Agricultural Profits and Farm Household Wealth: A Farm-level and Cross-sectional Analysis

by

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Abstract

This study examines the relationship between agricultural profits and farm household wealth across locations and farm sizes in U.S. agriculture. Farmland has out-performed non-farm investments over the past decade. Thus, households may want to keep their farmland to build wealth, even if it requires them to earn off-farm income.

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Today's global markets for agricultural commodities add even more importance to the concept of comparative advantage for American farmers and ranchers. In the past, producers in a location could assess the comparative advantage of their resources and allocate assets to the production of the commodities for which their resources were best suited. Very little market assessment was necessary before making a cropping decision because virtually anything produced could be sold for some profit in what were mostly domestic markets. Today agricultural producers in some places in the U.S. are finding that the markets for the commodities in which they have a comparative advantage now include foreign competitors and, as a result, the American producer does not have much, if any, absolute advantage. Thus, a location's comparative advantage constrains its list of commodities which can be produced, therefore constraining the list of markets in which producers can compete. Regions and local areas with an absolute advantage in producing some commodities are expected to generate a higher profit margin than other locations that are not as well suited to agricultural production. Prior research has shown that differences in profit performance can be significant across regions in the United States (Blank, Erickson and Moss). This is important because relative profit levels indicate which producers are more competitive in a commodity market (i.e., more-profitable producers are said to have a "competitive advantage"). Profit differences across producers lead to some regions' agriculture sectors being financially stronger than other regions over time. This is most likely due to differences in the crops and livestock being produced in each region. In other words, comparative advantage differences lead to differences in financial performance which, in turn, contribute to differences in the long-run viability of agricultural industries in locations.

Cropping and other decisions are made at the farm level, so the key to assessing a region's agricultural viability is to assess the performance of farm-level financial decisions. It is usually hypothesized that farm-level decisions are made with an objective of increasing the household's wealth (Blank et al.). The household's ability to raise wealth is influenced by the size of the farm, what commodities are being produced, and by its proximity to urban development and opportunity for off-farm employment. Thus, significant differences between households across American agriculture imply that some locations are at risk of losing their agricultural industries as individuals leave agricultural production for more profitable alternative investments.

Farm consolidation and competitive pressures in U.S. agriculture have been unprecedented in recent decades. Where possible, farmers are pursuing off-farm sources of income to support households that own production operations which cannot generate sufficient income. Also, income constraints affect demand for new technologies and new production systems. These changes in agriculture have affected the size and distribution of net value added by farm operators (Mishra et al.). Such developments strongly suggest the need for improved understanding of farm household wealth and its links to profitability and long-run viability.

For example, off-farm income affects how we view efficiency in the farm household. Small farmers have partially adapted to shortfalls in farming competitiveness by increasing off-farm income or have adopted an alternative strategy for producing household income that results in lesser farm competitiveness with more certain off-farm income (Nehring, Fernandez-Cornejo and Banker; Morrison-Paul and Nehring). Additionally, urban proximity, which is associated with higher levels of off-farm income, appears to have raised the costs and decreased the viability of traditional farms (Nehring et al). These trends suggest particularly strong competitive pressures on traditional farms in highly urban areas, inducing dramatic reductions in livestock herds.

The objectives of this study are to examine the relationship between agricultural profits and farm household wealth across locations in U.S. agriculture, and to highlight some policy implications. Farmers and ranchers are making production decisions based on total household wealth, not just of farm production profitability (Carriker et al.). Therefore, we want to explain wealth patterns across regions, farm sizes, and commodity specialization to gain insights into the future prospects for American agriculture. Existing research has largely focused on the *farm business* as the relevant unit of analysis rather than the *farm household.* Thus, this study contributes to the empirical literature in at least two ways. First, it evaluates farm household data from all 10 regions, not just a couple regions as done in previous studies. Second, it gives separate results for different farm types/sizes. In total, it is expected that these results will provide insights for better-targeted policy options. Finally, this study also makes an analytical contribution in that it demonstrates a new procedure for deriving regression results from farm-level pooled repeated cross-sectional survey data.

