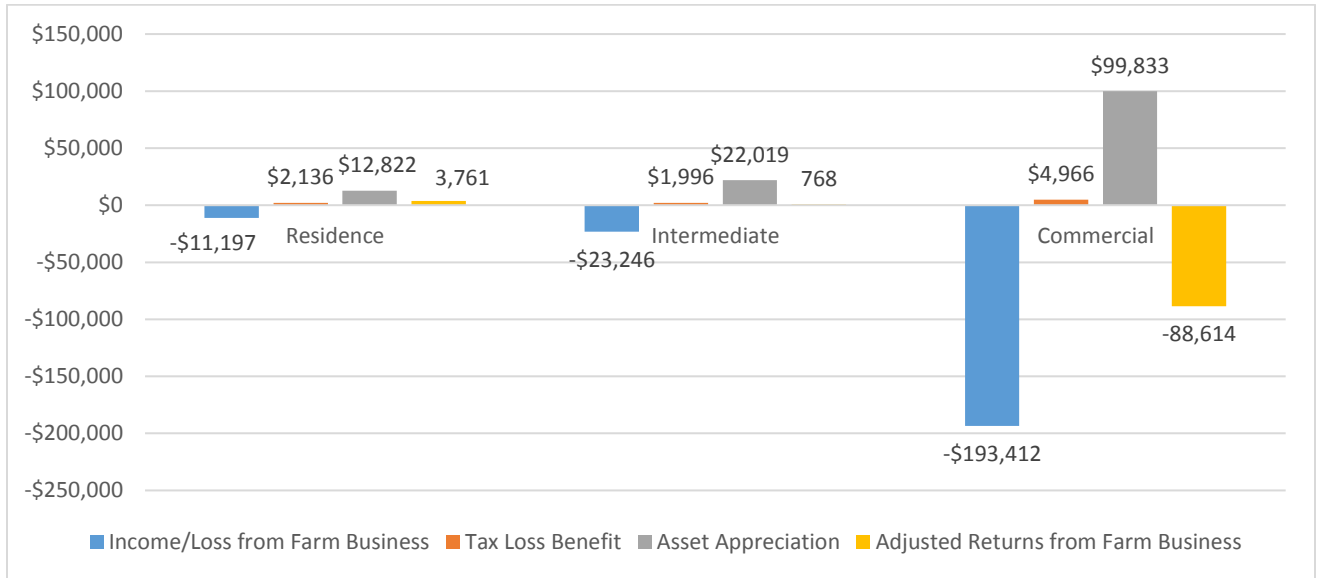


Source: ERS analysis of the 2015 Agricultural Resource Management Survey, USDA
**benefits refer to tax loss benefits and the gains from asset appreciation*

The share of farm households that experienced a loss from the farm business in 2015 had an inverse relationship with farm size, both in terms of the number of farm households (as the figure illustrates) and the percent. Almost two-thirds (65.8%) of residence farm households experienced a loss from the farm business in 2015, compared to 51.5% of intermediate farms and 18.1% of commercial farms. When limiting the analysis to only those that had experienced a loss, residence farms contained the largest share of households for which the tax loss benefits plus real estate appreciation outweighed the loss from the farm business (adjusted returns were positive), at 49.5%, followed by 47% of intermediate farms and 25.8% of commercial farms. The figure shows that this pattern is also mirrored in the number of households experiencing a loss from the farm business but positive adjusted returns.

The lower percentage of commercial farms with a loss from the farm business and a positive adjusted return is primarily due to the size of the losses reported by these farms. Figure 6 repeats the analysis from figure 4, but limits it to farm households that had experienced a loss from the farm business. Note that after adjusting for the tax loss benefit and real estate appreciation, the average adjusted returns from the farm business were positive for residential and intermediate farms but were still negative for commercial farms.

