Do Most U.S. Farms Really Lose Money?

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Title:

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Introduction:

The USDA Agricultural Resource Management Survey (ARMS) indicates that the majority of farm sole proprietors earn negative on-farm household income, and many of those with positive income earn an implicit wage substantially below what could be earned off farm. What can explain the prevalence of negative or low returns in farming – particularly on smaller-scale operations? One possibility is that farmers derive nonpecuniary benefits from farming and are willing to accept a lower return from farming because they enjoy certain attributes associated with farm work. Another possibility is that farm income understates the true return to farming because farm income does not account for asset (land) appreciation. A third possible explanation, and the one explored in this study, is that farmers underreport their revenues and/or over-report their expenses on the survey so that the estimated farm income is lower than the "true" farm income (the farm income that would be estimated if the household had no incentive to underreport revenue or over-report expenses).

We develop a method for indirectly estimating the possible extent that income is "underreported" ("underreported" farm income is the difference between the estimated on-farm household income based on ARMS data and the estimated "true" farm household income). We do this by exploiting the fact that farm households generally receive income from both farm and nonfarm sources and face an incentive to report expenses and revenues that varies with their reported nonfarm income. Using ten years of farm survey data, we estimate the "true" and "underreported" farm income of representative households in five asset categories.

Chart 1: Farm income is negative for many farm households
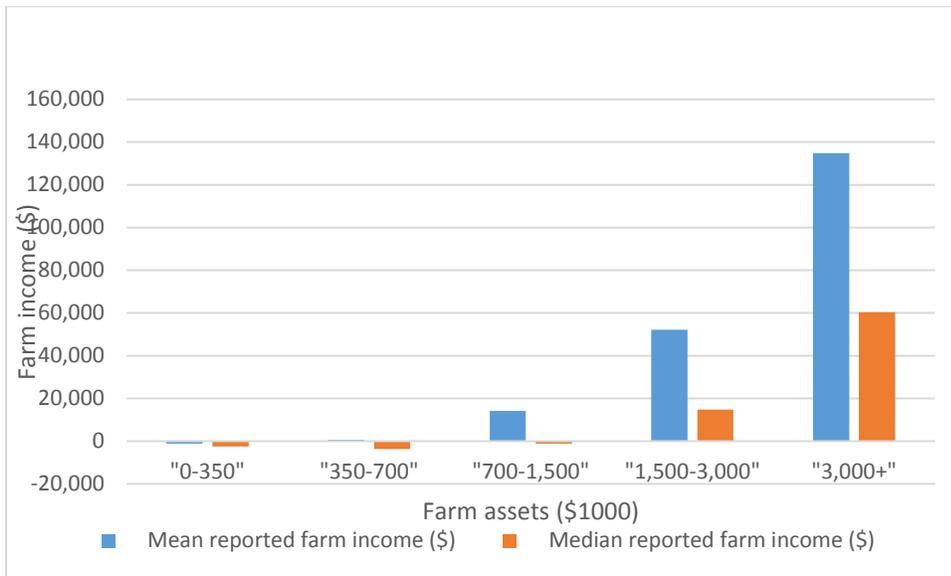
Source: ARMS 2006-2015. Values in 2016 dollars.

Chart 1 shows the median and mean farm household income for farm households in five different farm asset categories from 2006 to 2015. For the three smallest farm asset categories, which account of 87 percent of farms, the median farm income is negative. Why would farmers continue to operate farms that lose money? We explore the hypothesis that "true" farm income is actually higher than the estimated farm income (based on the expenses and revenues reported on USDA's ARMS) because households underreport revenues and/or over-report expenses.