The Relationship Between Income and Wealth[1]

Total *wealth* (W) is usually expressed as equity or total net worth at time *t*. Over time, wealth changes such that $W_t = W_{t-1} + \Delta W_t$. Three components of income (i.e., economic

[1] This section draws upon the material in Blank et al. to summarize the accounting identities and theoretical relationships between variables. See that article for additional details. This paper does expand significantly on Blank et al.'s study by adding new variables, redefining some existing variables, expanding the number of regions

gains) contribute to wealth: profits from farm output, off-farm income, and capital gains on assets. Therefore, to understand the dynamics of wealth, we focus on *wealth changes* (ΔW) during a time period ending at *t*, which equals *farm income* (FInc) plus *off-farm income* (OFInc) plus *capital gains* (ΔK) minus *consumption* (C) for the period, or

(1) $$\Delta W_t = FInc_t + OFInc_t + \Delta K_t - C_t.$$

The four components of wealth changes, on the right-hand side of (1), are themselves functions of other factors:

(2) $$FInc_t = R_t + GP_t - PC_t - OK_t$$

(3) $$OFInc_t = Sal_t + Inv_t$$

(4) $$\Delta K_t = (K_t - K_{t-1})$$

(5) $$C_t = CL_t + QL_t.$$

As a result, we estimate a system of equations with recursive linkages among some key income factors and a household's wealth, as explained below.

In this study, total farm income (equation 2) is derived from total revenues from farmers' and ranchers' sales of production output (R), plus all government payments (GP) received by household members, minus all production and ownership costs. Production costs (PC) are the variable expenses incurred when producing an output. Ownership costs (OK) are the fixed and other expenses incurred (e.g., depreciation). Government transfers are included as an explanatory variable to enable an assessment of the true sustainability of farm production as an income source. To many farm households, government payments may be significant (Ahearn, El-Osta and Dewbre; Key and Roberts). Government payments could come from various

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evaluated, using a lengthier data set, and applying new analytical procedures. Appendix Table A lists and defines all variables.

sources, such as unemployment benefits, pensions or commodity program benefits. However, it is expected that most government payments to agricultural producers come from business activities concerning the household's ownership and/or operation of a farm or ranch. These payments are expected to vary across commodities and locations. Including the GP variable enables a test of that hypothesis.

Off-farm income has represented over 90% of average farm household income in recent years (Mishra et al.). Equation (3) states that off-farm income for a period ending at time *t* consists of the sum of off-farm salary or wages earned (*Sal*) and non-farm investment or "unearned" income (*Inv*). Off-farm employment is the primary source of non-farm income for a majority of farm and ranch households. Non-farm investment includes income sources such as interest income on savings, Social Security and other retirement benefits, and capital gains and dividends on nonfarm assets such as stocks and bonds.

Equation (4) specifies that *capital gains* are simply the change in value of a farmer's capital from one period to the next (i.e., $K_t - K_{t-1}$).[2] The capital variable (*K*) in (4) can be expressed as the sum of the market values for all assets (real estate, nonreal estate, and non-farm assets) held by a farm at time *t*,

(4a) $$K_t = LV_t + MV_t + FV_t,$$

where *LV* is the *value of land* and improvements (buildings, irrigation systems, etc.), *MV* is the *value of non-real estate assets* (e.g., machinery and other equipment), and *FV* is the *value of non-farm financial assets* (stocks, bonds, liquid savings, etc.). Farmland has historically represented about 75% of assets held by farm households. Also, farmland values vary much more than do

[2] It is worth noting that not all capital gains are liquid. Gains on physical capital are only realized if the asset is sold. However, some portion of unrealized capital gains can be converted into liquid assets to improve a farmer's operation. Lenders will usually loan a farmer up to some specific portion of the market value of the assets, referred to as the *loan-to-value* ratio (LTV). In all cases, $1 > LTV \geq 0$. Gains on financial assets (such as interest on savings

the other agricultural assets because they are a function of numerous variables (Drozd and Johnson; Huang et al.). A simple model for the expected price of farmland can be specified as

$$E(LV_{ft}) = E(R_{ft} + GP_{ft} - CK_{ft} + PROD_{ft} + D_{ft}), \quad (4b)$$

where LV_{ft} is the (average) value per acre of farmland and buildings (in state) for farm *f* at time t, R_{ft} is the (average) cash flow per acre from agricultural production (in state) of farm *f* at time t, GP_{ft} is government payments expressed in per acre operated terms, CK_{ft} is the average *cost of capital* at time t, $PROD_{ft}$ is a farm-level estimate of *productivity* per acre,[3] and the *population density* (people per square mile) in county (or state) *f* at time t is D_{ft}.[4]

Equation (5) specifies farm household consumption during a period ending at time *t* as the sum of the basic cost of living (CL_t), such as the cost of providing a minimum level of food and shelter to members of the household, and the extra expenditures made by household members to raise the quality of life to the desired level (QL_t). Consumption decisions affect change in wealth levels directly because all income (from farm and non-farm sources) not consumed become savings, which are held in some form as capital, thus contributing to capital gains.

