Wealth, Debt, Government Payments, and Yield Performance

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Abstract

We use a large sample of Kansas Farm Management Association farms for eight different crop/practice combinations (dryland and irrigated corn, sorghum, soybeans, and wheat) for 1994 through 2006 to evaluate the determinants of relative yield performance and explore the ability of financial variables to account for some of the remaining unexplained variation. Our hypothesis is that more financially sound farms should be able to implement better production techniques, thus have better yields. We further test whether decoupled payments can be used to enhance yield performance. Our hypothesis is that payments may be used to boost investment in inputs or equipment that can lead to better yields. Our results suggest this could be the case.

Keywords: yield performance, decoupled payments.

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1. Introduction

The Federal Agricultural Improvement and Reform (FAIR) Act of 1996, or 1996 farm bill, modernized U.S. farm policy, challenged by the rising costs of farm support programs and by the lack of compatibility between increased spending on agricultural support and the multilateral commitments made under the World Trade Organization (WTO) to limit trade-distorting agricultural support. The replacement of the more traditional instruments of support by decoupled payments was based on the idea that if decoupled payments do not distort market incentives, they should not distort production or trade. But the literature has identified several potential "coupling" mechanisms that suggest theory and practice are not in accord, such as wealth effects and their impact on risk aversion and labor choices, credit constraints, and expectations about future revisions of policy. Empirically, the effects of decoupled payments have been studied on variables such as cropland allocation, time allocation between on- and off-farm work and leisure, and land rents and values.[1]

But decoupled payments need not affect farmers' decisions solely at the extensive margin. They may also affect how resources are used at the intensive margin, leading to different application rates of inputs such as pesticides, fertilizer or water. Farmers may choose to invest the additional financial resources into better production methods, such as improved technology or other inputs, thereby increasing productivity. There is very little work published in the economics literature on the determinants of crop yield performance. Except for Goodwin *et al.* (2002), who found that farmers' experience in growing the crop or alternative crops improves yield performance, no other studies analyze the individual characteristics of farms and farmers that may lead some farms to have greater productivity than others. Aside from the biological

[1] For a thorough review of coupling mechanisms and empirical studies see Bhaskar and Beghin (2007).

constraints that cause yields to vary from farm to farm, or from field to field within a farm, understanding the farm-level individual characteristics that cause yields to differ is important, and this importance may be linked to the increased tendency for farm support to be awarded through decoupled payments. With the creation of Production Flexibility Contract (PFC) payments and the elimination of deficiency payments, the 1996 Farm Bill provided farmers with payments that were independent of market prices. Together with the increasing willingness of the U.S. government to forestall future *ad hoc* assistance programs, the effects of these two policies could be thought of as increasing farmers' risk exposure, as deficiency payments helped offset low prices and disaster assistance programs helped offset low yields, low prices, or both.

Our goal is to revisit the determinants of yield performance at the farm level as studied by Goodwin *et al.* (2002) and explore the ability of additional variables to account for the remaining unexplained variation. In particular, we observe whether the financial characteristics of the farms may help explain differing yield performances; among these characteristics we include farmers' wealth and debt to asset ratio, along with government payments. Moreover, we investigate whether decoupled payments may be used to enhance yields at the farm level. Our hypothesis is that these payments may be used to boost investment in inputs or equipment that can lead to better yields. We use a large sample of Kansas Farm Management Association (KFMA) farms for eight different crop/practice combinations (dryland and irrigated corn, sorghum, soybeans, and wheat) for 1994 through 2006. These farms are full-time commercial operations, which are mainly farms with gross sales exceeding $100,000. The KFMA farms represent, according to Albright (2001), the various farming areas and farm types in Kansas. Our access to historical farm level data allows us to overcome some of the problems related with our inability to observe so many factors that should influence yield performance at the farm level, such as the experience

of the operator or the soil-water characteristics of the farm. Our econometric techniques involve the use of ordinary least squares (OLS), fixed effects (FE), and random effects (RE).

We proceed as follows. The next section discusses the factors that affect yield performance at the farm level. Along with the empirical framework and econometric approach, the following section presents the data used. The results of the estimation are then discussed. Some concluding remarks are finally offered.

2. Factors affecting yield performance

Crop yields depend on a number of factors, whether naturally occurring, like the soil-water properties of the field or rainfall, or management induced, like the variety selected or the amount of fertilizer applied. These factors, and the degree of their impact, vary from year to year and from field to field, and they also interact with each other in space and time, which can minimize or cause a more extreme impact from a single factor. Consider the role of water. The importance of water in the soil is clear as one thinks about how spring rains can delay planting or when crops are endangered by summer droughts. And water interacts with the characteristics of the soil to determine the availability to crops of soil nutrients, fertilizers, and pesticides over the course of the growing season. To see this, think about how the movement of water through soil determines the amount of fertilizer or pesticide/herbicide that remains available to crops in contrast to how much is carried downward to the groundwater. For example, a sandy soil holds less water for the crops (thereby reducing yield in a dry year) than a clay soil, and it also has lower nutrient levels. But the clay soil holds the water more tightly in smaller pores, making drainage slower and the water less readily available to plant roots.[2]

[2] For an overview of the interaction between water and soil characteristics see Trautman *et al.* (1985). The sources of yield variation on a field were taken from this source.

Other naturally occurring factors that influence yield performance include the weather, the physical and chemical properties of the soil, the slope and geographical orientation of the site, and the susceptibility to pest infestations. In terms of weather, the amount, frequency and distribution of precipitation, the temperature, the solar radiation, and the wind may significantly affect the yield performance of a crop. The physical and chemical properties of the soil include the texture, topsoil depth, nutrient availability, ph, and organic matter. These are related to the aforementioned soil-water relationships, which are related to drainage, soil depth, and water holding capacity. The topography and direction of a site (North, South, East or West) include characteristics as soil erosion, temperature, and machinery operations. Finally, crop pest infestations include weed, insects and diseases.

Along with naturally occurring factors, management practices may also affect crop yields. In broad terms, these factors include the choice of crop inputs, the field history, and past cultural practices and/or mistakes. An example of a performance improving choice of crop inputs is the adoption of plants bred to include resistance to diseases and insects, tolerance to heat and drought, reduction in the time to crop maturity, greater yield, and better agronomic quality. The field history is concerned with the historical use of herbicide or pesticide, and with fertilizer/manure inputs. Poor management practices such as the inappropriate use of pesticides and monocropping could induce resource degradation that injures yield performance. These could be considered as cultural practices and/or mistakes, which also include crop rotation, tillage and compaction, manure applications, land leveling, ditch cleaning, misapplication of nutrients or pesticides etc. Other management induced factors influencing yield performance include those studied by Goodwin *et al.* (2202). Using KFMA over the 1980 through 1998 period, the authors found that more years of experience in growing a crop tended to be correlated

with higher relative yields, as did superior historical performance on other crops.

Finally, note that differing yields may happen for completely different reasons, and indeed factors that limit or boost yields will vary from field to field, and from place to place within a field. And what may be a yield-boosting factor for one crop or in a given year does not necessarily have the same effect on a different crop or in the next year.

3. Empirical framework and data

Given the naturally occurring factors that influence yield performance, proper management should be able to minimize the influence of yield-decreasing factors and enhance the influence of yield-boosting factors. For a given crop/practice combination, a reduced form yield performance equation can be defined as

$$(1) \qquad Yield_{ict} = \{\mathbf{Natural}_{ict}, \mathbf{Management}_{ict}\}$$

where the subscripts *i*, *c*, and *t* index the ith farm in county *c* at time *t*, $Yield_{ict}$ denotes crop yields, $\mathbf{Natural}_{ict}$ is a vector of naturally occurring factors, and $\mathbf{Management}_{ict}$ is a vector of management induced factors.

But yields cannot be compared across time and space without normalization. A common means of normalization is to divide the individual farmer's yield by the average yield for the county in which the farm is located. We use the National Agricultural Statistics Service (NASS) county average yields in the normalization. This procedure deals with the deterministic time effects associated with yield trends while at the same time picking up some of the effects of localized weather events. It also specifically addresses the issue of farmers in areas with higher than average yields exhibiting this pattern as well. For a given crop/yield combination, normalized yields are given by

(2) $\hat{y}_{ict} = Yield_{ict} / Yield_{ct}$

where $\hat{y}_{ict}$ is the normalized yield for the ith farm in county *c* at time *t* and $Yield_{ct}$ is the NASS county average yield for all producers in the ith farm's county. Normalized yields, which we represent as a percentage of the county average yield, can be used to compare yield patterns across different crop/practice combinations and years. We now turn to the variables that should be included in the estimating equation. These are variables that are included in the $\mathbf{Management}_{ict}$ vector. Our discussion of the estimation methodology explains how we deal with the unobserved variables that are included in the $\mathbf{Natural}_{ict}$ vector.

Successful crop production should depend on careful management of the soil, water, and chemicals, so that plant needs are met as they occur in the growing season. For example, we hypothesize that greater per acre expenditures on seed and chemicals (fertilizer and herbicide) should be correlated with better yield performance. Likewise, investment in machinery and equipment should increase productivity. We also expect farm size to be correlated with yield performance. In order to see this, consider the association between the adoption of newer and improved technology and farm size. One reason farms have been growing is to make more economical use of machines capable of covering more ground with less labor. And larger farms can typically get volume discounts on inputs such as chemicals and seed. Conversely, larger farms may have lower average yields due to decreasing marginal productivities. Indeed, the inverse relationship between farm size and land productivity is an "old and puzzling empirical regularity" (Assunção and Braido 2007).

Like Goodwin *et al.* (2002), we hypothesize that yield performance may be affected by the diversification of the farm. We consider three measures of diversification. The first measure connects the performance in growing crops to that of growing livestock. Given the considerable

differences in expertise required by these practices, we hypothesize that farmers who receive greater sales shares from livestock will exhibit less proficiency in producing crops, and vice-versa. The authors found that farm operations with a significant share of sales coming from livestock production tended to have lower relative crop yields.

The second measure is related to the dispersion of expertise over too many enterprises. While we expect dispersion of the farmers' attention over too many activities to hinder yield performance, so that more highly diversified farms could face lower yields on individual crops, we also expect some degree of expertise to be transferable across crops, so that an individual farmer with a good performance on one crop could have high expected yields on a different crop. For example, a producer with a historical above-average performance in soybeans would be expected to also have an above-average performance in corn. Goodwin *et al.* found diversification over enterprises yielded varied results. They also found a positive effect on the historical performance in alternative crops. The authors also considered the presence of knowledge spillovers, the idea being that farmers in counties with more production in recent years tended to have higher relative yields. While the results did not indicate the presence of those neighboring effects, we include all these measures of diversification, relative performance in alternative crops, and learning from neighbors in our estimating equation. We also account for the farmers' production experience in the crop/practice under analysis by observing the average number of years the crop was grown in the previous four years.

Our third measure of diversification includes the hypothesis of a relationship between relative crop performance and the relevance of farming activities in overall income. Intuitively, farmers whose greatest share of income comes from off-farm activities should have less incentives to invest in crop yield-boosting methods than farmers whose greatest share (or sole

source) of income comes from the farm. The logic underlying this regressor is similar to that of the potential negative impact of diversification over too many enterprises on yield performance.

Finally, and even though we cannot observe the quality of the land in the farm, we hypothesize that farms with better land quality will put a greater share of this land into crop production. Alternatively, we expect farms with higher land quality to be likely to have less waste and set-aside than other farms.

For a given crop/practice combination, the estimating equation for the ith farmer in county *c* is given by

$$\begin{aligned}\hat{y}_{ict} = {} & \alpha_0 + \alpha_1 Seed_{ict} + \alpha_2 Chemical_{ict} + \alpha_3 Machinery_{ict} + \alpha_4 Size_{ict} + \alpha_5 Cropacres_{ict} + \\ & + \alpha_6 Livestock_{ict} + \alpha_7 Diversification_{ict} + \alpha_8 Owner_{ict} + \alpha_9 Meancrops_{ict} \\ & + \alpha_{10} Experience_{ict} + \alpha_{11} Countyacres_{ct} + \alpha_{12} Cropsacresshare_{ict} + \eta_{ct} + u_{ict}\end{aligned} \tag{3}$$

where $Seed_{ict}$, $Chemical_{ict}$, and $Machinery_{ict}$ measure per crop acre expenditures on seed, chemicals (herbicide and fertilizer), and machinery investment, respectively, $Size_{ict}$ is the number of operated acres, $Cropacres_{ict}$ is the number of acres devoted to the crop/practice under analysis, $Livestock_{ict}$ is the share of livestock sales in total sales, $Diversification_{ict}$ is a Herfindahl index of diversification over enterprises calculated from sales shares, $Owner_{ict}$ is the is the share of farm income in total (farm and off-farm) income, $Meancrops_{ict}$ measures the farmer's performance on other crops, $Experience_{ict}$ is the number of years the farmer produced the crop/practice in question over the past four years, $Countyacres_{ct}$ is the average number of acres in the county where the farm is located devoted to the crop/practice over the past four years, and $Cropsacresshare_{ict}$ is the proportion of total acres engaged in crop production.

The last two terms in the equation correspond to the error term, where u_{ict} is the

idiosyncratic term and η_{ct} are the unobserved factors that cause yield performance to vary from year to year in each county. Following Moulton (1986) the covariance is matrix is estimated by allowing each county-year group to have a different and unrestricted covariance structure but assumes errors are uncorrelated across groups. Additionally, the estimating equation includes year dummy variables and county dummy variables. After including these regressors, a large variation in yield performance remains unexplained, since so many characteristics that determine it, such as rainfall or nutrient availability are unobserved. Indeed, in spite of our inclusion of $Cropsacresshare_{ict}$ to represent overall land quality, none of the factors in the $\mathbf{Natural}_{ict}$ vector appear. So, we specify the estimating equation with a farm-specific fixed effect f_i.