Chart 2: Methodology
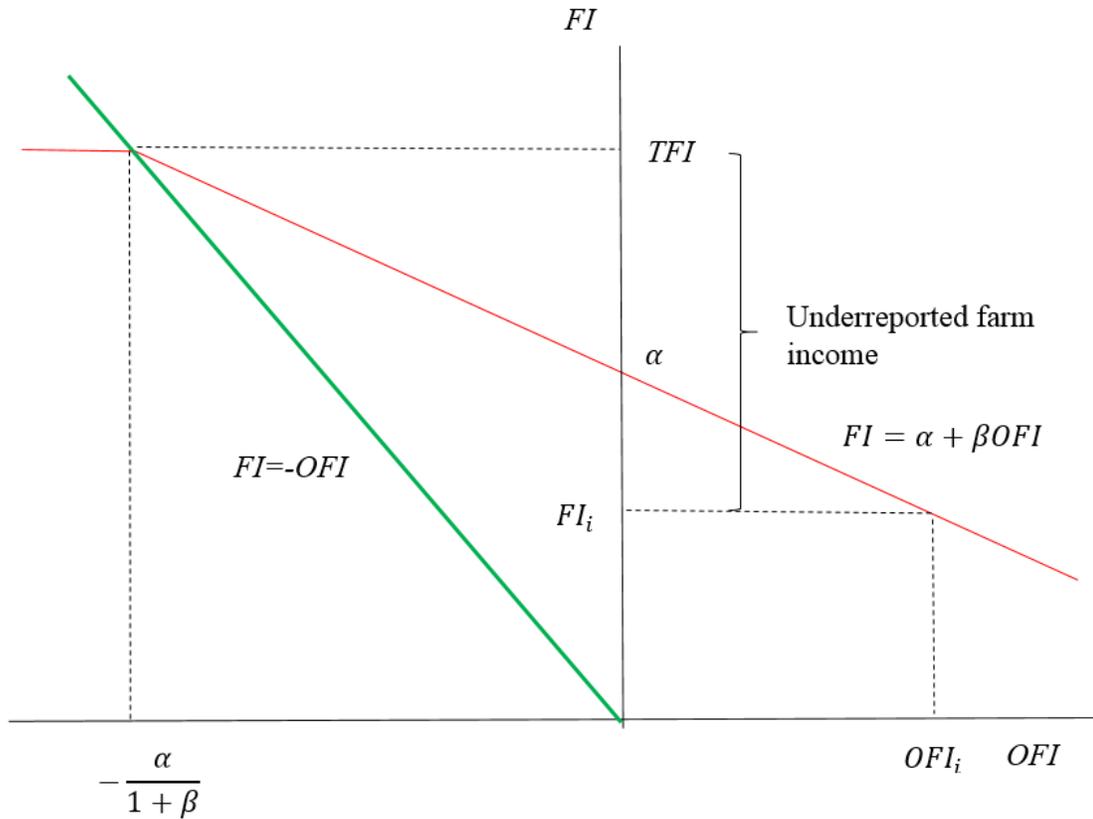
In chart 2 the x-axis shows the off-farm income of the household and the y-axis shows the on-farm income of the household (the income measures are estimates calculated using data from multiple survey questions). Farm income is agricultural income to the household, which includes farm business income (revenues minus expenses minus depreciation) plus farmland rental income plus other farm business income plus farm wages paid to the household.

The red line shows a negative linear relationship between farm income *FI* and off-farm income *OFI* for farm households that have a "true" unobserved farm income *TFI*. FI_i and OFI_i are the farm and off-farm income for a particular household i. A negative relationship between off-farm income and farm income could result from the way farm households respond to tax incentives. A household with variable off-farm income will have an incentive to adjust its farm spending and

sales across years to reduce its tax burden. This will result in a lower farm income when its off-farm income is high and higher farm income when its off-farm income is low.

An alternative reason we might see a negative relationship between farm income and off-farm income is if households underreport more income their household income increases. Holding farm income constant, a higher off-farm income means a higher marginal income tax rate, so a household will have a greater incentive to underreport the next dollar earned. A household should have no tax incentive to underreport farm income if its off-farm income exactly offsets its farm income. This occurs at all the points when $FI = -OFI$, which is shown by the green diagonal line. If we believe the negative association between farm and off-farm income is caused by underreporting, then we can use the predicted farm income at this offset point (at the intersection of the red and green lines) to estimate "true" farm income. We show that the predicted "true" farm income is a function of the slope and intercept of the red line: $FI = \alpha/(1 + \beta)$. Hence, by estimating the slope and intercept, we are able to estimate "true" farm income – which is defined as the farm income that would be estimated if the household had no incentive to underreport revenues or over-report expenses on the survey.