Industry sales and profit totals are simply the sum of results from decisions made by the individual firms that constitute the industry. In American agriculture, individuals are assumed to make production decisions based on the goal of maximizing expected profits. This study follows Blank et al. in recognizing that results are influenced by both the innovation expertise and capital

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amounts) are realized instantly once paid and, therefore, immediately increase liquid wealth their full amount.

[3] We test several productivity per acre indexes, listed in Table 1, some based on livestock output, some based on crop output, and some mixing products. The mixed index, Prod-crpliv, used in this analysis is modeled as Prod_crpliv=prodcrp/acresop for farm type 1 and zero otherwise, and Prod_crpliv=prodliv/acresop for farm type 2 and zero otherwise.

[4] Equation 4b is presented assuming that all variables are measured in common units so the expected signs of regression coefficients can be indicated. The functional form of equation 4b is assumed to be linear and the

available within an industry (or firm). Thus expected profit, for firm *f* at time *t*, is specified as

(6) $$E(\pi_{ft}) = E[R_{ft} + GP_{ft} - PC_{ft} - OK_{ft} + (m_f)g(cr_{ft})G - \Delta(cr_{ft})]$$

where *R*, *GP*, *PC* and *OK* are defined as above, but are for firm *f* only. E(•) is the expected value of (•). The innovation expertise of firm *f* is denoted m_f and influences the firm's success at improving productivity. The probability of firm *f* improving its productivity in period *t* is $(m_f)g(cr_{ft})$, where cr_{ft} is defined as the firm's cumulative investment in human capital and productive resources through time *t* and is some function of profits earned in all prior periods. The function $g(cr_{ft})$ reflects the opportunities for improving productivity. The potential increase in profits earned by an innovation that improves productivity is *G*. This can result from either reduced input costs per unit (*PC/Q* and/or *OK/Q*) or increased revenue from a higher yield. *G* is defined to equal $(R_{ft} - PC_{ft} - OK_{ft}) - (R^*_{ft} - PC^*_{ft} - OK^*_{ft})$, where the asterisk indicates a value that would have existed for firm *f* in period *t* without the innovation. The change in cumulative investment during period *t* $[\Delta(cr_{ft})]$ equals $cr_{ft} - cr_{ft-1}$, and it is constrained to be ≥ 0.

A firm's expected sales revenues are

(7) $$E(R_{ft}) = R_{ft-1} + E[(m_f)g(cr_{ft})G + \Delta(cr_{ft})] .$$

Current revenues are expected to equal the previous year's revenues plus expected improvements from a productivity component $[(m_f)g(cr_{ft})G]$ and an investment component $[\Delta(cr_{ft})]$.

Procedure

We use farm-level data to help explain the inter-linkages between farm household wealth, returns, and productivity. We estimate each equation using repeated cross-sectional data from annual surveys for 1996-2004 over ten production regions: the Northeast, Lake States, Corn Belt,

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parameters along with fixed effects can be estimated using OLS.

Northern Plains, Appalachia, Southeast, Delta, Southern Plains, Mountain, and Pacific. Then, we examine factors affecting the change in wealth, farm income, land values, and profitability, given farm size and time effects.

Our data are annual farm level observations from the U.S. Department of Agriculture's Agricultural Resource Management Survey (ARMS). We include all production regions, and all farms. Using U.S. farm-level data from the 1996 through 2004 ARMS Phase III surveys (USDA/ERS 1996-2004) gives us a total of 95,517 observations from which we distinguish financial variables (average values listed in Table 1).

The rich data available in ARMS make our analysis possible. ARMS is a survey covering farms in the 48 contiguous States, conducted each year by the USDA, and designed to incorporate information from both a list of farmers producing selected commodities and a random sample of farmers based on area (USDA/ERS). Since stratified sampling is used, inferences regarding the means of variables for states and regions are conducted using weighted observations. The USDA has an in-house jackknifing procedure that it requires when analyzing ARMS data (Dubman; Kott; Cohen et al.). The farm-level data is used in an innovative way. We link nine annual ARMS surveys to form a pooled time-series cross-section, assuming that the survey design for each year is comparable. Hence, we are able to use the annual ARMS survey data to examine structural changes over time.

Incorporating the survey weights, and following the jackknifing procedure described in Kott, assures that regression results are suitable for inference to the population in each of the regions analyzed. The USDA/NASS version of the delete-a-group jackknife divides the sample for each year into 15 nearly equal and mutually exclusive parts. Fifteen estimates of the statistic, called "replicates," are created. One of the 15 parts is eliminated in turn for each replicate estimate with replacement. The replicate and the full sample estimates are placed into the following basic jackknife formula:

(8) $$\text{Standard Error } (\beta) = \{14/15 \sum_{k=1}^{15} (\beta_k - \beta)^2\}^{1/2}$$

where β is the full sample vector of coefficients from the SAS@ program results using the replicated data for the "base" run and β_k is one of the 15 vectors of regression coefficients for each of the jackknife samples. The t-statistics for each coefficient are simply computed by dividing the "base" run vector of coefficients by the vector of standard errors of the coefficients (Dubman). Each reduced form equation was estimated with year and farm size fixed effects.