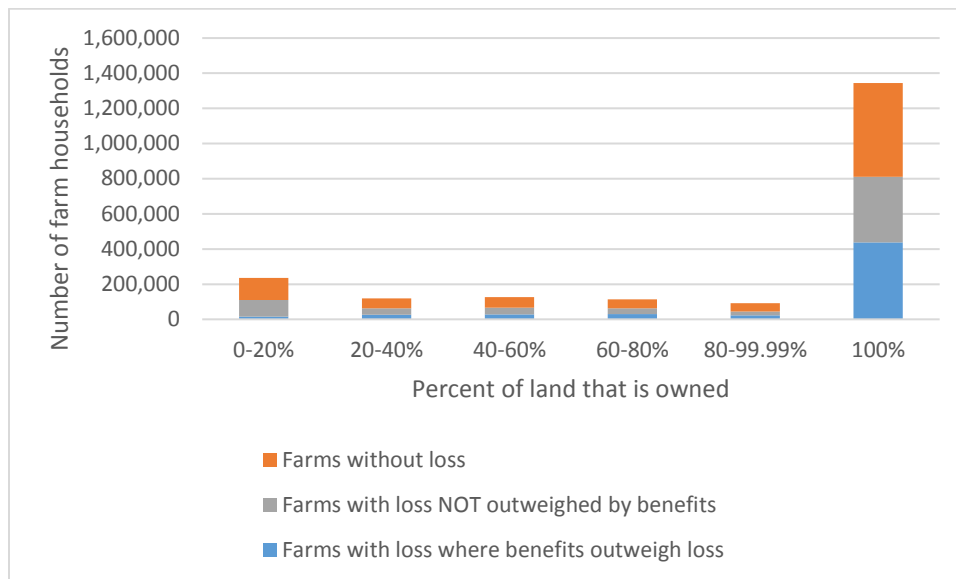
Figure 6: For farms with a loss: average adjusted returns from farm business were still negative for commercial farms



Source: ERS analysis of the 2015 Agricultural Resource Management Survey, USDA

As seen in figures 4 and 6, the value of the real estate appreciation was much larger than that of the tax loss benefit. It follows that there would be a greater concentration of households with combined benefits (tax loss benefit plus real estate appreciation) that outweighed the farm loss among those with the highest percentage of owned land (as opposed to rented land). Figure 7 sorts farm households into categories according to the percentage of operated land that was owned in 2015. As in figure 5, we show the percentage of households that experienced a positive on-farm profit, a farms loss outweighed once tax loss benefits and asset appreciation is accounted for, and a loss despite these benefits.

Figure 7: Positive relationship between the share of farmland owned and farm households with both negative income from the farm business and positive adjusted returns