We further hypothesize that the logic underlying the importance of size can be extended to the financial characteristics of the farm. In principle, more financially sound farms, with greater net worth and/or smaller debt to asset ratios, should be able to implement better production practices and, in turn, generate better yields. Including wealth in our estimating equation further allows us to account for differing risk responses and general wealth effects. Another component of the financial characteristics of the farm is government payments. By providing farms with additional liquidity, we expect payments to allow investment in production to occur and credit constraints to be less binding. Hence, these payments can be invested in technology or inputs, and we expect them to have a positive influence on yield performance.

We thus expand our estimating equation to include the financial characteristics of the farm, along with government payments, so that

$$\begin{aligned}\hat{y}_{ict} = {} & \beta_0 + \beta_1 Seed_{ict} + \beta_2 Chemical_{ict} + \beta_3 Machinery_{ict} + \beta_4 Size_{ict} + \beta_5 Cropacres_{ict} + \\ & + \beta_6 Livestock_{ict} + \beta_7 Diversification_{ict} + \beta_8 Owner_{ict} + \beta_9 Meancrops_{ict} \\ & + \beta_{10} Experience_{ict} + \beta_{11} Countyacres_{ct} + \beta_{12} Cropsacresshare_{ict} \\ & + \beta_{13} Networth_{ict} + \beta_{14} DAR_{ict} + \beta_{15} GP_{ict} + f_i + \eta_{ct} + u_{ict}\end{aligned} \tag{4}$$

where $Wealth_{ict}$ is the net worth of the farm, DAR_{ict} is the debt to asset ratio, and GP_{ict} is the amount of government payments received. In our analysis we further address the potential for decoupled payments to distort production via improved yield performance for a subset of farms by replacing GP_{ict} by the amount of decoupled payments received by farmers for the 1996-2001 period (when the FAIR Act was in place).[3]

We use KFMA data collected over the thirteen year period from 1994 to 2006. Our panel contains 23,255 observations on 3,273 farms that operated more than 50 acres. Because we do not impose that all farms grow all four crops and their different practices, we have a smaller number of farms which we observe over the period for each crop/practice combination. For the farms that are present for the 13 years in the sample, we always observe more farms growing the dryland practice. Overall, in terms of relative performance, the farms in our sample appear to have similar yields to the counties where they are located. The farms operated an average of 1,763 acres, 68.85 percent of those as cropland, and they devoted more acres to dryland crops, growing an average of 91 acres of dryland corn, 151 acres of dryland sorghum, 182 acres of dryland soybeans, and 361 acres of dryland wheat, while growing 60 acres of irrigated corn, 5 acres of irrigated sorghum, 20 acres of irrigated soybeans, and 16 acres of irrigated wheat.

The average farm had a net worth of about $440.47 thousand, and $224.61 thousand in debt. To avoid double counting we subtracted government payments from farmers' wealth. Non farm income was a source of revenue for the farms in our sample, of about $15.66 thousand. And while on average this number was smaller than that of net farm income, $40.75 thousand, the ratio of net farm income to total, non- and net farm income, was only of 0.6844.

Table 1 reports the summary statistics for the data used in our estimation.

[3] Note that because decoupled payments are based on historical acres and yields, larger payments should be associated with size, so these effects may be difficult to disentangle.

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[4] Since we are using an unbalanced panel where many farms do not grow all the crop/practices, our summary statistics undervalue the farms' acreages.

Table 1. Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Number of farms (per year)	23,255	1,789	535	1,137	2,237
Operated Acres, Total (1,000)	23,255	1.76	1.40	0.05	15.83
Share of Crops in Total Operated Acres	23,255	0.6885	0.2777	0.0034	1.0000
Wealth ($1,000)	23,255	440.47	501.10	-794.82	8,722.76
Total Liabilities ($1,000)	23,255	224.61	277.39	0.00	6,957.17
Debt to Asset Ratio	23,255	0.3848	0.3602	0.0000	11.1993
Government Payments ($1,000)	23,255	27.02	33.07	0.00	582.38
Net Farm Income ($1,000)	23,255	40.75	78.50	-2,465.68	1,706.14
Non Farm Income ($1,000)	23,255	15.66	21.48	-75.31	379.08
Seeds (per 1,000 crop acres) ($1,000)	23,255	0.08	1.07	-5.32	87.76
Chemical (per 1,000 crop acres) ($1,000)	23,255	0.27	2.84	-3.41	132.15
Machinery (per 1,000 crop acres) ($1,000)	23,255	122.78	166.82	0.00	12,730.45
Ownership Interest	23,255	0.6845	5.8491	-273.3977	241.7512
Diversification	23,083	0.5192	0.2033	0.0000	0.8670
Livestock Share of Sales	23,083	0.2774	0.3309	0.0000	1.0000
Normalized Yields,Irrigated Corn	3,861	98.39	21.67	0.00	185.12
Normalized Yields, Dryland Corn	4,490	100.47	40.74	0.00	384.25
Normalized Yields, Irrigated Sorghum	937	94.98	36.81	0.00	251.89
Normalized Yields, Dryland Sorghum	11,889	101.03	32.65	0.00	338.97
Normalized Yields, Irrigated Soybeans	1,994	102.29	27.88	0.00	210.00
Normalized Yields, Dryland Soybeans	7,500	101.75	36.56	0.00	383.81
Normalized Yields, Irrigated Wheat	1,695	98.71	37.99	0.00	393.48
Normalized Yields, Dryland Wheat	19,198	100.27	27.97	0.00	337.50
Acres, Irrigated Corn (1,000)	23,255	0.06	0.19	0.00	4.08
Acres, Dryland Corn (1,000)	23,255	0.09	0.20	0.00	3.34
Acres, Irrigated Sorghum (1,000)	23,255	0.01	0.04	0.00	2.66
Acres, Dryland Sorghum (1,000)	23,255	0.15	0.22	0.00	5.44
Acres, Irrigated Soybeans (1,000)	23,255	0.02	0.08	0.00	1.36
Acres, Dryland Soybeans (1,000)	23,255	0.18	0.32	0.00	4.13
Acres, Irrigated Wheat (1,000)	23,255	0.02	0.08	0.00	2.26
Acres, Dryland Wheat (1,000)	23,255	0.36	0.42	0.00	4.54
County Acreage, Irrigated Corn (1,000)	17,838	13.58	20.52	0.10	123.72
County Acreage, Dryland Corn (1,000)	19,016	7.33	9.20	0.10	72.38
County Acreage, Irrigated Sorghum (1,000)	14,729	2.70	3.66	0.10	25.74
County Acreage, Dryland Sorghum (1,000)	22,444	31.57	24.75	0.23	100.78
County Acreage, Irrigated Soybeans (1,000)	18,072	3.42	4.24	0.10	21.41
County Acreage, Dryland Soybeans (1,000)	20,497	25.76	24.85	0.10	106.01
County Acreage,Irrigated Wheat (1,000)	9,777	8.64	13.25	0.10	78.66
County Acreage, Dryland Wheat (1,000)	23,255	95.99	79.98	0.64	452.08
Years Produced, Irrigated Corn	23,255	1.18	1.64	0.00	4.00
Years Produced, Dryland Corn	23,255	1.90	1.69	0.00	4.00
Years Produced, Irrigated Sorghum	23,255	0.74	1.27	0.00	4.00
Years Produced, Dryland Sorghum	23,255	2.92	1.51	0.00	4.00
Years Produced, Irrigated Soybeans	23,255	0.92	1.43	0.00	4.00
Years Produced, Dryland Soybeans	23,255	2.47	1.72	0.00	4.00
Years Produced, Irrigated Wheat	23,255	0.82	1.36	0.00	4.00
Years Produced, Dryland Wheat	23,255	3.49	1.11	0.00	4.00
Mean other crops, Irrigated/Dryland Corn	23,255	0.9117	0.3356	0.0000	6.7728
Mean other crops, Irrigated/Dryland Sorghum	23,255	0.9098	0.3372	0.0000	6.7728
Mean other crops, Irrigated/Dryland Soybeans	23,255	0.9078	0.3082	0.0000	2.2112
Mean other crops, Irrigated/Dryland Wheat	23,255	0.8528	0.4396	0.0000	10.9809

The measure of ownership interest is one of three measures of farm diversification used.

The other two measures include the share of livestock sales to total sales of the farm and the Herfindahl index of sales diversification. For each farm, this index calculated as

$$(5.6) \quad diversification_{ict} = 1 - \sum_{k}^{K} h_k^2$$

where h_k^2 represents the share of total farm sales accounted for by enterprise *k* (and enterprises include the eight crop/practices under analysis and the different livestock raised in the farm). The advantage of this representation is that the diversification index is growing with the degree of diversification of the farm. The average farm had a livestock share of sales of 27.74 percent, and the sales diversification index was 0.5192 (note that if sales are completely concentrated in one enterprise, this index takes value 0, while approaching 1 the more diversified the farm).

The number of years growing the crop in the previous four years and the mean performance in other crops capture the effect of experience in farming. On average, the farmers in our sample grew dryland wheat in the previous 3.49 years, dryland sorghum in the previous 2.92 years, dryland soybeans in the previous 2.47 years, and dryland corn in the previous 1.90 years. Again, there was greater experience in growing the dryland practice of these four crops. The relative performance in alternative crops was calculated as in Goodwin *et al.* (2002), where the relative yield measures were normalized by their respective means and then averaged across all other crops for the preceding four years. This variable did not include the relative yield performance on the other practice of the crop, so that, for example, for dryland corn, the mean of other crops included all sorghum, soybeans, and wheat production, but not irrigated corn.

4. Empirical results

We begin our econometric approach by estimating equations (3) and (4) using simple, pooled OLS. This estimator is, however, biased and inconsistent if the unobserved heterogeneity is

correlated with any of the regressors. For that reason, we use FE methods to purge the unobserved heterogeneity from the equations, and estimate the slope parameters using OLS on the transformed data. This transformation leaves the term η_{ct} unaffected, so that we continue to assume that farms within a county-year "cluster" are correlated as a result of the unobserved cluster effect, and errors are uncorrelated across year-county clusters. Alternatively, if the regressors are not correlated with the unobserved heterogeneity, we can exploit the serial correlation in the composite error, $f_i + \eta_{ct} + u_{ict}$, in a generalized least squares framework by using random effects analysis (Wooldridge 2002). Of course, if the model does not contain an unobserved effect, pooled OLS is efficient. We tested the presence of unobserved effects by using the Breusch and Pagan Lagrange Multiplier test, which rejected the hypothesis of zero variance of the unobserved heterogeneity. In addition, we chose between the FE and RE estimators by using a Hausman test. For both equations, the null hypothesis that the RE estimator is consistent and efficient was rejected for all the dryland crops and for all irrigated crops except sorghum at the 1 percent level of significance (10% in the case of irrigated wheat). Thus, we use FE methods to estimate the equations for all dryland crops and for irrigated corn, soybeans, and wheat, and use RE methods to estimate the equations for irrigated sorghum.

Tables A.1 through A.8 (in the Appendix) report the results of estimating relative yield performance for the eight crop/practice combinations of corn, sorghum, soybeans, and wheat. Each table contains the results for a given crop/practice combination. The first four tables report the results for the dryland crops and the following four tables report the results for the irrigated crops. In each table, columns (1) through (5) report the results from estimating equation (3) and columns (6) through (10) report the results from estimating equation (4). Each equation is estimated using OLS and panel data methods, FE or RE, using specifications that vary in the

dummy variables included. Along with the parameter estimates and robust standard errors, the tables include the number of observations and the R^2 statistic; for the RE estimator, this statistic is the overall statistic. Finally, the last row in each table reports the p-value associated with the partial F-test for the joint significance of the additional three variables in equation (4).

Overall, our results reveal that the effects of the different farm characteristics on relative crop yield performance are crop and practice specific. For example, under the FE estimator, relative performance in other crops has a statistically significant positive effect on relative dryland wheat yields, but a statistically significant negative effect on relative dryland sorghum yields; they do not affect the irrigated practice of these crops.

Overall, expenditures on seed, chemicals, and machinery seem to play a small role in affecting the relative yield performance of these crops. These effects, along with varying between crop and the different practices within each crop, are also very dependent on the estimator used. For example, when using OLS, greater spending on seed has a statistically significant effect solely on wheat (both practices), but this effect becomes insignificant for dryland wheat and positive for irrigated wheat when FE methods are used.

When we take unobserved effects into account, we see that decreasing marginal productivities matter for dryland sorghum and dryland wheat, where farm size has a statistically significant negative effect on yield performance. Across both equations and their different specifications, larger farms have lower relative yields. For dryland sorghum, an additional 1,000 operated acres decreases relative sorghum yields by 1.3 to 2.7 percentage points, while for dryland wheat this increase in operated acreage brings about a decrease in relative wheat yields of between 1 to 1.7 percentage points. On the contrary, for irrigated soybeans, the relationship between farm size and productivity is significantly positive, and an additional 1,000 operated

acres increase relative soybeans yields by 3.9 to 4.6 percentage points. The coefficient estimates on the number of acres devoted to each crop/practice further suggest this is the case.

Like Goodwin *et al.* (2002), we find statistically significant negative coefficient estimates on the livestock share of sales. This is the case for all crops but corn and irrigated sorghum and soybeans; except for dryland sorghum, the magnitude of this effect is greater under the FE estimator. We also find that diversification over different enterprises has a significantly positive effect on relative yields; this occurs for sorghum, wheat, and irrigated corn, an effect that is slightly smaller under the FE estimator for dryland wheat. Ownership interest, while surprisingly significantly negative for dryland corn in equation (4) and irrigated sorghum across both equations, is significantly positive for irrigated wheat and not significant for the remaining crops.