To estimate these models using repeated cross-sections by year for the period 1996-2004, we created four size variables for each state. These four size variable are defined as: 1) small family farms (sales less than $250,000), 2) farming occupation, 3) large family farms (sales between $250,000 and $499,999) and 4) very large family farms (sales of $500,000 or more). The four-level size categories (i.e., our "cross-section" fixed effects) are by state and are meant to account for missing variables for similarly-sized farms within each state. They are appropriate when estimating our equations by region, for example. Therefore, these variables are used as fixed effects in all regional models, along with a year fixed effects variable.

In our assessment of financial performance across farm sizes, we use three size categories that are different than the four variables described above as fixed effects variables. These three categories follow the USDA's topology for farm types. Farm Size 1 corresponds to "limited resource," "retirement," and "residential" farms. Farm Size 2 corresponds to "farm/lower sales" and "farm/higher sales." Farm Size 3 is "large family farms" and "very large farms." Thus, in the farm size models we are estimating by a farm-size variable which has three levels. For example, when FarmSize = 1 (the smaller farms), in the estimation we are eliminating all observations where FarmSize = 2 or 3 (i.e., the middle and larger farms). In that case the size fixed effects variable essentially becomes a state dummy. To unlink this confounding of size the way we do in our analysis across farm sizes, we create a new State dummy and use that for the fixed effects when estimating the various equations for each FarmSize.

We deflated the nominal values of the monetary variables by the GDP implicit price deflator using the year 2000 as the base. Variables presented in the *Empirical Results* tables are in year 2000 dollars. Also, we wanted to refine our measure of productivity. Rather than using one measure for all farms (crop and livestock), we used two alternative measures of productivity: one for crop farms and one for livestock farms. The productivity measure for crop farms (Prod_crp) is calculated as value of crop production per acre; the measure for livestock farms (prod_liv) is calculated as value of livestock production per acre. We also used a combined crop and livestock productivity index. The intent was to allow the data to indicate which index best suited each location. The *value* of output, rather than just the quantity of output, is used to indicate a farm's ability to produce dollars per acre, reflecting a financial goal of the operator. The annual averages of all variables are presented by year in Table 1.

Empirical Results

As expected, we find a diverse pattern of relationships linking farm income, land value, farm household wealth, and profits over time. We also find patterns when we account for differences in locations, farm sizes and typologies, and commodity specializations caused by comparative advantage.

Farm Income Equation (2)

The results in the top section of Table 2 show some differences across regions. One striking result is that revenue, cash expenses, and depreciation were generally statistically significant in regions which are less dependent on farm program payments, yet government payments were not significant in any region. *Revenue* was significant in all but three regions, but with varied coefficients indicating varying average profit margins. *Depreciation* was also significant in all but three regions, indicating that in most areas farms are capital intensive, which creates high fixed costs.

Farmland Value Equation (4b)

Economic theory suggests that the price of farmland reflects either its value as an input in agricultural production, or the non-farm demand for land. The key result here is that the proxy variable for the non-farm demand for farmland (county population density by year) was significant across nine of the 10 regions (bottom section of Table 2). This is consistent with the growing realization that non-farm demand for farmland is increasingly affecting farmland values, even in areas such as the Corn Belt and Northern Plains whose economies have been dominated by production agriculture. The population density variable swamped the effects of the four other variables. This appears to be inconsistent with the traditional theory that farmland value is determined primarily by its ability to generate agricultural revenues. However, this result is consistent with the "urban influence" on farmland prices found in recent studies (e.g., Livanis et al.; USDA 2000; Shi, Phipps and Colyer). Thus, the proximity of a farmland parcel relative to non-agricultural development is a key factor in pricing. This implies that no commodity can generate enough revenue to adequately compete with urban development, meaning that land-use ordinances will be needed to preserve farmland in urbanizing areas.

Change in Wealth Equation (1)

Wealth consists of both farm and non-farm capital, although most farm household wealth is held in the form of farmland. As shown in the top section of Table 3, both components were significant in six of the 10 regions: the Lake States, Appalachia, Southeast, Delta, Southern Plains, and Pacific. Clearly, changes in farm capital are important in wealth-building. That variable was significant in every area except the Mountain region. Also, income from either farm or non-farm sources generally was not significant.[5] This means income, in absolute amounts, was small compared to capital gains. Thus, wealth comes from capital gains, not income, in all parts of the country's agricultural industry.