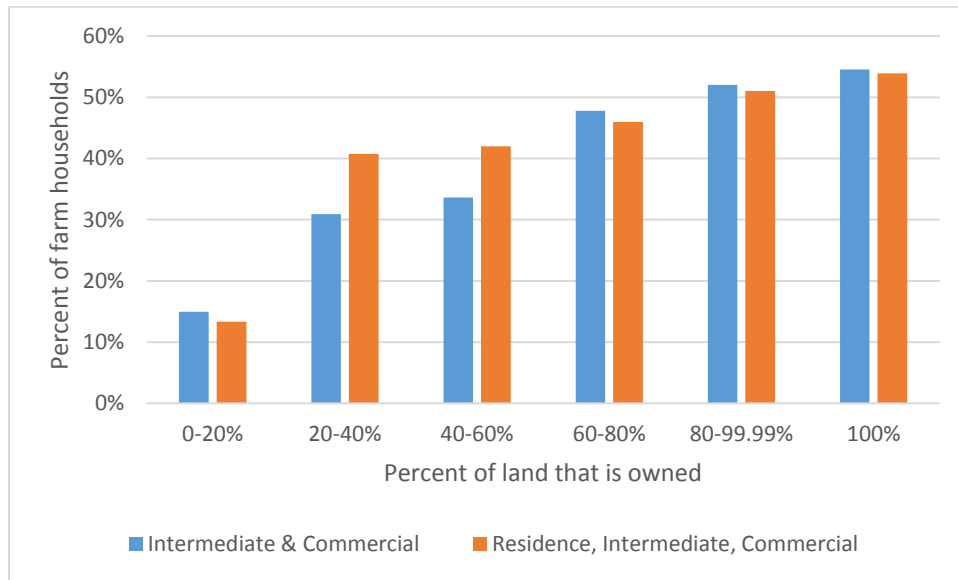


Source: ERS analysis of the 2015 Agricultural Resource Management Survey, USDA

Approximately half of farm households experienced a loss from the farm in 2015, across all ownership categories, ranging from 46.7% for those owning 0–20% of their operated land to 60.3% of those that owned 100% of their land. There was a positive relationship between the share of farm households that experienced combined benefits that outweighed the loss and the percentage of farmland that was owned. Only 13.3% of farm households owning 0–20% of their land benefited from tax loss benefits plus real estate appreciation that outweighed the loss from their farm business, compared to 40.8% that owned 20–40% of their land, 42% that owned 40–60%, 45.9% that owned 60–80%, 51% that owned 80–99.99%, and 53.9% that owned all of their operated farmland.

76% of all residence farms owned all their operated land in 2015, and residence farms included the largest number (and percentage) of farms that experienced a both loss from the farm business and positive adjusted returns. Does increased ownership (percent of operated land that is owned) also lead to higher positive adjusted returns when excluding residence farms? The number of farm households in each category and sub-category is qualitatively similar terms. In terms of the percentage of farms within each ownership category, the positive relationship between land ownership and the percentage of households with a loss but positive adjusted returns still remains but the increase is more gradual than what is presented above. Figure 8 presents a comparison.

Figure 8: Percent of farm households with negative income from the farm business but positive adjusted returns, by percent of operated land that was owned



Source: ERS analysis of the 2015 Agricultural Resource Management Survey, USDA

The foregoing analysis shows that households with small farming operations that experience a loss often have positive returns once full tax benefits are accounted for. However, given that commonly-used financial instruments, such as treasury bonds, will provide a safe, guaranteed return above zero, how do farm operations compare? In the next section, we investigate the returns to assets for households operating farm operations, taking into account the opportunity cost of unpaid family labor needed to operate the farm.

Return on assets

Although the average return in a given year may be low, continuing to operate the farm may still make economic sense for the household. Indeed, farm households must continually evaluate whether to sell the farm and invest the money (and time needed to run the operation) elsewhere, or continue to farm. One financial benchmark used to determine this is the return on assets (ROA), a widely-used measure across many industries.

ROA is one of the financial ratios that indicates the performance of an individual firm, relative to others in industry. One industry group, Northwest Farm Credit Services, recommends that, depending on whether most assets are owned or leased, the ROA should be greater than 5% or 12% to be considered in the “green” zone. An ROA between 1 and 5% (for farms owning their assets) or between 5 and 12% (for farms leasing their assets) is in the “yellow” zone.

Alternatively, an ROA of less than 1% or less than 3% is considered in the “red” zone (Northwest Farm Credit Services).

For farming operations, the Return on Assets is calculated as:

$$ROA = \frac{FarmBus.Income + InterestPayments - Time Charge}{Farm Assets}$$

where *FarmBus.Income* (farm business income) is equal to net cash farm income (revenues minus expenses) less the value of economic depreciation of assets used for farm operations, such as tractors or harvesters. Interest payments include interest on all farm loans (both real-estate, non-real estate and operating loans). The time charge is calculated as the average wage rate paid to workers in the farm typology.⁴

To account for tax loss benefits and asset appreciation, we create a modified ROA that includes the real estate appreciation and tax loss benefits that farm households receive. This produces a modified return on assets (MROA), which better captures the actual return from operating the farm business. While the tax loss benefit (TLB) is a financial return captured in the same year, gains from asset appreciation are not realized until the farm is sold.