Experience also does not affect the four crops in the same fashion. For dryland wheat, better performance in alternative crops raises relative yields, the magnitude of this effect being greater under the FE estimator. But the effect is opposite for dryland sorghum, where performance in other crops decreases relative yields, less so under the FE estimator. For some crops, the number of years growing the crop in question also has a negative effect on relative yields. No learning effects from neighbors are found except in dryland corn, irrigated soybeans, and dryland wheat, where larger average county acres cause relative yields to decrease.

Our measure of overall land quality also yields mixed results. In general, OLS coefficient estimates suggest a greater share of operated acres used as cropland increases relative yields. But acknowledging the presence of unobserved effects renders these effects insignificant except for irrigated sorghum and for dryland sorghum. For the latter, a greater percentage of operated acres devoted to crops actually significantly decreases relative yields.

Finally, in terms of the financial characteristics of the farms, our results suggest the

following. In general, if unobserved effects are not accounted for, wealth has a statistically significant positive effect on relative yields, although this effect is very small in magnitude. On the contrary, the debt to asset ratio has a negative effect on the relative yields of all crops and their practices except for irrigated corn. But these effects are rendered insignificant by our acknowledgment of unobserved effects, except for irrigated sorghum. But this is the single crop/practice combination estimated using random effects, which implicitly assumes the unobserved effects are uncorrelated with the regressors.[5] When taking unobserved effects into account, government payments are found to have statistically significant positive effects on dryland corn, both practices of sorghum, and dryland wheat. For these crops, an additional $1,000 in government payments increases relative yields by between 0.04 and 0.1 percentage points. When using OLS, however, government payments have a statistically significantly negative effect on relative irrigated corn and wheat yields.

Overall, when using OLS, relative yields are significantly affected by farmers' wealth in seven out of eight cases, by farmers' debt to asset ratio in seven out of eight cases, and by farmers' government payment receipts in five out of eight cases. When using panel data methods, these numbers fall to one and zero for the first two coefficients, and to four for the third coefficient. These results suggest that government payments may play an important role in affecting relative yield performance. When we take into account unobserved effects, we find statistically significant positive effects for sorghum, dryland corn, and dryland wheat. In terms of joint significance, the partial F-tests suggest we reject the hypothesis that all three coefficients are zero for the different crops and their practices when using OLS, and for corn, sorghum, and

[5] When estimated using FE, the coefficient on wealth is statistically insignificant, whereas that of the debt to asset ratio is significantly positive. The coefficient on government payments is still statistically significantly positive and its magnitude unchanged. The partial F-test of joint significance has a p-value of 0.0014, suggesting these coefficient estimates are not equal to zero.

dryland wheat when using panel data methods.

The finding that government payments affect yield performance motivates our next analysis. Because decoupled payments may increase the liquidity or improve the collateral of the credit constrained farmer in a manner that allows investment in production to occur, we hypothesize this investment may be used to improve production methods. The goal of the following application is to observe whether decoupled payments affect yield performance.

5. AMTA payments and relative yield performance

Decoupled payments were introduced in the FAIR Act's Title I, known as the Agricultural Market Transition Act (AMTA). This act authorized the distribution of PFC payments for contract commodities to eligible landowners or producers with eligible cropland. Authorized by emergency legislation in 1998-2001, ad hoc Market Loss Assistance (MLA) payments were made to recipients of PFC payments to compensate them for the loss of markets. MLA payments effectively doubled the amount of payments given to landowners or producers for the years 1998-1999, and were labeled as "double AMTA" by Goodwin and Mishra (2006). This section estimates the impact of AMTA payments on relative crop yields.

We estimate equation (4) for 1996 through 2001 (the period of the FAIR Act), using AMTA payments instead of total government payments. Because information is required on the farms' historical acres and yields, a smaller set of farms is available for this application. In particular, we can only use the subset of farms that reported production in the years 1986 through 1988, since we base our estimation of the AMTA payments on these years' average acres and yields (we follow Serra *et al.* (2005) in calculating these payments). Our data contain a total of 7,187 observations. The highest number of observations in a year occurs in 1996 (1,307 observations) and the lowest number occurs in 2001 (1,056 observations). We observe 882 farms

over all the years in our sample; of these, we observe between 8 farms and 130 farms growing irrigated crops (the bounds correspond to sorghum and corn, respectively) and between 241 farms and 608 farms growing dryland crops (the bounds correspond to corn and wheat, respectively). As before, we subtract the amount of AMTA payments from farmers' wealth to avoid double counting. Because the remaining portion of payments is not subtracted from wealth, average wealth in this sample is greater than that of the previous application. Now, the average farmer has a wealth of about $520.66 thousand and $222.36 thousand in debt. In terms of normalized yields, those of irrigated corn, irrigated sorghum, dryland soybeans, and irrigated and dryland wheat are greater than in the previous sample, and those of dryland corn, dryland sorghum, and irrigated soybeans smaller than those in the previous sample.

Tables A.9 through A.16 (in the Appendix) report the results of estimating relative yield performance for the eight crop/practice combinations of corn, sorghum, soybeans and wheat. Again, each table contains the results for a given crop/practice combination. Tables 5.11 through 5.14 report the results for dryland corn, sorghum, soybeans, and wheat, and tables 5.15 through 5.18 report the result for the irrigated practice of those crops, respectively. Once more, we use OLS and panel data methods, FE or RE, and use specifications that vary in the dummy variables included. Again, the last row in each table reports the p-value associated with the partial F-test for the joint significance of the net worth of the farm, the debt to asset ratio, and the amount of government payments received. We again estimate the dryland crops and irrigated corn, soybeans, and wheat using FE and estimate irrigated sorghum using RE.

Table 2 reports the summary statistics for the data used in our estimation.

As before, we subtract the amount of AMTA payments from farmers' wealth to avoid double counting. Because the remaining portion of payments is not subtracted from wealth,

average wealth in this sample is greater than that of the previous application. Now, the average farmer has a wealth of about $520.66 thousand and $222.36 thousand in debt. In terms of normalized yields, those of irrigated corn, irrigated sorghum, dryland soybeans, and irrigated and dryland wheat are greater than in the previous sample, and those of dryland corn, dryland sorghum, and irrigated soybeans smaller than those in the previous sample.

Tables A.9 through A.16 (in the Appendix) report the results of estimating relative yield performance for the eight crop/practice combinations of corn, sorghum, soybeans and wheat. Again, each table contains the results for a given crop/practice combination. Tables 5.11 through 5.14 report the results for dryland corn, sorghum, soybeans, and wheat, and tables 5.15 through 5.18 report the result for the irrigated practice of those crops, respectively. Once more, we use OLS and panel data methods, FE or RE, and use specifications that vary in the dummy variables included. Again, the last row in each table reports the p-value associated with the partial F-test for the joint significance of the net worth of the farm, the debt to asset ratio, and the amount of government payments received. We again estimate the dryland crops and irrigated corn, soybeans, and wheat using FE and estimate irrigated sorghum using RE.[6]

[6] We again judged the appropriateness of the FE estimator by a series of Hausman tests. The results were similar to those in the previous section.

Table 2. Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Number of farms (per year)	7,188	1,198	98	1,056	1,307
Operated Acres, Total (1,000)	7,188	1.78	1.37	0.05	11.06
Share of Crops in Total Operated Acres	7,188	0.6778	0.2701	0.0034	1.0000
Wealth ($1,000)	7,188	520.66	518.84	-568.61	5,924.80
Total Liabilities ($1,000)	7,188	222.36	272.92	0.00	4,313.30
Debt to Asset Ratio	7,188	0.3328	0.3219	0.0000	9.2463
Government Payments ($1,000)	7,188	19.12	18.09	0.00	329.80
Net Farm Income ($1,000)	7,188	45.46	83.32	-563.70	1,555.62
Non Farm Income ($1,000)	7,188	16.76	23.06	-8.46	309.21
Seeds (per 1,000 crop acres) ($1,000)	7,188	0.06	0.71	-0.18	28.01
Chemical (per 1,000 crop acres) ($1,000)	7,188	0.31	3.60	-0.34	132.15
Machinery (per 1,000 crop acres) ($1,000)	7,188	133.15	193.15	0.00	12,730.45
Ownership Interest	7,188	0.6982	5.7050	-257.6805	134.6589
Diversification	7,139	0.5229	0.2025	0.0000	0.8392
Livestock Share of Sales	7,139	0.2676	0.3273	0.0000	1.0000
Normalized Yields,Irrigated Corn	1,140	98.31	18.78	0.00	182.34
Normalized Yields, Dryland Corn	977	101.66	40.15	0.00	384.13
Normalized Yields, Irrigated Sorghum	259	94.30	38.07	0.00	251.89
Normalized Yields, Dryland Sorghum	3,822	102.55	28.90	0.00	232.31
Normalized Yields, Irrigated Soybeans	594	104.98	25.34	9.41	209.09
Normalized Yields, Dryland Soybeans	2,220	100.70	36.77	0.00	382.63
Normalized Yields, Irrigated Wheat	482	96.49	40.32	0.00	393.48
Normalized Yields, Dryland Wheat	5,972	99.99	27.70	0.00	306.67
Acres, Irrigated Corn (1,000)	7,188	0.06	0.17	0.00	2.63
Acres, Dryland Corn (1,000)	7,188	0.08	0.17	0.00	1.64
Acres, Irrigated Sorghum (1,000)	7,188	0.01	0.05	0.00	2.66
Acres, Dryland Sorghum (1,000)	7,188	0.17	0.23	0.00	4.49
Acres, Irrigated Soybeans (1,000)	7,188	0.02	0.07	0.00	0.94
Acres, Dryland Soybeans (1,000)	7,188	0.18	0.31	0.00	3.57
Acres, Irrigated Wheat (1,000)	7,188	0.01	0.07	0.00	1.37
Acres, Dryland Wheat (1,000)	7,188	0.35	0.40	0.00	4.20
County Acreage, Irrigated Corn (1,000)	5,667	13.58	21.28	0.10	123.72
County Acreage, Dryland Corn (1,000)	6,101	6.62	8.39	0.17	57.15
County Acreage, Irrigated Sorghum (1,000)	4,948	2.45	3.29	0.10	18.46
County Acreage, Dryland Sorghum (1,000)	7,188	34.82	25.81	0.23	100.78
County Acreage, Irrigated Soybeans (1,000)	5,646	3.15	3.96	0.10	20.73
County Acreage, Dryland Soybeans (1,000)	6,626	26.63	24.72	0.10	100.88
County Acreage,Irrigated Wheat (1,000)	3,132	8.27	12.93	0.10	76.44
County Acreage, Dryland Wheat (1,000)	7,188	98.17	82.49	0.64	452.08
Years Produced, Irrigated Corn	7,188	0.94	1.56	0.00	4.00
Years Produced, Dryland Corn	7,188	1.61	1.68	0.00	4.00
Years Produced, Irrigated Sorghum	7,188	0.43	0.98	0.00	4.00
Years Produced, Dryland Sorghum	7,188	2.99	1.47	0.00	4.00
Years Produced, Irrigated Soybeans	7,188	0.60	1.21	0.00	4.00
Years Produced, Dryland Soybeans	7,188	2.32	1.77	0.00	4.00
Years Produced, Irrigated Wheat	7,188	0.51	1.13	0.00	4.00
Years Produced, Dryland Wheat	7,188	3.52	1.08	0.00	4.00
Mean other crops, Irrigated/Dryland Corn	7,188	0.9781	0.2544	0.0000	5.3481
Mean other crops, Irrigated/Dryland Sorghum	7,188	0.9736	0.2542	0.0000	5.3481
Mean other crops, Irrigated/Dryland Soybeans	7,188	0.9656	0.2050	0.0000	2.0792
Mean other crops, Irrigated/Dryland Wheat	7,188	0.9469	0.4156	0.0000	10.9809

Our results suggest AMTA payments distort relative crop yields. When using OLS, a statistically significant positive effect is found in five out of eight cases: irrigated and dryland

corn, dryland sorghum, irrigated soybeans, and dryland wheat. When panel data methods are used, these effects are only significant for dryland sorghum, where this effect is negative, and for irrigated wheat, where it is positive. The magnitude of these effects is crop and practice specific. When using OLS, an additional $1,000 in AMTA payments increases relative crop yields by 0.03 percentage points for irrigated corn, by 0.18 percentage points for dryland corn, and by between 0.10 and 0.28 percentage points for dryland sorghum and soybeans. For dryland wheat, these values vary between 0.08 and 0.18 percentage points. When using FE, an additional $1,000 in AMTA payments decreases dryland sorghum yields by 0.25 percentage points, although this effect is no longer significant when year dummy variables are included in the estimating equation; irrigated wheat yields are increased by between 0.30 to 0.43 percentage points.

As before, the effects of the other regressors on relative yields are crop and practice specific. Again, both size, number of acres devoted to the crop/practice, and share of livestock sales have a negative impact on relative yields. And although the coefficient estimates are never statistically significant for the first variable for either estimator, those on the number of acres devoted to the crop/practice in question are significantly positive in two out of eight cases under OLS (irrigated corn and dryland sorghum) and significantly negative in three out of eight cases under FE (irrigated corn and both practices of soybeans). Those on the livestock share of sales are significantly negative in five cases under OLS (dryland sorghum, soybeans, and wheat, and irrigated corn and sorghum) and two cases under panel FE (dryland corn and wheat). Diversification overall has a positive effect on relative yields, although some coefficient estimates are negative (but statistically insignificant). The estimate for the Herfindahl index coefficient is significant in three cases under OLS (irrigated sorghum and dryland sorghum and wheat) and in one case under panel data methods (dryland sorghum). Ownership interest raises

relative crop yields for irrigated corn and wheat under both estimators and for irrigated soybeans under OLS, while decreasing relative irrigated sorghum yields under RE. In terms of experience, a better performance in other crops raises relative dryland wheat yields under both estimators, irrigated wheat under FE, and irrigated corn yields under OLS, while decreasing those of dryland sorghum under OLS and dryland corn under FE. The effect of more years growing the crop is also not clear: a statistically significant positive effect is found for dryland sorghum and soybeans under OLS, but a negative effect is found for irrigated wheat under OLS and dryland corn under FE. Having more acres in the county devoted to growing the crop/practice in question tends to lower relative yields, as we find a significantly negative effect in six out of eight cases using OLS (irrigated corn, sorghum, soybeans and wheat, and dryland sorghum and wheat) and in three our of eight cases when using FE (irrigated corn, soybeans, and wheat). But a statistically significant positive effect for dryland corn and sorghum is found when using FE.