Both farm and non-farm capital were significant in most regions but had differential impacts on wealth (top section of Table 3). For example, a $1,000 increase in *farm capital* in the Lake States would raise wealth by about $976, compared to $736 in the Corn Belt. Also, a $1,000 increase in *non-farm capital* would raise wealth by about $206 in the Lake States, for example. In all regions except the Pacific, the lower regression coefficients for *Changes in Non-farm Capital*, compared to coefficients for *FarmCapital*, imply that there are few economic opportunities for shifting resources out of agriculture and into non-agricultural uses. In general, these results show that holding farmland (which represents about three-quarters of *FarmCapital*) has been a much more profitable investment over the past decade than have non-farm investment alternatives, on average. The different performance levels of capital asset markets across regions and types of capital may be partly due to differences in the opportunities and multiplier effects

[5] The only region to have significant farm income was the highly profitable Pacific. However, households in that region got a much larger contribution to wealth, on average, from off-farm income, as indicated by the relative size

available off-farm in the regional economies.

Farm Profits Equation (6)

There were weak statistical results across regions for the profits equation (bottom section of Table 3) reflecting the common problem of a profit squeeze in the different commodity markets represented by the production specializations across regions. *HumanCapitalEd*, which represents the productivity and investment components of human capital, was significant only in the Corn Belt (bottom section of Table 3). No other variable was significant in any region. Combining these results makes it clear how difficult it is to find a significant relationship between profits and any explanatory variables because, on average, profits from agricultural production have been near zero for the past decade. The poor household average profit performance is shown in the data in Table 1. As indicated, national average farm profits were negative in five of the nine years. These results reinforce the results for the *Change in Wealth* equation which show that farm income is not significant. Clearly, farm owner-operators benefit from the rising value of their farmland, not from producing commodities on that land. Overall, these results support the hypothesis raised by Blank that real estate investment, rather than agricultural production, is the true focus of most small scale farm owners.

Farm Size Results

Results in Table 4 show how American farms of different sizes from all 10 regions have performed over the last decade. As expected, the size of a farm has significant effects on its financial performance.

In the *Change in Wealth* equation results, it is clear that Size 1 households are better off

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of the two regression coefficients.

focusing their activities off the farm. *Non-farm income* and *Changes in non-farm capital* were significant for small-sized farms. As a result, *Farm income* had a significant negative effect on wealth, indicating that the opportunity cost of farming exceeds the income generated by small farm households. Medium sized farms derive wealth only from gains on their farm capital, which is most likely their land. Large farms from all 10 regions benefit from capital gains on all assets, plus from their off-farm income.

The *Profits* equation has poor statistical results across farm sizes because profit amounts are so close to zero, on average. On the other hand, the *Farm Income* equation has excellent results because farm operations are being run as businesses with close attention to cash flows.

The most interesting result for the *Farm Income* equations is that *Revenue*, *Cash expenses* and *Depreciation* all have a decreasing absolute value of their regression coefficients as farm size increases. This mostly is explained by the fact that farms diversify their activities as they grow in size, thus reducing their farm income risk. Also worth noting is the significant result for government payments on small farms' income. It indicates that government payments are substituting for losses incurred by the smallest operators, as intended by most farm programs.

The *Farmland Value* equation results are strong and have significant implications for land pricing theory. For medium size farms, the revenue per acre generated by farming has some effect, as expected according to traditional theory. What is surprising is that small and large farms do not have significant revenue effects on their farmland values. Instead, those farms are significantly influenced by *Government Payments* per acre. All three farm sizes have significant *Population Density* effects, but the regression coefficient increases with farm size. This implies that a large farm's proximity to urban areas is key to its farmland values, as noted by recent studies (e.g., Livanis et al.; Shi, Phipps and Colyer).

Implications of the Results

These results generally agree with other studies of farm financial performance, and with other studies that have used farm-level data to empirically assess wealth and income patterns across states, farm types, and commodity specializations. We suggest three implications of our results.

First, although previous studies have found that U.S. farm sector returns were converging over time and across regions (Blank, Erickson and Moss), farm profits still vary widely by farm type, farm size, location, and by other factors. Using repeated cross-sections of pooled farm-level data to estimate equations linking wealth, income, and profits helps explain the linkages between the various components. For example, the finding that changes in both farm and non-farm capital are significant in explaining changes in wealth in most regions suggests that non-farm capital is a substitute for farm capital. This indicates that farm households have diversified their portfolios.