$$MROA = \frac{FarmBus.Income + AnnualAppreciation + TLB + InterestPayments - Time Charge}{Farm Assets}$$

For this analysis, we show results using measures of return on assets using NASS’ farmland real estate values. This describes the return using a single year of asset value appreciation. Because real estate values fluctuate, we also include a five-year average. Depending on whether 1-year or 5-year real estate values are used, including the tax loss benefits and real estate appreciation adds an additional 3.2% or 5.6% to the average return. While most of the benefits come from asset appreciation, for smaller farms, the tax loss benefits may increase overall returns by up to 2-3%.

Table 1, Modified return on assets, using 1-year asset appreciation

	Mean	p10	p25	p50	p75	p90
Residence	-0.007	-0.089	-0.029	0.005	0.040	0.077
Intermediate	0.007	-0.081	-0.025	0.013	0.056	0.106
Commercial	0.154	-0.035	0.017	0.073	0.153	0.309

Source: ERS Analysis of Agricultural Resource Management Survey, 2015; NASS Quick Stats database

Across all farms, using the 1-year measure, the average return from farming is 1.1%. Average return on assets are very close to zero for households operating residence and intermediate farms,

⁴ According to data collected in the 2015 ARMS, average wages ranged from \$13.17 to \$13.78 per hour, and were highest on commercial farms.

while higher for those owning commercial farms. For commercial farms, returns average 15% with half of all farms earning more than 7.3% return on their assets.

Table 2, Modified return on assets, using 5-year asset appreciation

	Mean	p10	p25	p50	p75	p90
Residence	0.011	-0.078	-0.018	0.019	0.062	0.109
Intermediate	0.032	-0.070	-0.009	0.031	0.089	0.149
Commercial	0.204	0.002	0.063	0.120	0.197	0.340

Source: ERS Analysis of Agricultural Resource Management Survey, 2015; NASS Quick Stats database

Alternatively, arranging the measure using the 5-year asset appreciation yields higher returns. Across all farms, the average return is 3.4%, with household operating residence farms earning 1% at the mean and just under 2% at the median. Rates for intermediate and commercial farms average 3% and 20%, respectively. In other words, while official statistics show that more than half of these farms lose money on the farm operation, adjusted returns are above 2-3% for half of non-commercial farms.

Not all commodities require the same amount of investment or time. In 2015, returns varied by commodity type produced, with average returns for cash grain, dairy, poultry and high value crops with relatively high returns. We show returns only for “farm businesses,” where farming is the primary occupation or gross cash income is over \$350,000 (intermediate or commercial farms). Notably, the highest returns at the upper end are for specialty crops and hogs, while these same farms also generated the biggest losses. At the median only general livestock produced returns under 3%, with cash grains and hogs having the highest median returns.

Table 3, Modified return on assets, 5-year asset appreciation, by commodity type*

	Mean	p10	p25	p50	p75	p90
Cash Grain	0.132	-0.021	0.044	0.098	0.152	0.237
Rice, Tobacco, Cotton, Peanuts	0.042	-0.328	-0.024	0.037	0.130	0.332
Other field crops	0.065	-0.051	-0.006	0.051	0.143	0.173
High value crops	0.120	-0.084	0.005	0.048	0.144	0.307
Beef Cattle	0.037	-0.056	-0.007	0.027	0.072	0.132
Hogs	0.083	-0.243	0.004	0.103	0.163	0.276
Poultry	0.036	-0.065	-0.007	0.048	0.107	0.190
Dairy	0.086	-0.043	0.017	0.063	0.119	0.205
General Livestock	-0.042	-0.186	-0.049	0.006	0.055	0.099

Source: ERS Analysis of Agricultural Resource Management Survey, 2015; NASS Quick Stats database

*includes only farms with a primary-occupation farmer or more than \$350,000 in gross cash income

Another way to examine these results is through the percentage of farmland that is owned by the operation. Because farmland tenure increases throughout the operator’s lifecycle, those operations owning all of their land include retirement farms, which may have a lower return. In fact, the highest average return is for those operations owning between one-fifth and four-fifths of their farmland. Conversely, large farms may rent in land for their operation and those farms owning less than one-fifth of their land earn the highest returns at the 75th and 90th percentile.