In terms of the other two variables that pertain to the financial characteristics of the farms, wealth is found to have a statistically significant positive effect on relative crop yields only when using OLS, where it raises relative yields of irrigated corn, sorghum, and soybeans, and dryland sorghum, soybeans, and wheat. But, as before, the magnitude of this effect is very small. The debt to asset ratio is also found to significantly affect relative yields when using OLS, lowering those of irrigated sorghum and soybeans, and those of dryland sorghum and wheat, while increasing those of irrigated corn. But when unobserved effects are taken into account, a single statistically significant negative effect is found for irrigated soybeans. When taken together, the three variables included in the set of financial characteristics of the farms, net worth, debt to asset ratio, and government payments receipts, seem to be relevant in terms of explaining relative yield performance in six out of eight cases when using OLS (irrigated corn,

sorghum and soybeans, and dryland sorghum, soybeans, and wheat), and in two out of eight cases when using panel data methods (irrigated and dryland sorghum).

6. Conclusions

The question of which specific farm characteristics affect crop yields has been largely ignored by the economics literature. Yet, one would expect yields to be higher for farmers who are more skilled, who have a better knowledge of farming, or who have access to better technology or seeds. The goal of this section was to observe whether specific farm characteristics could explain relative crop yield performance. A variety of farm characteristics were treated as regressors in the econometric model of farm yields, including the financial characteristics of the farms, such as their wealth, debt to asset ratio, and the amount of government payments they received. As in Goodwin et al. (2002), we found that larger farms had lower relative yields, as did farms that had a greater share of sales coming from livestock. Wealthier farms also showed a tendency to have higher relative yields, as did farms with greater government payments receipts; these effects were mainly found when using OLS methods.

We took the analysis one step further and investigated whether decoupled payments under the form of AMTA payments could explain differing yield performances. Our results suggest this is the case. When using OLS, AMTA payments are found to have statistically significant positive effects on both practices of corn and soybeans, dryland sorghum, and irrigated wheat; when using FE a statistically significant positive effect is found on dryland sorghum, whereas a negative effect is found on irrigated wheat. This finding has potentially important implications for agricultural trade policy, as the sole motivation for the distribution of these payments is that they do not distort production. While there is a large existing literature on the effects of AMTA payments on acreage, land prices, and labor choices, there are no existing

studies on whether AMTA payments enhance yield performance. Our results seem to suggest there is the potential for decoupled payments to boost relative yields, thereby giving an unfair advantage to their recipients. This is likely to become an issue in upcoming WTO discussions over the distortionary effects of decoupled payments.

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A. Appendix

Table A.1. Parameter estimates and summary statistics for dryland corn

		OLS		FE			OLS		FE	
Corn, Dryland	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	0.2957	0.2119	0.5717	0.7116	0.6647	0.5019	0.4229	0.7190	0.7493	0.6963
	(0.7742)	(0.741)	(0.763)	(1.306)	(1.269)	(0.746)	(0.71)	(0.743)	(1.305)	(1.27)
Chemical ($1000/crop acres)	-0.1027	-0.0793	-0.1220	0.2353	0.2458	-0.0401	-0.0124	-0.0707	0.2078	0.2241
	(0.1919)	(0.186)	(0.198)	(0.153)	(0.165)	(0.177)	(0.17)	(0.181)	(0.154)	(0.168)
Machinery ($1000/crop acres)	0.0068	0.0076	0.0058	-0.0008	-0.0012	0.0019	0.0021	0.0016	-0.0010	-0.0014
	(0.0075)	(0.009)	(0.005)	(0.004)	(0.003)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)
Operated acres	0.1295	0.4151	1.8302 *	0.7875	1.6385	-0.8296	-0.6499	0.8781	0.3946	0.9199
	(0.5458)	(0.569)	(0.535)	(2.195)	(2.032)	(0.707)	(0.703)	(0.68)	(2.262)	(2.143)
Acres of crop/practice	7.1459	6.0576	3.5169	0.0868	-3.7245	6.7688	5.6498	2.9640	-1.2119	-4.6102
	(4.8344)	(4.755)	(4.894)	(10.631)	(10.285)	(4.794)	(4.702)	(4.879)	(10.478)	(10.262)
Livestock share of sales	-0.8140	-0.8594	-4.1397	-12.5361	-9.9354	-2.6156	-2.6453	-5.0922 **	-12.3914	-9.6348
	(2.5709)	(2.508)	(2.517)	(7.679)	(7.382)	(2.581)	(2.495)	(2.49)	(7.727)	(7.415)
Diversification	4.3370	4.6596	0.9105	9.1318	7.6276	5.5914	5.9370	1.8071	8.3437	7.7324
	(4.4029)	(4.349)	(4.243)	(8.379)	(8.285)	(4.433)	(4.379)	(4.274)	(8.447)	(8.272)
Ownership interest	0.0591	0.0412	0.0569	-0.2011	-0.2255	0.0523	0.0325	0.0507	-0.2038 ***	-0.2315
	(0.0988)	(0.098)	(0.091)	(0.122)	(0.143)	(0.099)	(0.099)	(0.092)	(0.122)	(0.145)
Mean other crops	-1.5358	-1.4695	-2.7612	-3.9442	-5.7721	-1.8735	-1.7531	-2.8881	-3.9786	-5.3515
	(2.2428)	(2.209)	(2.184)	(4.017)	(3.77)	(2.226)	(2.206)	(2.199)	(3.968)	(3.731)
Number of years	2.0312 *	2.0393 *	0.8836	-2.9784 **	-2.8938 **	1.8268 *	1.8628 *	0.8247	-2.8935 **	-2.7714 **
	(0.5829)	(0.607)	(0.576)	(1.214)	(1.145)	(0.586)	(0.598)	(0.575)	(1.204)	(1.135)
Average county acres (1,000)	-0.3907 *	-0.3255 *	-0.9406 **	-0.7871 ***	-0.5234	-0.3823 *	-0.3177 *	-0.9434 *	-0.8347 ***	-0.5202
	(0.119)	(0.098)	(0.367)	(0.443)	(0.504)	(0.118)	(0.097)	(0.361)	(0.452)	(0.5)
Crops acres share of operated acres	6.1510	8.8070 **	9.8706 **	-5.3399	-3.7304	4.5742	6.7600 ***	8.4486 **	-5.9891	-5.1823
	(4.113)	(3.966)	(3.966)	(11.555)	(11.142)	(4.287)	(4.108)	(4.11)	(11.81)	(11.397)
Wealth ($1,000)						0.0070 *	0.0067 *	0.0040 *	-0.0021	0.0020
						(0.002)	(0.002)	(0.002)	(0.007)	(0.007)
Debt to asset ratio						-2.8417	-3.4450	-4.2584 ***	-7.7612	-8.2878
						(2.513)	(2.566)	(2.458)	(8.088)	(8.092)
Government payments ($1,000)						0.0004	0.0089	0.0226	0.0662 ***	0.0908 **
						(0.023)	(0.022)	(0.023)	(0.04)	(0.041)
Constant	91.2403 *	90.4460 *	97.8781 *	121.0744 *	120.5215 *	93.4284 *	93.2522 *	99.7971 *	125.1165 *	123.7795 *
	(5.809)	(6.183)	(5.728)	(13.575)	(12.905)	(5.867)	(6.355)	(5.86)	(14.004)	(13.398)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	4,301	4,301	4,301	4,301	4,301	4,301	4,301	4,301	4,301	4,301
R^2	0.0145	0.0460	0.1286	0.4548	0.4825	0.0231	0.0548	0.1332	0.4564	0.4844
F-test	-	-	-	-	-	0.0000	0.0000	0.0001	0.2588	0.0800

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.2. Parameter estimates and summary statistics for dryland sorghum

		OLS		FE			OLS		FE	
Soghum, Dryland	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	0.3387	0.2705	0.3682	0.4715	0.3933	0.5441 **	0.4585	0.5467 ***	0.4748	0.3913
	(0.2833)	(0.288)	(0.301)	(0.369)	(0.372)	(0.274)	(0.28)	(0.281)	(0.367)	(0.369)
Chemical ($1000/crop acres)	-0.2359 **	-0.2430 **	-0.2285 **	0.1984 ***	0.1913 ***	-0.1466	-0.1520	-0.1560 ***	0.1959 ***	0.1882 ***
	(0.107)	(0.104)	(0.093)	(0.108)	(0.105)	(0.099)	(0.095)	(0.085)	(0.109)	(0.105)
Machinery ($1000/crop acres)	0.0384 *	0.0434 *	0.0376 *	-0.0167 **	-0.0025	0.0229 *	0.0275 *	0.0240 *	-0.0161 **	-0.0023
	(0.0043)	(0.004)	(0.004)	(0.008)	(0.007)	(0.004)	(0.004)	(0.004)	(0.008)	(0.007)
Operated acres	0.4098	0.6376 ***	1.6797 *	-2.6523 *	-1.2605	-0.7729 ***	-0.8185 **	0.3530	-2.5776 **	-1.7769 ***
	(0.3533)	(0.349)	(0.33)	(0.968)	(0.963)	(0.402)	(0.398)	(0.37)	(1.02)	(1.003)
Acres of crop/practice	10.3953 *	10.0120 *	8.8377 *	-0.4244	-2.5074	9.0255 *	8.1955 *	7.0485 *	-0.5898	-2.8955
	(2.523)	(2.482)	(2.567)	(2.605)	(2.567)	(2.47)	(2.396)	(2.52)	(2.616)	(2.56)
Livestock share of sales	-8.8429 *	-8.6779 *	-9.8075 *	-6.0623 **	-5.4918 **	-10.5691 *	-10.3940 *	-11.0705 *	-6.1118 **	-5.3930 **
	(1.3016)	(1.297)	(1.285)	(2.378)	(2.383)	(1.309)	(1.303)	(1.296)	(2.387)	(2.401)
Diversification	12.6077 *	12.7643 *	9.8574 *	11.3204 *	11.1418 *	13.5584 *	13.5967 *	10.0422 *	11.3292 *	10.8584 *
	(2.1745)	(2.163)	(2.106)	(2.929)	(2.901)	(2.159)	(2.149)	(2.105)	(2.92)	(2.899)
Ownership interest	0.0680	0.0609	0.0554	0.0761	0.0678	0.0723	0.0647	0.0565	0.0765	0.0666
	(0.0517)	(0.051)	(0.051)	(0.064)	(0.063)	(0.05)	(0.049)	(0.05)	(0.064)	(0.063)
Mean other crops	-5.4368 *	-5.3630 *	-6.2445 *	-2.3688 ***	-2.2589 ***	-5.9771 *	-5.8355 *	-6.7605 *	-2.4273 ***	-2.3136 ***
	(1.184)	(1.19)	(1.156)	(1.309)	(1.327)	(1.161)	(1.17)	(1.145)	(1.315)	(1.326)
Number of years	3.0226 *	3.0769 *	1.8886 *	-0.4087	-0.3078	2.9589 *	3.0495 *	1.8244 *	-0.4506	-0.3474
	(0.5233)	(0.517)	(0.495)	(0.799)	(0.787)	(0.516)	(0.508)	(0.491)	(0.797)	(0.786)
Average county acres (1,000)	-0.0291	-0.0366 **	0.0001	0.0129	0.0077	-0.0327 ***	-0.0396 **	0.0164	0.0029	0.0086
	(0.0186)	(0.018)	(0.075)	(0.07)	(0.076)	(0.018)	(0.018)	(0.074)	(0.07)	(0.075)
Crops acres share of operated acres	6.4563 *	7.2285 *	14.6901 *	-13.3113 *	-9.4493 **	5.5054 *	5.3142 *	13.0578 *	-13.3142 *	-10.4157 *
	(1.8682)	(1.839)	(1.821)	(4.058)	(3.966)	(1.943)	(1.914)	(1.888)	(4.108)	(4.006)
Wealth ($1,000)						0.0066 *	0.0066 *	0.0048 *	-0.0040	0.0008
						(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Debt to asset ratio						-5.0576 *	-5.1958 *	-6.5996 *	-1.7627	-1.3262
						(1.129)	(1.126)	(1.121)	(3.198)	(3.145)
Government payments ($1,000)						0.0101	0.0367 ***	0.0524 *	0.0261	0.0635 *
						(0.019)	(0.022)	(0.02)	(0.02)	(0.023)
Constant	79.4111 *	78.3567 *	90.3476 *	115.4401 *	109.1838 *	83.6902 *	83.5738 *	95.0700 *	117.6171 *	110.4495 *
	(3.0524)	(3.159)	(4.95)	(6.138)	(5.922)	(3.086)	(3.224)	(5.026)	(6.35)	(6.08)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	11,765	11,765	11,765	11,765	11,765	11,765	11,765	11,765	11,765	11,765
R^2	0.0451	0.0518	0.0978	0.4705	0.4766	0.0601	0.0680	0.1110	0.4709	0.4773
F-test	-	-	-	-	-	0.0000	0.0000	0.0000	0.3086	0.0362

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.3. Parameter estimates and summary statistics for dryland soybeans