Second, changes in farm and non-farm capital have differential impacts on farm wealth across farm locations. In general, the fact that changes in non-farm capital have smaller impacts than do changes in farm capital across all regions except the Pacific implies that there are few profitable opportunities to shift resources out of agriculture in most of the country. However, this may also reflect the asset fixity problem faced by most farm households. Or it may indicate simply that urban pressures pushing farmland values up are creating the best investment alternative available to agricultural producers. In other words, farmland has out-performed non-farm investments over the past decade.

Third, we found evidence that farm size affects farm wealth. In Table 4, three of the four income sources were significant in increasing the wealth of large farms, and the scale of their effects were greater for large farms than for small or medium size farms. Capital gains from farm assets were significant for medium and large farms, but the coefficient was higher for large farms. Capital gains from non-farm assets were significant for small and large farms, but again the coefficient was higher for large farms. Finally, off-farm income was significant for small and large farms, but the coefficient was highest for large operations. Therefore, large farms not only generate more dollars due to their larger scale of operations, but a higher portion of each dollar of income from each source is captured as wealth.

These the results support the long-expressed notion that large scale farms are more competitive in today's global commodity markets and, therefore, have a higher probability of surviving. They are also consistent with the "big fish eat little fish" story of consolidation long visible in American agriculture. Therefore, the pattern of financial performance observed in our household data indicates that existing trends of decline are likely to continue for some time. The unknown is the pace of consolidation because it will depend on how long the "little fish" choose to hang on to their farmland. Our analysis implies that choice will be made based on farm household wealth factors having little to do with agriculture.

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Appendix Table A. Description of Variables

Variable	Equation	Decription	Calculated as:	Source
W_t		Total wealth at time t	Farm plus non-farm net worth	ARMS
ΔW_t	1	Change in total wealth	$W_t - W_{t-1}$	Estimated
FInc	2	Net farm income	Total for year	ARMS
OFInc	3	Off-farm income	Total for year	ARMS
Sal_t	3	Salaries, wages		ARMS
Inv_t	3	Investment income	Unearned income for year	ARMS
ΔK_t	4	Capital gains	$K_t - K_{t-1}$	Estimated
K_t	4a	Capital stock	Farm plus non-farm capital	ARMS
C_t	5	Household consumption expenditures	Total for year	ARMS
R_t	2	Gross value of sales		ARMS
GP_t	2	Government Payments		ARMS
PC_t	2	Production costs		ARMS
OK_t	2	Ownership costs		ARMS
LTV_t	4	Loan-to-value ratio		Estimated
PROD	4b	Productivity	Productivity index	ARMS
D_t	4b	Population density	People per square mile in county	Bureau of the Census
CK	4b	Cost of capital	Interest/farm debt * 100	ARMS
LV_t	4a	Land and building value per acre	Land and building value per acre	ARMS
$(m_f)g(cr_{ft})G\Delta(cr_{ft})$	6	Productivity component and investment component	Uses age, education, and farm physical capital (3 alternatives)	ARMS
π_t	6	Profits	Percent rate of return on farm equity	ARMS

Summary of Average Values ($000s, deflated into 2000 dollars using the GDP implicit price deflator)									
	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
me	65.9501	110.2481	82.7142	82.0934	86.3529	146.0179	88.3395	117.5647	130.3268
[ncome	40.2280	39.4387	43.9315	46.0550	86.3529	45.7853	52.2051	51.0114	58.4082
rmCapital	n.a.	139.312	524.5032	364.3077	524.3059	748.3630	56.3723	574.5303	416.0330
onFarmCap	n.a.	689.961	22.9498	452.2253	-20.7720	134.8614	205.3955	223.3381	318.8248
:ion	27.2695	88.8980	33.9931	28.6070	31.7265	33.4066	36.6533	42.7151	44.3901
ients	3.059	2.9827	66.4494	71.0372	76.2557	81.5335	79.3038	83.6421	93.0895
	6.6489	7.4542	-13.0984	-10.4316	-2.6328	-9.0589	1.4667	-3.6517	18.8325
pitalEducation[2]	0.112	0.111	0.126	0.135	0.136	0.154	0.150	0.120	0.212
ity[3]	6.5332	8.4767	9.3641	8.9797	12.9384	6.7691	7.8373	9.0995	15.2741
stock	3.5669	5.0076	1.8483	3.0318	2.3168	3.2720	2.6997	2.9755	4.2814
)	2.2919	1.9244	1.8309	1.5561	1.5915	5.7603	3.1379	2.6530	2.9819
l animal units	4.9872	6.0041	33.5573	44.6913	35.7185	7.2527	22.8730	3.0728	n.a.
) & livestock	5.8328	6.8897	3.6434	4.5577	3.8637	8.9668	5.8084	5.5771	7.2209
ıExpenses	61.488	62.419	72.736	76.794	82.738	102.686	97.375	108.608	127.497
ion	7.326	8.199	9.011	9.582	10.902	12.748	11.926	12.199	13.823
ePerAcre	3.3916	2.993	3.7799	3.4399	3.9435	4.3739	4.7301	5.4594	7.6899
al[4]	8.7364	9.2302	9.2108	8.9969	9.1037	8.9463	8.3497	8.2144	8.1386
ty[5]	120.1783	121.4396	133.6860	113.9805	109.0726	124.5397	125.5100	127.6317	129.8886