Table 4, Modified return on assets, 5-year asset appreciation, by percent of land owned*

	Mean	p10	p25	p50	p75	p90
0-20%	0.071	-0.238	-0.046	0.058	0.172	0.371
20-40%	0.101	-0.045	0.014	0.065	0.134	0.236
40=60%	0.093	-0.023	0.011	0.066	0.130	0.184
60-80%	0.108	-0.051	0.015	0.066	0.115	0.180
80-99.99%	0.082	-0.021	0.019	0.060	0.118	0.172
100%	0.053	-0.050	-0.003	0.038	0.097	0.155

Source: ERS Analysis of Agricultural Resource Management Survey, 2015; NASS Quick Stats database

*includes only farms with a primary-occupation farmer or more than \$350,000 in gross cash income

Finally, an examination by debt status (debt-to-asset ratio), shows that farms with increased debt have higher returns on the assets that they do own. Households operating these farms leverage their assets and experience higher profits on their farm operations. Farm businesses with debt between 15% and 30% of assets earn the highest profits (\$210,000), while those with a debt-to-asset ratio greater than 30% earn the second-highest. As the ROA measure adds back interest payments to the numerator, it does not penalize the households for the cost of servicing the debt (interest payments are deducted from farm business income as an expense). The MROA measure shows returns increasing monotonically with debt-to-asset ratios.

Table 5, Modified return on assets, 5-year asset appreciation, by debt class*

	Mean	p10	p25	p50	p75	p90
<5%	0.056	-0.054	-0.004	0.040	0.101	0.167
5-15%	0.072	-0.038	0.010	0.063	0.124	0.190
15-30%	0.095	-0.056	0.010	0.070	0.135	0.211
>30%	0.109	-0.101	-0.005	0.071	0.161	0.290

Source: ERS Analysis of Agricultural Resource Management Survey, 2015; NASS Quick Stats database

*includes only farms with a primary-occupation farmer or more than \$350,000 in gross cash income

In sum, farm households earn returns that vary substantially depending on the size and commodity produced by the farm operation, ranging from average returns near zero, to 20% for the largest operations. Because output prices and input costs vary substantially from year-to-year, an individual operation may experience highly volatile profits and corresponding returns.

How do these results compare with other industries?

Erickson et al. examine the historical rates of return for farms and corporate nonfarm nonfinancial business assets. They find that over the period 1960-2001, nonfarm assets dominate those from farm business in every year but one. Similar to the analysis here, farm returns averaged between -1% and 10% (not including real estate appreciation or tax loss benefits), while the nonfarm sector varied between 11% and 21%.

Conclusion

This paper explores different measures of returns from farming. One measure was adjusted returns from farming, where a household's income or loss from the farm operation was adjusted for farmland appreciation and (for households that had experienced a loss from the farm business) tax loss benefits. The analysis showed that these adjustments, although smaller than for commercial farms, had a larger relative effect on households operating residence and intermediate farms—that is, they experienced a greater boost to their economic return, relative to the size of their farm operation. In the case of residence farms these adjustments were large enough on average to outweigh the average loss that the household received from the farm business. Households operating small farms, and farms that owned a large percentage of their land, were more likely to experience a pre-tax loss from the farm business but have positive adjusted returns, relative to households operating larger farms or those with more rented land.

We also calculated a modified measure of return on assets, incorporating these adjustments. Larger farms were found to have higher average modified return on assets, as were cash grain and high-value crop farms. There was also a positive relationship between the farm's leverage and its modified return on assets.

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