Chart 3: Households report less farm income as their off-farm income increases
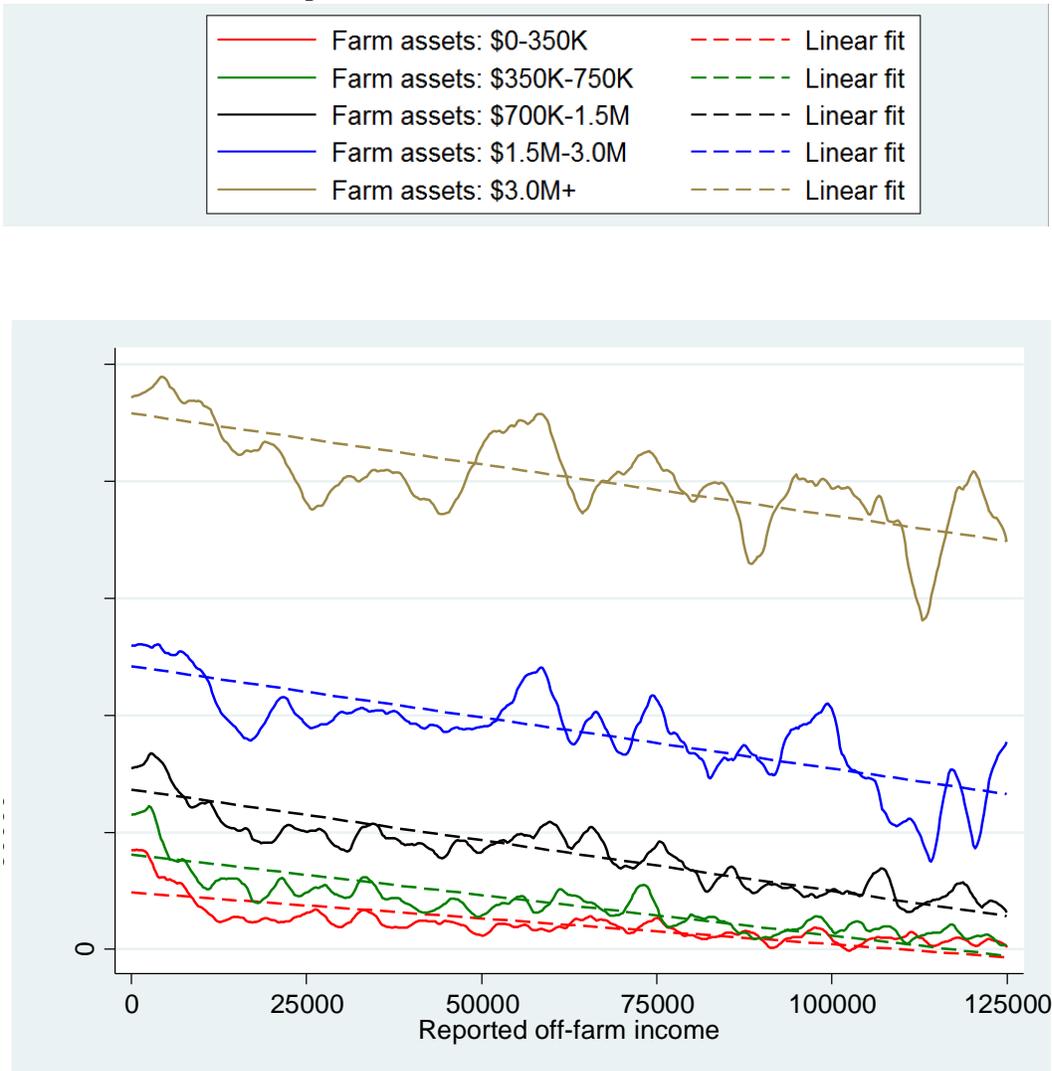
Source: ARMS 2006-2015. Values in 2016 dollars.