d as rate of return on equity (percent).
, education, and farm physical capital; op_educ*atot/10^7, scaled.
value of crop or livestock production per acre, deflated into 2000 dollars using the GDP implicit price deflator.
n farm debt as percent of farm debt outstanding.
er square mile (county-level).

2. Regression Results for Farm Income and Farmland Value Equations by Region, 1996-2004

ble	Northeast	Lake States	Corn Belt	Appalachia	Southeast	Delta	Southern Plains	Northern Plains	Mountain
					Farm income equation				
ne	0.4863 (3.74)***	0.3489 (0.97)	0.2359 (1.39)	0.3416 (2.75)***	0.3739 (3.94)***	0.3014 (2.61)***	0.1060 (1.37)	0.0679 (2.52)**	0.4499 (2.85)***
ayments	-0.3907 (-0.45)	-1.4679 (-1.51)	-0.0090 (-0.01)	-2.5565 (-0.43)	-0.0381 (-0.02)	-0.6279 (-1.19)	1.1621 (0.31)	-0.3507 (-0.64)	-0.4695 (-0.50)
xpenses	-0.2033 (-1.70)*	0.1323 (0.28)	-0.1933 (-1.39)	0.1120 (0.82)	-0.2343 (-2.83)***	0.0225 (0.32)	0.1502 (1.31)	-0.0216 (-0.27)	-0.2743 (1.80)*
iation	-1.0405 (-6.35)***	-1.1949 (-1.02)	-1.3276 (-2.01)**	-0.7740 (-2.39)**	-0.6499 (-3.72)***	-0.9066 (-5.26)***	-0.9788 (-1.74)*	0.1423 (0.44)	-0.2316 (-0.42)
					Farmland value equation				
ne e	0.1179 (1.02)	-0.0547 (-0.46)	0.1820 (1.15)	-0.0042 (-0.18)	-0.0937 (-0.87)	0.1526 (1.90)*	0.0246 (0.08)	0.3190 (0.88)	2.7762 (0.97)
ayments re	0.1712 (0.90)	0.1463 (0.89)	0.0853 (0.68)	0.0147 (0.18)	0.0977 (1.13)	-0.0103 (-0.79)	0.6735 (0.44)	-0.0353 (-0.15)	0.4327 (1.35)
apital	-0.0007 (-1.00)	-0.0000 (-0.56)	-0.0001 (-1.16)	0.0001 (0.61)	-0.0001 (-0.75)	-0.0000 (-0.05)	0.0001 (0.56)	-0.0003 (-1.95)*	-0.0006 (-2.78)***
tivity	0.0020 (0.02)	0.0219 (0.16)	-0.0391 (-0.32)	0.0368 (0.68)	0.2768 (2.28)**	-0.1384 (-1.68)*	-.0233 (-0.29)	-0.2247 (-0.57)	-2.7820 (-0.97)
nsity	0.0091 (5.99)***	0.0049 (6.66)***	0.0055 (3.66)***	0.0076 (2.31)**	0.0103 (6.14)***	0.0053 (5.58)***	0.0034 (1.45)	0.0081 (3.20)***	0.0312 (3.24)***

n each box is the variable's regression coefficient and the value in parentheses is its t-statistic.

denote statistical significance at the 99%, 95%, and 90% confidence levels, respectively.