		OLS		FE			OLS		FE	
Soybeans, Dryland	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	-0.8966	-0.9818	-0.4012 *	-0.1622	-0.2039	-0.6710	-0.7516	-0.2253	-0.1658 *	-0.2175
	(0.9592)	(0.971)	(-0.42)	(1.003)	(1.002)	(0.962)	(0.975)	(0.966)	(-0.17)	(1)
Chemical ($1000/crop acres)	-0.6617 *	-0.6133 *	-0.5738 *	-0.2180	-0.2036	-0.5805 *	-0.5258 *	-0.5086 *	-0.2422	-0.2208
	(0.1659)	(0.151)	(0.145)	(0.194)	(0.193)	(0.158)	(0.139)	(0.135)	(0.194)	(0.193)
Machinery ($1000/crop acres)	0.0293 *	0.0331 *	0.0276 *	-0.0057	-0.0050	0.0197 *	0.0233 *	0.0197 *	-0.0109	-0.0070
	(0.0079)	(0.009)	(0.008)	(0.009)	(0.009)	(0.007)	(0.008)	(0.007)	(0.009)	(0.009)
Operated acres	2.5139 *	2.9172 *	2.8090 *	0.2465	0.3321	1.6007 **	1.5297 **	1.4619 **	-0.4193	-0.2281
	(0.5701)	(0.581)	(0.577)	(1.499)	(1.496)	(0.685)	(0.666)	(0.675)	(1.563)	(1.54)
Acres of crop/practice	1.5192	0.5012	1.4154	-8.8784 **	-10.1026 **	1.0115	-0.0424	0.5227	-10.5545 **	-10.8161 **
	(2.2065)	(2.11)	(2.038)	(4.348)	(4.301)	(2.223)	(2.126)	(2.052)	(4.4)	(4.378)
Livestock share of sales	-4.2586 **	-4.6451 *	-5.7799 *	-10.2726 **	-11.4691 **	-5.6193 *	-5.8781 *	-6.7101 *	-10.5226 **	-11.5767 **
	(1.7842)	(1.782)	(1.721)	(4.233)	(4.459)	(1.748)	(1.743)	(1.698)	(4.227)	(4.463)
Diversification	4.2146	3.8261	5.8426 ***	7.8439	6.8760	4.6179	3.5805	5.3798	7.3104	6.5654
	(3.5929)	(3.501)	(3.413)	(5.126)	(4.983)	(3.576)	(3.502)	(3.42)	(5.07)	(4.978)
Ownership interest	0.0600	0.0690	0.0658	0.0230	0.0350	0.0690	0.0777	0.0696	0.0191	0.0328
	(0.0735)	(0.07)	(0.07)	(0.067)	(0.063)	(0.072)	(0.069)	(0.069)	(0.068)	(0.063)
Mean other crops	-0.7380	-0.1044	-0.4199	-1.2895	-1.3261	-1.4195	-0.7685	-1.0103	-1.4390	-1.2524
	(1.6542)	(1.649)	(1.596)	(2.122)	(2.101)	(1.638)	(1.629)	(1.582)	(2.103)	(2.092)
Number of years	3.0835 *	3.0820 *	2.3632 *	-1.3032	-1.3847	3.0045 *	2.9605 *	2.3240 *	-1.2267	-1.3544
	(0.6367)	(0.612)	(0.655)	(1.05)	(1.056)	(0.637)	(0.61)	(0.653)	(1.048)	(1.055)
Average county acres (1,000)	-0.0023	0.0068	-0.3388	-0.2351	-0.1990	0.0018	0.0125	-0.3306	-0.2853	-0.1826
	(0.0325)	(0.032)	(0.222)	(0.172)	(0.25)	(0.033)	(0.032)	(0.219)	(0.175)	(0.249)
Crops acres share of operated acres	10.8997 *	12.1584 *	10.3255 *	6.3409	6.2449	9.6609 *	9.2512 *	8.2192 *	4.9656	5.0671
	(2.857)	(2.856)	(3.004)	(6.037)	(5.963)	(3.096)	(2.98)	(3.114)	(6.025)	(5.964)
Wealth ($1,000)						0.0044 *	0.0037 **	0.0031 **	0.0014	0.0013
						(0.001)	(0.002)	(0.002)	(0.004)	(0.004)
Debt to asset ratio						-4.7762 *	-5.4038 *	-5.2045 *	-5.5428	-5.5279
						(1.784)	(1.861)	(1.791)	(4.6)	(4.585)
Government payments ($1,000)						0.0183	0.0740 **	0.0777 *	0.0654	0.0655
						(0.028)	(0.029)	(0.029)	(0.04)	(0.043)
Constant	74.8297 *	74.9638 *	104.4478 *	110.6181 *	110.6546 *	78.8699 *	81.5021 *	109.4449 *	115.5638 *	113.4129 *
	(4.5912)	(4.74)	(15.582)	(9.503)	(11.404)	(4.681)	(4.92)	(15.569)	(9.925)	(11.853)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	7,194	7,194	7,194	7,194	7,194	7,194	7,194	7,194	7,194	7,194
R^2	0.0320	0.0470	0.0824	0.4656	0.4716	0.0386	0.0547	0.0888	0.4666	0.4722
F-test	-	-	-	-	-	0.0000	0.0000	0.0000	0.1883	0.2304

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.4. Parameter estimates and summary statistics for dryland wheat

	OLS			FE		OLS			FE	
Wheat, Dryland	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	-0.3217 **	-0.3157 **	-0.2694 ***	-0.0603 *	-0.0491	-0.2460	-0.2375	-0.2060	-0.0585	-0.0528
	(0.1581)	(0.159)	(0.155)	(-0.41)	(0.149)	(0.156)	(0.157)	(0.151)	(0.146)	(0.148)
Chemical ($1000/crop acres)	-0.2478 *	-0.2409 *	-0.2130 *	-0.0494	-0.0353	-0.2047 *	-0.1962 *	-0.1773 *	-0.0529	-0.0376
	(0.0564)	(0.056)	(0.058)	(0.062)	(0.061)	(0.057)	(0.056)	(0.058)	(0.062)	(0.061)
Machinery ($1000/crop acres)	0.0114 *	0.0122 *	0.0112 *	-0.0029	0.0005	0.0065 **	0.0072 **	0.0067 **	-0.0030	0.0003
	(0.0037)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Operated acres	0.2213	0.2452	1.1392 *	-1.6422 *	-1.0026 ***	-0.6532 **	-0.6834 **	0.2502	-1.7162 *	-1.3342 **
	(0.268)	(0.266)	(0.237)	(0.591)	(0.583)	(0.328)	(0.315)	(0.279)	(0.623)	(0.609)
Acres of crop/practice	0.9770	1.0276	1.7709 **	0.2949	0.3802	1.5009	1.5106 ***	1.4314 ***	0.4961	0.3612
	(0.9052)	(0.886)	(0.814)	(1.543)	(1.513)	(0.925)	(0.912)	(0.838)	(1.543)	(1.506)
Livestock share of sales	-4.8265 *	-5.0283 *	-6.3509 *	-8.6313 *	-10.0978 *	-5.7566 *	-5.9333 *	-6.9202 *	-8.6919 *	-10.0306 *
	(1.0014)	(0.997)	(0.957)	(1.624)	(1.633)	(1)	(0.994)	(0.96)	(1.623)	(1.637)
Diversification	11.0318 *	11.1492 *	5.9051 *	5.5709 *	5.0592 **	11.4949 *	11.5992 *	5.9673 *	5.3983 *	4.7821 **
	(1.6739)	(1.634)	(1.295)	(2.045)	(1.993)	(1.653)	(1.627)	(1.285)	(2.027)	(1.974)
Ownership interest	0.0562 ***	0.0596 ***	0.0421	0.0392	0.0413	0.0593 ***	0.0628 **	0.0436	0.0375	0.0403
	(0.0313)	(0.032)	(0.03)	(0.031)	(0.032)	(0.031)	(0.031)	(0.03)	(0.031)	(0.032)
Mean other crops	1.6440 *	1.5514 *	0.9280 ***	2.1465 *	2.1078 *	1.5278 *	1.4239 **	0.8646	2.0381 **	2.1004 *
	(0.5724)	(0.564)	(0.533)	(0.806)	(0.763)	(0.562)	(0.553)	(0.527)	(0.795)	(0.762)
Number of years	0.4216	0.2923	0.2285	-0.8485	-1.3110 ***	0.2606	0.1146	0.0454	-0.8130	-1.3372 ***
	(0.4596)	(0.46)	(0.456)	(0.7)	(0.705)	(0.459)	(0.46)	(0.458)	(0.7)	(0.701)
Average county acres (1,000)	-0.0070	-0.0076	-0.1245 *	-0.0285	-0.1315 *	-0.0056	-0.0062	-0.1246 *	-0.0274	-0.1281 *
	(0.005)	(0.005)	(0.041)	(0.036)	(0.046)	(0.005)	(0.005)	(0.04)	(0.037)	(0.045)
Crops acres share of operated acres	6.3788 *	6.4805 *	11.3032 *	-2.8254	-0.5790	4.8561 *	4.7922 *	9.6850 *	-3.2338	-1.3037
	(1.5955)	(1.592)	(1.398)	(2.796)	(2.748)	(1.642)	(1.646)	(1.451)	(2.811)	(2.752)
Wealth ($1,000)						0.0039 *	0.0038 *	0.0023 *	-0.0020	0.0006
						(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Debt to asset ratio						-2.9125 *	-3.0769 *	-3.8083 *	-1.1668	-1.4012
						(0.734)	(0.726)	(0.779)	(1.18)	(1.169)
Government payments ($1,000)						0.0098	0.0156	0.0422 *	0.0217	0.0433 *
						(0.01)	(0.01)	(0.009)	(0.013)	(0.014)
Constant	86.4986 *	88.2590 *	104.6337 *	109.0441 *	122.9785 *	89.1852 *	91.4565 *	108.1457 *	110.0672 *	123.6677 *
	(2.443)	(2.568)	(3.952)	(5.303)	(6.373)	(2.44)	(2.619)	(3.973)	(5.41)	(6.398)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	19,159	19,159	19,159	19,159	19,159	19,159	19,159	19,159	19,159	19,159
R^2	0.0188	0.0253	0.0767	0.3526	0.3614	0.0266	0.0335	0.0834	0.3530	0.3621
F-test	-	-	-	-	-	0.0000	0.0000	0.0000	0.1657	0.0115

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.5. Parameter estimates and summary statistics for irrigated corn

		OLS			FE		OLS			FE
Corn, Irrigated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	0.1406	0.1491	0.2360	0.2408	0.2557	0.1915	0.2017	0.2933	0.2497	0.2508
	(0.1338)	(0.136)	(0.181)	(0.237)	(0.22)	(0.134)	(0.138)	(0.189)	(0.236)	(0.222)
Chemical ($1000/crop acres)	-0.0715	-0.0720	-0.0692	-0.0095	-0.0051	-0.0644	-0.0647	-0.0666	-0.0108	-0.0050
	(0.0499)	(0.047)	(0.047)	(0.056)	(0.054)	(0.049)	(0.046)	(0.046)	(0.057)	(0.055)
Machinery ($1000/crop acres)	0.0040	0.0024	0.0021	-0.0003	-0.0020 ***	0.0029	0.0015	0.0012	-0.0005	-0.0020 ***
	(0.0033)	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Operated acres	0.5770 ***	0.4881	0.7035 **	-0.4032	-0.6896	0.2961	0.3692	0.5063	-0.4966	-0.7073
	(0.3402)	(0.336)	(0.332)	(0.663)	(0.639)	(0.393)	(0.391)	(0.397)	(0.649)	(0.626)
Acres of crop/practice	5.0487 *	5.2209 *	3.4347 *	-5.1704 **	-5.9798 **	4.8644 *	6.1717 *	4.1204 *	-5.6656 **	-6.2252 **
	(1.2262)	(1.198)	(1.134)	(2.547)	(2.498)	(1.316)	(1.447)	(1.339)	(2.665)	(2.567)
Livestock share of sales	-8.0496 *	-8.2457 *	-7.1702 *	-5.3051	-4.9173	-8.5637 *	-8.8541 *	-7.7243 *	-5.4275	-4.7748
	(2.0937)	(2.05)	(2.079)	(3.852)	(3.771)	(2.112)	(2.065)	(2.103)	(3.858)	(3.79)
Diversification	-0.9798	-1.6217	0.0397	5.9273 ***	5.6754 ***	-0.8035	-1.1612	0.6453	5.8827 ***	5.4814 ***
	(2.5994)	(2.628)	(2.815)	(3.286)	(3.313)	(2.602)	(2.634)	(2.825)	(3.31)	(3.307)
Ownership interest	0.0994	0.0869	0.0315	-0.0249	-0.0570	0.0984	0.0878	0.0370	-0.0270	-0.0581
	(0.1246)	(0.136)	(0.121)	(0.092)	(0.101)	(0.126)	(0.138)	(0.122)	(0.092)	(0.101)
Mean other crops	2.1845 ***	1.8940	1.0023	0.4891	0.7564	2.0696 ***	1.7941	0.9032	0.4236	0.7312
	(1.2548)	(1.238)	(1.235)	(1.434)	(1.442)	(1.252)	(1.241)	(1.231)	(1.422)	(1.438)
Number of years	1.4164 **	1.3481 **	1.1937 **	-1.5210 **	-1.7017 *	1.3489 **	1.2441 **	1.1119 ***	-1.5169 **	-1.7042 *
	(0.6025)	(0.594)	(0.599)	(0.613)	(0.617)	(0.598)	(0.588)	(0.593)	(0.614)	(0.618)
Average county acres (1,000)	-0.1031 *	-0.1094 *	-0.0486	0.0886	-0.0085	-0.1000 *	-0.1060 *	-0.0370	0.0726	-0.0129
	(0.0193)	(0.02)	(0.127)	(0.104)	(0.119)	(0.02)	(0.02)	(0.126)	(0.108)	(0.12)
Crops acres share of operated acres	4.4150	3.7071	5.8921 **	1.3170	-0.5269	3.9564	3.6554	6.1719 **	1.1495	-0.6443
	(2.7266)	(2.661)	(2.84)	(4.607)	(4.509)	(2.738)	(2.691)	(2.842)	(4.608)	(4.517)
Wealth ($1,000)						0.0015 **	0.0015 **	0.0019 *	0.0016	-0.0013
						(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Debt to asset ratio						-0.9020	-0.9870	-0.8768	0.0088	-0.7613
						(1.169)	(1.164)	(1.129)	(2.897)	(2.699)
Government payments ($1,000)						0.0014	-0.0139	-0.0126	0.0060	0.0075
						(0.01)	(0.012)	(0.012)	(0.011)	(0.013)
Constant	88.6163 *	89.5722 *	110.9859 *	99.5406 *	105.6544 *	89.5789 *	89.8265 *	110.6543 *	99.5106 *	106.8792 *
	(4.6267)	(4.852)	(5.978)	(7.492)	(7.081)	(4.636)	(4.858)	(5.833)	(7.846)	(7.343)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	3,815	3,815	3,815	3,815	3,815	3,815	3,815	3,815	3,815	3,815
R^2	0.0341	0.0531	0.1064	0.4485	0.4630	0.0362	0.0557	0.1093	0.4486	0.4632
F-test	-	-	-	-	-	0.0790	0.0129	0.0018	0.8242	0.8344