Chart 3 shows a kernel-weighted local polynomial regression and a linear regression of farm income on off-farm for farms in five farm asset categories. Off-farm income is truncated at $125,000 for clarity. The data show that relationship between off farm income and farm income is negative and approximately linear. Note that at each off-farm income level, the farm income values shown in chart 3 are greater than would be implied by the average values presented in chart 1. This is because the values in the chart 1 are estimated using weights in order to account for ARMS sample design and response rates. The local polynomial and linear regressions shown in chart 3 are estimated without weights.

Chart 4. Implicit hourly farm wage declines with off-farm income
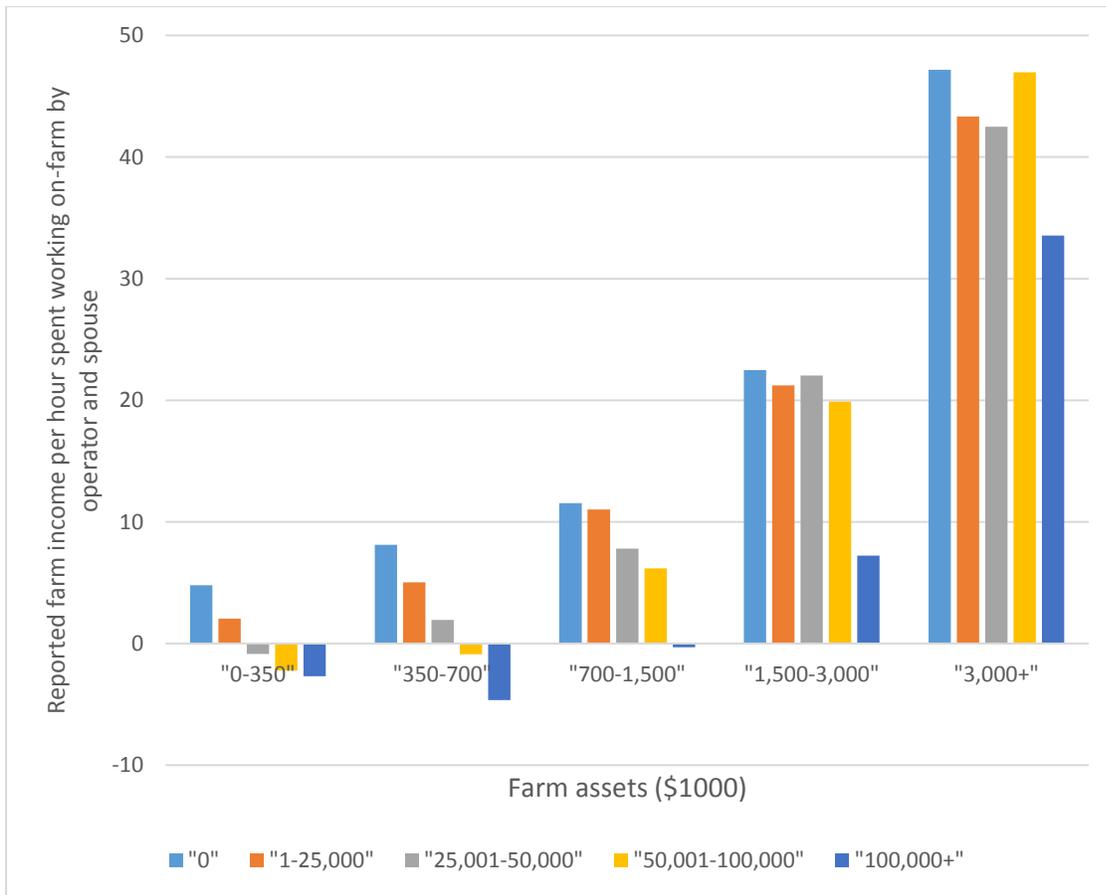
Source: ARMS 2006-2015. Values in 2016 dollars.