gression Results for Change in Wealth and Profits Equations by Region, 1996-2004

	Northeast	Lake States	Corn Belt	Appalachia	Southeast	Delta	Southern Plains	Northern Plains	Mountain
Change in Wealth equation									
e	0.3447 (0.70)	0.0507 (0.79)	0.0687 (1.30)	0.0706 (1.08)	0.1515 (1.58)	-0.0245 (-0.27)	-0.0393 (-0.42)	-0.0001 (-0.00)	-2.0732 (-0.78)
come	0.7621 (0.98)	0.0857 (1.18)	0.1236 (1.70)*	0.1038 (1.21)	0.1515 (1.06)	0.1261 (0.53)	-0.4188 (-0.57)	0.3984 (3.11)***	7.8051 (0.73)
ıCap	0.9159 (3.06)***	0.9758 (16.19)***	0.7364 (9.78)***	1.0082 (26.46)***	0.9735 (15.96)***	0.9214 (13.93)***	1.0401 (28.19)***	0.9986 (12.98)***	0.3174 (0.54)
FarmCap	0.0778 (1.44)	0.2057 (3.67)***	0.0491 (0.77)	0.2483 (10.19)***	0.1404 (6.44)***	0.2399 (2.13)**	0.5294 (4.27)***	0.0115 (0.71)	0.1859 (1.37)
n	-0.0463 (-0.04)	0.2607 (1.29)	0.1319 (1.66)*	-0.1457 (-1.96)*	0.2602 (0.69)	0.1973 (0.85)	-0.0757 (-0.74)	-0.0903 (-0.17)	1.3575 (0.60)
Profits equation									
	0.0052 (0.54)	-0.0029 (-0.54)	-0.0034 (-0.88)	0.0019 (0.19)	0.0038 (1.29)	0.0472 (0.27)	0.0077 (1.00)	-0.0018 (-0.57)	-0.0022 (-0.43)
ıts	-0.4633 (-1.22)	0.3853 (0.35)	-0.2936 (-0.79)	0.2340 (0.27)	0.0087 (0.01)	-0.5908 (-0.36)	-1.6912 (-0.18)	-1.2701 (-0.66)	-2.0762 (1.18)
	0.1498 (0.79)	0.1141 (0.21)	0.0810 (0.69)	-0.1257 (-0.31)	-0.3025 (-0.35)	0.4866 (0.27)	-0.0559 (-0.01)	1.3701 (0.81)	2.2261 (1.24)
:alEduc	10.0079 (1.04)	26.9359 (1.55)	29.4988 (2.14)**	5.2073 (0.31)	-0.5984 (-0.65)	-953.2933 (-0.82)	-11.0713 (-0.90)	16.9426 (0.69)	2.4497 (1.29)

n each box is the variable's regression coefficient and the value in parentheses is its t-statistic.

denote statistical significance at the 99%, 95%, and 90% confidence levels, respectively.

Table 4. Regression Results for Equations by Farm Size, Across Ten Regions, 1996-2004

Variable	Farm Size 1 Estimate	Farm Size 1 t value	Farm Size 2 Estimate	Farm Size 2 t value	Farm Size 3 Estimate	Farm Size 3 t value
Change in Wealth equation						
FarmInc	-2.9685	-1.66*	0.0984	0.49	-0.0142	-0.32
NonFarmInc	0.8039	2.27**	0.2977	1.44	0.9099	2.05**
ChngFarmCap	0.2574	0.18	0.8320	16.04***	0.9292	25.66***
ChngNFarmCap	0.0912	1.67*	0.0104	0.77	0.1446	4.21***
Consumption	0.4073	0.89	0.2381	1.07	0.2449	1.95*
Profits equation						
Revenue	-0.6555	-1.09	0.4346	1.25	0.0005	0.34
GovtPayments	-1.3875	-0.38	0.7287	0.68	-0.1086	-0.41
Productivity_crpliv	2.0297	1.08	-0.8025	-0.88	0.1785	1.44
HumanCapitalEd	-49.8720	-0.58	-4.9970	-0.45	-1.7998	-0.58
Farm Income equation						
Revenue	0.7118	18.52***	0.6167	15.43***	0.1957	5.40***
GovtPayments	-0.2190	-1.78*	-0.2396	-1.63	-0.4256	-1.10
CashExpenses	-0.5273	-15.20***	-0.3756	-7.33***	0.0349	0.77
Depreciation	-1.0485	-7.63***	-0.8720	-17.02***	-0.8430	-1.93*
Farmland Value equation						
RevenuePerAcre	-0.1085	-0.19	0.3688	2.95***	-0.0956	-0.76
GovtPayments/ac	1.1210	1.74*	0.4842	1.26	0.1569	2.63***
CostCapital	-0.0001	-0.85	-0.0000	-1.04	-0.0000	-0.12
Producicitivity_crpliv	0.1203	0.38	-0.0042	-0.08	0.1059	0.79
PopDensity	0.0081	6.02***	0.0113	3.38***	0.0191	4.88***

***, **, and * denote statistical significance at the 99%, 95%, and 90% confidence levels, respectively. These regressions use year and state dummy variables for fixed effects.

Farm Size 1 corresponds to limited resource, retirement, and residential farms. Farm Size 2 corresponds to farm/lower sales and farm/higher sales. Farm Size 3 are large family farms and very large farms.