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A. 6. Parameter estimates and summary statistics for irrigated sorghum

		OLS			RE		OLS			RE
Sorghum, Irrigated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	-3.1982	-2.8719	-2.8063	-0.1944	0.5042	-2.4799	-2.0102 *	-2.2778	-0.1318	0.7052
	(2.7164)	(2.641)	(2.767)	(2.98)	(2.908)	(2.618)	(-0.8)	(2.68)	(3.025)	(2.893)
Chemical ($1000/crop acres)	-0.1351	-0.2764	-0.6403	-0.5523	-0.7336	0.1297	-0.0166	-0.4652	-0.4539	-0.6838
	(0.8626)	(0.936)	(0.981)	(0.784)	(0.828)	(0.852)	(0.91)	(0.984)	(0.799)	(0.834)
Machinery ($1000/crop acres)	0.0174	0.0168	0.0198	0.0071	0.0066	-0.0238	-0.0254	-0.0132	-0.0147	-0.0129
	(0.0177)	(0.018)	(0.02)	(0.021)	(0.021)	(0.018)	(0.018)	(0.02)	(0.021)	(0.021)
Operated acres	1.9346 **	1.7587 ***	2.8830 *	1.3774	1.2059	-0.3205	-1.2128	0.7205	-0.9405	-1.4821
	(0.9194)	(0.939)	(0.997)	(1.211)	(1.225)	(1.181)	(1.232)	(1.302)	(1.406)	(1.425)
Acres of crop/practice	19.6264	21.0507	31.3087 **	30.8956 **	31.3747 **	12.8389	12.6724	24.5494 ***	27.5205 **	27.2704 **
	(13.2371)	(13.777)	(14.33)	(13.578)	(13.642)	(13.091)	(13.855)	(14.637)	(13.042)	(13.309)
Livestock share of sales	-0.6454	-1.1016	7.4550	5.5221	5.3882	-3.1734	-3.3386	4.3634	4.6974	4.8109
	(6.7587)	(6.682)	(6.719)	(8.148)	(8.07)	(6.803)	(6.684)	(6.89)	(8.207)	(8.121)
Diversification	12.4935	10.3298	4.6844	13.8340 ***	12.7266 ***	12.5041	10.2467	3.1536	14.0656 ***	12.2443
	(8.1205)	(8.118)	(8.377)	(7.548)	(7.715)	(8.153)	(8.069)	(8.374)	(7.577)	(7.716)
Ownership interest	-0.1335	-0.1497	-0.2943 *	-0.2729 **	-0.2901 **	-0.1905	-0.2126	-0.3156 *	-0.2786 **	-0.2990 **
	(0.166)	(0.172)	(0.104)	(0.12)	(0.123)	(0.157)	(0.156)	(0.107)	(0.123)	(0.127)
Mean other crops	4.3023	4.1807	3.0731	4.4750	3.9021	3.6738	3.4896	2.7984	4.1636	3.6716
	(4.667)	(4.81)	(4.842)	(3.709)	(3.743)	(4.609)	(4.753)	(4.838)	(3.639)	(3.651)
Number of years	-0.0957	0.0973	0.2687	0.0026	0.2624	-0.4347	-0.3909	-0.0465	-0.1874	0.0163
	(1.0964)	(1.163)	(1.137)	(1.154)	(1.216)	(1.083)	(1.139)	(1.115)	(1.147)	(1.202)
Average county acres (1,000)	-0.3159	-0.3138	-0.0883	-0.3235	-0.3470	-0.3925 ***	-0.4182	0.0230	-0.2958	-0.3841
	(0.2258)	(0.251)	(0.64)	(0.259)	(0.298)	(0.232)	(0.259)	(0.638)	(0.261)	(0.3)
Crops acres share of operated acres	22.9973 *	23.0692 *	47.0015 *	29.2594 *	29.9216 *	23.5514 **	21.2383 **	44.3573 *	24.0460 **	23.8697 **
	(8.5788)	(8.463)	(9.581)	(9.731)	(9.826)	(9.346)	(9.188)	(9.756)	(10.26)	(10.206)
Wealth ($1,000)						0.0089 *	0.0087 *	0.0074 *	0.0058 ***	0.0057 ***
						(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Debt to asset ratio						-5.3517 **	-5.7706 **	-5.3918 **	-1.3733	-1.5113
						(2.127)	(2.221)	(2.263)	(2.126)	(2.048)
Government payments ($1,000)						0.0260	0.0763 ***	0.0415	0.0696 **	0.1012 *
						(0.03)	(0.044)	(0.042)	(0.031)	(0.039)
Constant	59.1539 *	61.0274 *	79.3911 *	52.8966 *	54.0707 *	67.2754 *	73.3039 *	95.9895 *	60.5499 *	64.0251 *
	(10.9584)	(11.501)	(16.481)	(11.265)	(11.286)	(11.062)	(11.931)	(16.954)	(11.597)	(11.656)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	928	928	928	928	928	928	928	928	928	928
R^2	0.0288	0.0433	0.2047	0.0251	0.0364	0.0553	0.0726	0.2214	0.0443	0.0592
F-test	-	-	-	-	-	0.0000	0.0000	0.0001	0.0061	0.0045

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.7. Parameter estimates and summary statistics for irrigated soybeans

	OLS			FE		OLS			FE	
Soybeans, Irrigated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	-1.8525 **	-1.8374 **	-1.5571 *	-0.1737	-0.1527	-1.6259 **	-1.6051 **	-1.3188 ***	-0.2121	-0.1920
	(0.8526)	(0.805)	(-2.18)	(1.008)	(1)	(0.8)	(0.748)	(0.671)	(1.013)	(0.999)
Chemical ($1000/crop acres)	-0.0159	-0.0358	-0.0186	0.1203	0.1245 ***	0.0085	-0.0199	-0.0137	0.1355 ***	0.1378 ***
	(0.0572)	(0.055)	(0.054)	(0.08)	(0.073)	(0.056)	(0.054)	(0.052)	(0.081)	(0.075)
Machinery ($1000/crop acres)	0.0118 ***	0.0124 ***	0.0097	0.0084	0.0275 ***	0.0051	0.0058	0.0040	0.0138	0.0301 ***
	(0.0063)	(0.007)	(0.006)	(0.016)	(0.016)	(0.005)	(0.005)	(0.005)	(0.016)	(0.015)
Operated acres	2.4612 *	2.6303 *	2.2664 *	3.4400	4.6264 **	1.4199 **	1.1323	1.1150	3.9442 ***	4.5249 **
	(0.5647)	(0.565)	(0.654)	(2.1)	(2)	(0.72)	(0.691)	(0.772)	(2.083)	(1.999)
Acres of crop/practice	2.2213	4.4030	2.8344	-22.1316 **	-12.0694	0.8480	1.6195	1.2973	-21.7019 **	-12.6905
	(4.3697)	(4.454)	(3.931)	(10.116)	(9.021)	(4.708)	(4.9)	(4.455)	(10.162)	(9.091)
Livestock share of sales	-6.3127	-6.6358 ***	-4.6691	1.4801	0.9809	-8.0546 **	-7.4445 ***	-5.6211	1.7783	1.3558
	(3.8527)	(3.844)	(4.146)	(6.921)	(7.262)	(3.898)	(3.855)	(4.066)	(6.918)	(7.282)
Diversification	3.5819	1.9540	1.7009	7.2867	7.2388	4.7655	3.4772	3.2393	7.4767	7.0299
	(6.5393)	(6.25)	(5.428)	(6.855)	(6.904)	(6.501)	(6.185)	(5.379)	(6.906)	(6.909)
Ownership interest	0.1182	0.0772	0.0717	-0.1722	-0.2311	0.1415	0.1016	0.0908	-0.1591	-0.2155
	(0.3216)	(0.338)	(0.366)	(0.395)	(0.4)	(0.339)	(0.357)	(0.379)	(0.394)	(0.396)
Mean other crops	0.3099	1.5269	0.8205	-3.9131	-1.7546	-0.3014	1.0025	0.2746	-3.6331	-1.6420
	(2.8938)	(2.845)	(2.646)	(3.383)	(3.155)	(2.808)	(2.76)	(2.575)	(3.332)	(3.171)
Number of years	1.2715 **	1.0462 ***	1.1252 ***	-0.7194	0.0533	1.1972 **	0.9475	1.0086 ***	-0.6562	0.0973
	(0.5854)	(0.587)	(0.589)	(0.985)	(0.965)	(0.596)	(0.594)	(0.595)	(0.983)	(0.956)
Average county acres (1,000)	-0.1596	-0.0675	-0.1593	-1.2681 **	0.0011	-0.1923	-0.0890	-0.2160	-1.2112 **	0.0478
	(0.1901)	(0.189)	(0.67)	(0.635)	(0.734)	(0.187)	(0.186)	(0.663)	(0.612)	(0.727)
Crops acres share of operated acres	12.2768 *	9.9239 **	9.3536 ***	14.9631	17.1201	11.0007 **	7.4441	8.6965	15.7301	16.1957
	(4.4587)	(4.501)	(5.228)	(11.108)	(10.738)	(4.569)	(4.565)	(5.315)	(11.117)	(10.843)
Wealth ($1,000)						0.0018	0.0013	0.0013	-0.0025	-0.0016
						(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
Debt to asset ratio						-7.0176 *	-7.0075 *	-6.9317 *	3.5313	4.3251
						(1.782)	(1.744)	(1.701)	(3.776)	(3.309)
Government payments ($1,000)						0.0328	0.0677 *	0.0475 ***	-0.0189	0.0207
						(0.024)	(0.025)	(0.026)	(0.034)	(0.038)
Constant	80.0985 *	83.6149 *	29.7166 **	96.6253 *	79.1234 *	85.4404 *	90.5383 *	33.7741 *	93.7468 *	77.8803 *
	(7.0956)	(7.826)	(11.667)	(15.864)	(16.192)	(7.146)	(7.957)	(11.678)	(15.814)	(16.257)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950
R^2	0.0261	0.0602	0.1760	0.5086	0.5361	0.0425	0.0774	0.1897	0.5096	0.5369
F-test	-	-	-	-	-	0.0000	0.0000	0.0000	0.5564	0.4863

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively.