Chart 4 shows that the implicit farm wage (farm income divided by hours spent working on-farm by the operator and spouse) declines with off-farm income in each of the farm asset categories. For example, among households with less than $350,000 in farm assets, those with no off-farm income earned $4.80 per hour working on-farm while households that earned more than $100,000 off-farm lost $2.69 per hour working on farm. Hence, the negative relationship between farm and off-farm income remains, even after adjusting for time worked on-farm.

Chart 5. Main results: Estimates of "true" farm income and "underreported" farm income

	Farm assets ($1,000)				
	0-350	350-700	700-1,500	1,500-3,000	3,000+
1. Farm income	-1,168	651	14,192	52,231	134,761
2. Estimated "true" farm income	230	4,587	23,205	81,751	211,173
3. Estimated "underreported" farm income	1,398	3,936	9,013	29,520	76,412
4. Estimated "underreported" farm income/ Estimated "true" farm income	6.08	0.86	0.39	0.36	0.36
5. Estimated "underreported" farm income/ total income	0.02	0.05	0.10	0.24	0.38
6. Farm income/hour	-0.99	0.41	6.84	19.17	43.04
7. Est. "true" farm income/hour	0.19	2.90	11.18	30.01	67.45

Source: Author's calculations using ARMS 2006-2015. Values in 2016 dollars.
Note: Values are average per farm. Ratio averages (rows 4-6) are calculated by dividing the numerator total for the asset category by the denominator total for the asset category.

Using ten years of ARMS data, we econometrically estimate the relationship between farm income and off-farm income conditional on farm assets, time spent working on-farm, and other factors. Statistically significant parameter estimates from the regression model allow us to estimate "true" and "underreported" farm income for representative farms in five asset categories ("underreported" farm income is the difference between "true" and the farm income calculated based on ARMS responses). The main findings are:

- For all farm sizes, estimated "true" farm income (row 2) is substantially higher than estimated farm income (row 1). For example, in the smallest farm size category, the estimated income based on reported sales and expenses is a loss of $1,168 whereas we estimate these farms actually earned $230.
- For the smallest size category estimated "underreported" income actually exceeds true income because average farm income is negative (row 3).
- Households operating smaller farms are estimated to "underreport" a larger share of their farm income (row 4). In aggregate, we estimate that 39% of true farm income is not reported. This is consistent with underreporting percentages reported by studies using IRS data.
- Households operating larger farms are estimated to "underreport" more total income, and their "underreported" income represents a greater share of their total household income (row 5). The ratio increases because for households with bigger farms, farm income represents a greater share of household income.

- Row 6 shows the implied average hourly returns to the operator and spouse's labor based on farm income. The implicit wage is higher if we account for income underreporting (row 7). However, this "true" implicit wage is low for farms with less than $700,000 in farm assets.

Conclusions:

- **Difference between farm income and our estimate of "true" farm income varies by off-farm income and farm size**. We estimate that, holding farm assets, time worked on-farm and other factors constant, those who earn more off-farm also have less on-farm income. Based on this relationship we estimate "true" farm income for representative farms in five asset categories. We estimated that "underreported" income increases with farm size, though "underreported" income as a share of estimated "true" income decreases with farm size.
- **Average estimated "true" farm returns are positive for small farms after accounting for estimated income underreporting**. However, the implicit hourly farm wage is well below the statutory minimum wage for households operating farms with less than $700,000 in assets. This suggests that other motivations, such as nonpecuniary benefits to farming, are needed to explain why many households continue to operate small-scale farms.
- **Farm income may underestimate the "true" return to farming.** We estimate that farm households underreported 39% of their farm income in aggregate, a level consistent with IRS studies of sole proprietors. For large-scale operations, we estimate that farm households earn thousands of dollars more than is reported on the survey.
- **Accounting for incentives to underreport revenues or over-report costs could improve measures of farm household well-being**. USDA estimates of farm household income can inform policies such as targeted technical assistance and provision of credit that aim to address rural poverty and inequality between agricultural areas and non-agricultural areas. This study suggests that estimates of farm income could be improved by accounting for the possibility that some farmers may underreport revenues or over-report expenses.