Table A.8. Parameter estimates and summary statistics for irrigated wheat

		OLS		FE			OLS		FE	
Wheat, Irrigated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Seed ($1000/crop acres)	-3.5604 **	-3.3796 **	-2.8991 ***	0.3803	0.0971 *	-3.1317 ***	1.5110 *	-2.3888	0.4371	0.1504
	(1.6464)	(1.555)	(1.614)	(1.791)	(0.05)	(1.603)	(-1.96)	(1.562)	(1.8)	(1.8)
Chemical ($1000/crop acres)	-0.2913	0.0712	0.1771	-0.0312	0.3511	-0.2261	0.1433	0.2186	-0.0341	0.3426
	(0.8119)	(0.815)	(0.852)	(1.239)	(1.219)	(0.812)	(0.815)	(0.854)	(1.241)	(1.22)
Machinery ($1000/crop acres)	0.0061	0.0089	0.0071	-0.0075 *	-0.0038	0.0046	0.0072	0.0061	-0.0075 *	-0.0038 ***
	(0.0086)	(0.008)	(0.007)	(0.003)	(0.002)	(0.008)	(0.007)	(0.006)	(0.003)	(0.002)
Operated acres	1.5864 **	1.6747 **	1.8870 **	-1.0424	-0.7276	0.9462	1.0099	1.4068	-0.9894	-0.7456
	(0.6508)	(0.656)	(0.728)	(1.432)	(1.45)	(0.807)	(0.804)	(0.907)	(1.428)	(1.456)
Acres of crop/practice	6.3543	7.1607	3.8846	20.3967 ***	20.9718 ***	8.1354	8.7288	6.0884	20.1757 ***	20.8277 ***
	(5.0558)	(5.363)	(5.728)	(11.879)	(11.839)	(5.35)	(5.673)	(5.953)	(11.981)	(11.924)
Livestock share of sales	-15.1454 **	-14.3187 **	-15.3158 **	-22.2757 ***	-19.8852 ***	-16.1313 **	-15.3576 **	-16.5282 **	-22.4324 ***	-20.1251 ***
	(7.3267)	(7.211)	(6.438)	(12.528)	(11.701)	(7.384)	(7.261)	(6.481)	(12.514)	(11.76)
Diversification	17.4139 *	16.7187 *	12.5842 **	16.1815 ***	14.7280 ***	18.2820 *	17.6175 *	13.8428 **	16.4476 ***	14.9781 ***
	(6.1692)	(5.654)	(6.016)	(8.426)	(8.151)	(6.226)	(5.684)	(6.009)	(8.462)	(8.187)
Ownership interest	0.3873 *	0.4663 *	0.4746 *	0.3113 **	0.4114 *	0.3744 *	0.4499 *	0.4730 *	0.3105 **	0.4116 *
	(0.1256)	(0.132)	(0.128)	(0.149)	(0.129)	(0.133)	(0.136)	(0.134)	(0.149)	(0.13)
Mean other crops	2.4720	2.2892	2.1593	5.5211	4.8778	2.6797	2.4208	2.1907	5.7092	4.9280
	(3.0749)	(2.935)	(2.963)	(3.882)	(3.775)	(3.061)	(2.936)	(2.966)	(3.838)	(3.79)
Number of years	-2.1942 **	-2.7412 **	-2.2525 **	-2.3290	-2.3920	-2.1967 **	-2.7612 **	-2.2325 ***	-2.2818	-2.3467
	(1.0387)	(1.075)	(1.121)	(2.085)	(1.918)	(1.049)	(1.079)	(1.136)	(2.089)	(1.914)
Average county acres (1,000)	-0.1425 **	-0.1799 *	-0.0868	0.0106	-0.3560	-0.1466 **	-0.1829 *	-0.0959	-0.0207	-0.3849
	(0.0705)	(0.064)	(0.339)	(0.298)	(0.41)	(0.071)	(0.065)	(0.34)	(0.318)	(0.416)
Crops acres share of operated acres	20.3539 *	23.0167 *	18.9398 **	-10.6320	0.4626	20.5646 *	22.9654 *	19.5324 **	-10.2420	0.9126
	(7.4085)	(7.322)	(7.281)	(15.309)	(15.617)	(7.571)	(7.412)	(7.515)	(15.537)	(15.608)
Wealth ($1,000)						0.0033 ***	0.0030 ***	0.0027	0.0018	0.0041
						(0.002)	(0.002)	(0.002)	(0.006)	(0.006)
Debt to asset ratio						-3.9290	-4.1916 ***	-5.7080 **	-1.2019	-0.1856
						(2.475)	(2.509)	(2.773)	(3.766)	(3.817)
Government payments ($1,000)						-0.0083	-0.0041	-0.0130	-0.0087	-0.0017
						(0.018)	(0.017)	(0.017)	(0.025)	(0.024)
Constant	75.6161 *	78.6690 *	88.2564 *	102.7941 *	104.4627 *	76.5531 *	79.7921 *	93.2258 *	102.5557 *	102.5357 *
	(8.8298)	(8.378)	(13.647)	(19.975)	(20.486)	(8.973)	(8.521)	(13.747)	(20.176)	(20.18)
Year dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes	No	No	No	No	Yes
N	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682
R^2	0.0388	0.0668	0.1300	0.4516	0.4706	0.0455	0.0730	0.1369	0.4518	0.4708
F-test	-	-	-	-	-	0.0085	0.0115	0.0052	0.9478	0.9211

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.9. Parameter estimates and summary statistics for dryland corn (AMTA payments)

	OLS			FE	
Corn, Dryland	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	2.1877 **	1.9829 ***	2.3487 **	1.8826	1.1104
	(1.086)	(1.13)	(1.137)	(1.883)	(1.817)
Chemical ($1000/crop acres)	0.0966	0.1146	0.1103	0.4021 *	0.4179 *
	(0.173)	(0.19)	(0.181)	(0.122)	(0.144)
Machinery ($1000/crop acres)	0.0602 *	0.0688 *	0.0490 **	0.0281	0.0461
	(0.022)	(0.022)	(0.023)	(0.076)	(0.075)
Operated acres	-0.0320	-0.4821	0.1990	-3.6352	-3.4264
	(1.313)	(1.302)	(1.559)	(4.419)	(4.285)
Acres of crop/practice	3.4094	7.1337	0.1143	-1.0359	5.0622
	(9.419)	(8.518)	(8.049)	(15.146)	(14.192)
Livestock share of sales	-0.8586	1.7375	-8.7294	-27.4536 ***	-23.6434 ***
	(5.956)	(5.905)	(6.578)	(14.65)	(14.042)
Diversification	0.2332	3.7149	6.0333	3.2997	4.5602
	(8.733)	(8.232)	(8.901)	(14.106)	(13.878)
Ownership interest	0.0742	0.0511	0.1170	-0.1329	-0.1495
	(0.159)	(0.161)	(0.231)	(0.304)	(0.343)
Mean other crops	1.8222	1.0954	4.2846	-33.1585 ***	-33.3123 ***
	(12.768)	(12.125)	(12.165)	(19.43)	(18.829)
Number of years	-0.3831	-0.6846	-1.4570	-6.2038 *	-3.3094
	(1.083)	(1.021)	(1.07)	(2.239)	(2.461)
Average county acres (1,000)	-0.2265	-0.0475	0.7078	0.7052	1.4299 ***
	(0.217)	(0.201)	(0.526)	(0.692)	(0.794)
Crops acres share of operated acres	10.0499	11.8364	13.5441	16.7385	24.5536
	(9.1)	(8.983)	(10.169)	(21.201)	(21.196)
Wealth ($1,000)	0.0052	0.0043	0.0036	0.0100	0.0106
	(0.003)	(0.003)	(0.003)	(0.014)	(0.013)
Debt to asset ratio	-0.7660	-1.5405	-0.6451	3.9430	1.2138
	(6.295)	(6.364)	(7.505)	(15.318)	(14.634)
AMTA payments ($1,000)	0.0911	0.1853 ***	0.1261	-0.3148	0.1001
	(0.098)	(0.098)	(0.106)	(0.286)	(0.498)
Constant	81.3478 *	75.8194 *	17.6592	139.4553 *	116.8287 *
	(19.235)	(18.153)	(18.053)	(34.348)	(35.123)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	913	913	913	913	913
R^2	0.0415	0.0741	0.1860	0.5012	0.5198
F-test	0.1783	0.0970	0.3503	0.5950	0.8306

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.10. Parameter estimates and summary statistics for dryland sorghum (AMTA payments)

	OLS			FE	
Soghum, Dryland	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-0.3558	-0.4525	-0.4462	0.6600	0.4502
	(0.594)	(0.623)	(0.624)	(0.66)	(0.705)
Chemical ($1000/crop acres)	-0.1001	-0.1004	-0.1485	0.1221	0.1398
	(0.133)	(0.123)	(0.109)	(0.145)	(0.139)
Machinery ($1000/crop acres)	0.0156 *	0.0193 *	0.0165 *	0.0018	0.0090
	(0.005)	(0.005)	(0.005)	(0.009)	(0.009)
Operated acres	-0.1444	-0.3210	0.2297	-0.0808	0.3380
	(0.493)	(0.484)	(0.464)	(1.417)	(1.403)
Acres of crop/practice	8.9598 *	7.4054 *	5.5481 **	-3.2570	-5.3570
	(2.42)	(2.35)	(2.341)	(4.291)	(4.376)
Livestock share of sales	-10.2388 *	-9.8606 *	-10.3719 *	-3.8188	-4.1487
	(1.925)	(1.932)	(1.9)	(4.075)	(4.016)
Diversification	13.4110 *	13.0022 *	10.0904 *	8.5964 ***	8.5184 ***
	(3.19)	(3.157)	(3.146)	(4.752)	(4.654)
Ownership interest	0.0509	0.0404	0.0620	0.0338	0.0143
	(0.057)	(0.054)	(0.051)	(0.064)	(0.06)
Mean other crops	-7.3964 **	-8.2516 **	-8.7309 **	-2.1077	-2.1952
	(3.482)	(3.519)	(3.572)	(4.814)	(4.727)
Number of years	2.2147 *	2.3766 *	0.9685	-0.0061	-0.5303
	(0.687)	(0.673)	(0.689)	(1.423)	(1.402)
Average county acres (1,000)	-0.0278	-0.0479 ***	0.1221	0.1775	0.2988 ***
	(0.026)	(0.025)	(0.164)	(0.159)	(0.177)
Crops acres share of operated acres	-1.0113	-2.8366	4.5469	-14.9804 ***	-12.6162 ***
	(2.864)	(2.795)	(2.91)	(7.813)	(7.596)
Wealth ($1,000)	0.0047 *	0.0046 *	0.0033 *	0.0012	0.0023
	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)
Debt to asset ratio	-7.2752 *	-7.5145 *	-8.7867 *	-3.1494	-4.4523
	(1.748)	(1.798)	(1.981)	(6.384)	(6.309)
AMTA payments ($1,000)	0.1406 *	0.2115 *	0.2611 *	-0.2456 **	0.0069
	(0.04)	(0.044)	(0.051)	(0.095)	(0.112)
Constant	92.3774 *	89.5568 *	102.4388 *	110.3005 *	104.7000 *
	(5.436)	(5.742)	(9.234)	(11.374)	(11.457)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	3,815	3,815	3,815	3,815	3,815
R^2	0.0784	0.0895	0.1553	0.5699	0.5770
F-test	0.0000	0.0000	0.0000	0.0745	0.8033

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.11. Parameter estimates and summary statistics for dryland soybeans (AMTA payments)

	OLS			FE	
Soybeans, Dryland	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-4.0562 *	-3.9150 *	-2.8513 ***	1.7488 *	-1.6129
	(1.384)	(1.375)	(1.665)	(-0.88)	(1.847)
Chemical ($1000/crop acres)	-0.5941 **	-0.5515 **	-0.6175 *	-0.5669 ***	-0.5594
	(0.228)	(0.213)	(0.212)	(0.341)	(0.348)
Machinery ($1000/crop acres)	0.0319 *	0.0359 *	0.0326 *	-0.0086	-0.0068
	(0.009)	(0.01)	(0.01)	(0.019)	(0.02)
Operated acres	1.1604	0.9008	0.7096	0.2108	0.2590
	(1.105)	(1.126)	(1.155)	(4.224)	(4.238)
Acres of crop/practice	-4.3811	-4.1286	-2.7948	-19.4016 ***	-19.5166 ***
	(3.565)	(3.444)	(3.788)	(11.3)	(10.92)
Livestock share of sales	-7.0114 **	-6.5218 ***	-6.1102 ***	-11.4777	-13.2663
	(3.525)	(3.569)	(3.629)	(8.73)	(9.253)
Diversification	-0.6044	-1.1813	-0.7061	-4.9858	-3.9358
	(6.154)	(6.029)	(6.181)	(13.089)	(13.589)
Ownership interest	-0.0482	-0.0374	-0.0346	-0.1090	-0.0976
	(0.167)	(0.171)	(0.18)	(0.253)	(0.249)
Mean other crops	-4.7856	-3.6027	-3.1469	-7.7509	-8.0388
	(5.674)	(5.839)	(5.66)	(8.906)	(8.718)
Number of years	3.0744 *	2.8162 *	2.2180 ***	-4.3206	-4.2190
	(1.049)	(1.02)	(1.144)	(2.682)	(2.823)
Average county acres (1,000)	0.0147	0.0376	-0.3852	-0.1172	-0.2298
	(0.052)	(0.052)	(0.644)	(0.43)	(0.844)
Crops acres share of operated acres	-3.1121	-4.7921	-4.8020	-19.9107	-17.7556
	(5.523)	(5.351)	(6.421)	(14.495)	(15.159)
Wealth ($1,000)	0.0073 *	0.0067 *	0.0059 *	0.0032	0.0054
	(0.002)	(0.002)	(0.002)	(0.01)	(0.01)
Debt to asset ratio	-2.2750	-2.5643	-3.0139	4.1156	3.0982
	(2.852)	(2.936)	(2.786)	(12.478)	(12.213)
AMTA payments ($1,000)	0.1860 **	0.2748 *	0.2835 *	0.0480	0.0519
	(0.073)	(0.073)	(0.076)	(0.261)	(0.331)
Constant	88.1444 *	84.0197 *	125.2456 **	147.5804 *	155.4306 *
	(8.633)	(11.11)	(50.107)	(23.279)	(36.151)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	2,214	2,214	2,214	2,214	2,214
R^2	0.0568	0.0727	0.1195	0.5491	0.5514
F-test	0.0000	0.0000	0.0000	0.9853	0.9541

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.12. Parameter estimates and summary statistics for dryland wheat (AMTA payments)

	OLS			FE	
Wheat, Dryland	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-0.3793	-0.3764	-0.4295	0.5034 *	0.2045 *
	(0.452)	(0.452)	(0.479)	(0.42)	(0.39)
Chemical ($1000/crop acres)	-0.2691 *	-0.2661 *	-0.2284 *	0.0194	0.0261
	(0.073)	(0.072)	(0.077)	(0.077)	(0.076)
Machinery ($1000/crop acres)	0.0107 **	0.0106 **	0.0074 ***	-0.0026	-0.0009
	(0.005)	(0.005)	(0.004)	(0.008)	(0.008)
Operated acres	-0.4501	-0.4756	0.3947	-1.3594	-1.4212
	(0.514)	(0.503)	(0.498)	(1.173)	(1.178)
Acres of crop/practice	2.2706	2.2992	0.7752	-1.6798	-1.7049
	(1.817)	(1.8)	(1.613)	(3.276)	(3.279)
Livestock share of sales	-4.9648 *	-5.1342 *	-6.0336 *	-7.9869 **	-7.9465 **
	(1.628)	(1.621)	(1.621)	(3.616)	(3.618)
Diversification	11.3128 *	11.2150 *	5.7469 *	4.9533	4.6645
	(2.564)	(2.567)	(2.136)	(3.301)	(3.308)
Ownership interest	-0.0005	0.0014	-0.0160	-0.0454	-0.0429
	(0.038)	(0.036)	(0.034)	(0.042)	(0.043)
Mean other crops	3.4986 *	3.4459 *	3.4040 *	10.6357 *	10.6676 *
	(1.249)	(1.249)	(1.173)	(2.637)	(2.607)
Number of years	0.3044	0.4038	1.1213	-1.8095	-1.7151
	(0.915)	(0.913)	(0.922)	(1.409)	(1.435)
Average county acres (1,000)	-0.0108	-0.0109	-0.3015 *	-0.3045 *	-0.2910 **
	(0.008)	(0.008)	(0.099)	(0.096)	(0.113)
Crops acres share of operated acres	1.7878	1.6667	9.2317 *	4.8001	5.5330
	(2.865)	(2.849)	(2.628)	(5.857)	(5.817)
Wealth ($1,000)	0.0030 *	0.0030 *	0.0009	-0.0054	-0.0046
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
Debt to asset ratio	-5.6216 *	-5.6112 *	-6.7466 *	5.1560	5.7589
	(1.307)	(1.296)	(1.372)	(4.996)	(4.975)
AMTA payments ($1,000)	0.0793 *	0.0786 *	0.1810 *	0.0582	0.1377
	(0.025)	(0.024)	(0.026)	(0.091)	(0.113)
Constant	87.7642 *	87.6880 *	101.7913 *	129.7574 *	125.1458 *
	(4.454)	(4.605)	(6.789)	(14.617)	(16.677)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	5,961	5,961	5,961	5,961	5,961
R^2	0.0361	0.0403	0.1310	0.4633	0.4660
F-test	0.0000	0.0000	0.0000	0.1606	0.1444

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.13. Parameter estimates and summary statistics for irrigated corn (AMTA payments)

	OLS			FE	
Corn, Irrigated	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-0.0323	-0.0831	0.2068	0.3235	0.0447
	(0.253)	(0.22)	(0.298)	(0.324)	(0.304)
Chemical ($1000/crop acres)	-0.0192	-0.0285	-0.0581 ***	0.0095	-0.0106
	(0.036)	(0.029)	(0.031)	(0.059)	(0.051)
Machinery ($1000/crop acres)	0.0078	0.0086	0.0127 **	-0.0153	-0.0175
	(0.005)	(0.006)	(0.006)	(0.013)	(0.013)
Operated acres	-0.0924	-0.0710	-0.5147	-1.6840	-1.5371
	(0.619)	(0.589)	(0.467)	(1.168)	(1.241)
Acres of crop/practice	5.0321 **	4.8570 **	2.3161	-7.1146 ***	-7.6135 ***
	(2.193)	(2.233)	(2.209)	(3.955)	(4.102)
Livestock share of sales	-16.0874 *	-15.5801 *	-16.4782 *	-4.2809	-2.7942
	(3.036)	(2.955)	(3.167)	(4.857)	(4.702)
Diversification	-2.9411	-2.8098	-1.6426	0.2460	-0.5867
	(3.464)	(3.419)	(3.009)	(4.702)	(4.717)
Ownership interest	0.6610 *	0.7199 *	0.4988 *	0.4550 *	0.5095 *
	(0.196)	(0.205)	(0.157)	(0.169)	(0.165)
Mean other crops	13.0435 *	12.7029 *	9.9697 **	1.2348	-1.6992
	(4.423)	(4.377)	(5.012)	(5.935)	(5.672)
Number of years	0.5266	0.4246	1.0675	-0.9592	-1.3722
	(1.001)	(0.986)	(1.067)	(2.018)	(1.901)
Average county acres (1,000)	-0.0924 *	-0.0954 *	-0.0810	-0.2840 **	-0.1465
	(0.028)	(0.028)	(0.158)	(0.127)	(0.189)
Crops acres share of operated acres	-6.7170 ***	-5.9859	0.4871	-3.0601	-4.3985
	(3.711)	(3.758)	(3.833)	(10.409)	(10.061)
Wealth ($1,000)	0.0037 *	0.0037 *	0.0058 *	0.0041	0.0020
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
Debt to asset ratio	3.2712	3.3609	6.8855 *	9.2452	5.9380
	(2.459)	(2.468)	(2.559)	(9.038)	(8.168)
AMTA payments ($1,000)	0.0306	0.0308 ***	-0.0158	0.0400	-0.0438
	(0.019)	(0.018)	(0.026)	(0.06)	(0.054)
Constant	88.0928 *	84.8468 *	87.5522 *	113.9269 *	115.3677 *
	(7.085)	(7.473)	(21.285)	(15.976)	(16.428)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	1,120	1,120	1,120	1,120	1,120
R^2	0.0816	0.1046	0.2220	0.5224	0.5446
F-test	0.0059	0.0024	0.0007	0.6723	0.7635

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.14. Parameter estimates and summary statistics for irrigated sorghum (AMTA payments)

	OLS			RE	
Sorghum, Irrigated	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-13.3395 *	-12.4781 *	-13.0453 ***	3.9286 **	-7.3372 **
	(2.494)	(-4.41)	(7.582)	(3.929)	(3.446)
Chemical ($1000/crop acres)	-9.8641 **	-10.1328 *	-11.5119	-9.2098 **	-9.4929 *
	(4.034)	(3.622)	(8.812)	(4.176)	(3.601)
Machinery ($1000/crop acres)	-0.0518	-0.0556 ***	-0.0587	-0.0465	-0.0419
	(0.033)	(0.033)	(0.039)	(0.04)	(0.04)
Operated acres	0.2315	-0.3880	-0.5527	-0.6292	-1.3781
	(2.05)	(2.119)	(1.985)	(2.391)	(2.379)
Acres of crop/practice	37.9130	37.6334	47.6899	68.7277 *	66.0267 *
	(27.776)	(29.212)	(31.345)	(22.927)	(24.005)
Livestock share of sales	-27.2888 **	-26.7255 **	-10.1710	-16.2706	-15.5086
	(11.425)	(11.118)	(13.763)	(11.574)	(10.792)
Diversification	26.0650 ***	20.9915	8.3734	13.4662	9.2734
	(14.589)	(15.165)	(16.098)	(13.516)	(13.768)
Ownership interest	-0.1321	-0.1931	-0.7875	-0.6010	-0.7939 ***
	(0.384)	(0.41)	(0.635)	(0.412)	(0.424)
Mean other crops	14.4759	14.5487	-10.5624	8.2080	6.9858
	(16.452)	(17.42)	(19.174)	(13.97)	(14.825)
Number of years	-2.3653	-2.3657	1.2230	-2.1040	-2.4767
	(2.308)	(2.373)	(2.554)	(2.248)	(2.336)
Average county acres (1,000)	-0.9492 ***	-1.1057 **	-2.3117 ***	-0.6280	-1.1518
	(0.495)	(0.517)	(1.309)	(0.653)	(0.731)
Crops acres share of operated acres	23.9236	24.7948 ***	44.9564 **	22.2972	26.4122
	(14.844)	(14.069)	(20.3)	(19.471)	(19.095)
Wealth ($1,000)	0.0095 **	0.0104 **	0.0106 **	0.0080	0.0091 ***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Debt to asset ratio	-4.1642 ***	-4.3715 ***	-9.3855 *	-4.7418 **	-4.4326 **
	(2.419)	(2.474)	(2.379)	(2.052)	(2.144)
AMTA payments ($1,000)	-0.0134	0.0480	-0.0299	-0.0279	0.1098
	(0.103)	(0.1)	(0.123)	(0.12)	(0.12)
Constant	61.5414 **	56.7670 **	85.6870 ***	72.6008 *	77.9464 *
	(25.673)	(26.703)	(50.42)	(25.209)	(25.692)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	259	259	259	259	259
R^2	0.1573	0.1732	0.4136	0.1356	0.1509
F-test	0.0136	0.0131	0.0001	0.0425	0.0373

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.15. Parameter estimates and summary statistics for irrigated soybeans (AMTA payments)

	OLS			FE	
Soybeans, Irrigated	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-0.8704	-0.8037	-1.1333	0.9730	-0.5175
	(0.659)	(0.572)	(0.756)	(0.973)	(0.95)
Chemical ($1000/crop acres)	0.0332	0.0074	-0.0218	0.0606	0.0797
	(0.061)	(0.053)	(0.051)	(0.079)	(0.079)
Machinery ($1000/crop acres)	-0.0094	-0.0043	-0.0035	-0.0181	-0.0017
	(0.007)	(0.006)	(0.006)	(0.037)	(0.037)
Operated acres	-0.0819	-0.3937	-0.3431	1.7272	3.4469
	(1.097)	(1.011)	(1.227)	(2.692)	(2.895)
Acres of crop/practice	-0.9538	0.6310	-4.0373	-28.8434 ***	-23.7802
	(8.474)	(8.228)	(8.879)	(17.04)	(16.952)
Livestock share of sales	-10.5979	-11.6460	-2.7323	-5.5829	-7.0434
	(7.743)	(7.457)	(7.12)	(11.339)	(11.469)
Diversification	-3.7053	-2.3698	-4.5776	-21.2448	-17.4756
	(11.518)	(10.113)	(8.757)	(17.346)	(15.831)
Ownership interest	0.4829	0.5332 ***	0.8524 **	0.6666	0.5628
	(0.335)	(0.275)	(0.341)	(0.502)	(0.537)
Mean other crops	-15.8825	-11.6706	-16.6862	3.4322	5.0118
	(12.791)	(12.706)	(13.44)	(18.393)	(18.412)
Number of years	1.0377	0.6000	1.1732	2.2184	3.0726
	(1.009)	(0.877)	(0.982)	(2.263)	(2.13)
Average county acres (1,000)	-0.7755 **	-0.6762 **	-2.4003 **	-3.9352 *	-2.6451 ***
	(0.301)	(0.302)	(1.077)	(1.102)	(1.339)
Crops acres share of operated acres	3.0117	-1.8035	3.1287	17.4629	21.1137
	(8.964)	(9.473)	(11.384)	(24.773)	(24.621)
Wealth ($1,000)	0.0053 **	0.0054 *	0.0057 *	-0.0017	0.0012
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)
Debt to asset ratio	-2.8997 **	-2.7247 **	-2.4707	0.3826	5.8906
	(1.408)	(1.342)	(1.687)	(12.35)	(11.471)
AMTA payments ($1,000)	0.0731	0.1033 **	0.0461	-0.1045	-0.2382
	(0.049)	(0.049)	(0.05)	(0.177)	(0.269)
Constant	120.9384 *	120.9299 *	98.0812 *	130.8872 *	109.7423 *
	(17.415)	(16.376)	(25.026)	(30.772)	(35.779)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	579	579	579	579	579
R^2	0.0669	0.1035	0.2685	0.5651	0.5751
F-test	0.0000	0.0000	0.0006	0.9227	0.8119

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.

Table A.16. Parameter estimates and summary statistics for irrigated wheat (AMTA payments)

	OLS			FE	
Wheat, Irrigated	(1)	(2)	(3)	(4)	(5)
Seed ($1000/crop acres)	-4.0856	-4.2021	-4.5396	3.0132	2.7296
	(2.607)	(2.799)	(3.116)	(3.013)	(3.33)
Chemical ($1000/crop acres)	-0.1963	-0.1067	0.1573	1.5363	0.9424
	(2.157)	(2.254)	(2.554)	(6.139)	(5.996)
Machinery ($1000/crop acres)	0.0641 **	0.0645 *	0.0630 *	0.0442	0.0542
	(0.025)	(0.024)	(0.023)	(0.039)	(0.046)
Operated acres	2.2062	2.2117	1.4240	-7.4485	-6.4972
	(1.521)	(1.543)	(2.101)	(5.702)	(5.729)
Acres of crop/practice	8.1368	8.6491	6.1162	27.2727	27.9406
	(10.804)	(10.944)	(13.401)	(28.7)	(28.932)
Livestock share of sales	-14.5151	-14.7284	-16.0063	-7.3122	-13.8850
	(11.268)	(11.488)	(11.914)	(24.919)	(24.719)
Diversification	2.9776	3.8127	1.5873	-10.8380	-10.8018
	(9.782)	(9.819)	(11.167)	(13.255)	(13.847)
Ownership interest	0.7242 ***	0.7909 ***	0.6387 ***	0.4259 **	0.4961 **
	(0.397)	(0.423)	(0.386)	(0.181)	(0.221)
Mean other crops	11.1124	11.5543	12.5479	23.2695	26.9010 ***
	(9.599)	(9.787)	(9.438)	(14.292)	(13.915)
Number of years	-3.7371 ***	-3.9048 ***	-3.4524	2.5840	2.9818
	(2.178)	(2.115)	(2.429)	(5.487)	(5.756)
Average county acres (1,000)	-0.2365 **	-0.2387 ***	0.2296	0.4765	-0.4215
	(0.119)	(0.126)	(1.038)	(0.836)	(1.041)
Crops acres share of operated acres	18.7895	18.8484	6.1637	-56.5866	-41.9128
	(13.178)	(13.455)	(15.343)	(35.405)	(36.642)
Wealth ($1,000)	0.0049	0.0050	0.0054	-0.0070	-0.0060
	(0.004)	(0.004)	(0.004)	(0.014)	(0.015)
Debt to asset ratio	-1.2981	-1.1213	5.0572	2.1702	1.0745
	(2.305)	(2.512)	(7.446)	(19.824)	(20.49)
AMTA payments ($1,000)	0.0148	0.0162	0.0505	0.2986 **	0.4297 **
	(0.056)	(0.06)	(0.07)	(0.144)	(0.176)
Constant	68.8334 *	65.3258 *	5.4939	109.0183 **	96.4052 ***
	(19.474)	(19.865)	(74.953)	(48.902)	(51.903)
Year dummies	No	Yes	Yes	No	No
County dummies	No	No	Yes	No	-
Year - County dummies	No	No	No	No	Yes
N	482	482	482	482	482
R^2	0.0792	0.0843	0.1902	0.5555	0.5629
F-test	0.4328	0.4422	0.4671	0.2336	0.1013

Notes: Robust standard errors reported in parentheses. Single, double and triple asterisks indicate significance at the α= 0.01, 0.05 and 0.10 levels, respectively. F-test is the p-value associated with the partial F-test of joint significance of wealth, debt to asset ratio, and government payments.