An Analysis of the Government Payment Program in US Agriculture

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Abstract

In an analysis of the determinants of government payments to a farm the paper finds cropping patterns, soil productivity, and more importantly human capital variables such as education, and age as significant. While analyzing the effect of government payments on the profit efficiency of agriculture the paper finds that the inclusion of government payments does not cause structural change in US agriculture (i.e., a change in returns to scale of the underlying technology). Nevertheless, the paper does find evidence of an indirect effect of government payments on efficiency. Farms that received greater government payments on aggregate were more efficient than other farms.

Key Words and Phrases: Government Payments, Agricultural Policy

JEL Classifications. Primary: Q1; **Secondary:** H5.

1 Introduction

Between 1929 and 1987 in the United States of America, output per farm increased more than six times, and land per farm expanded almost threefold (Kislev and Peterson (1996)). In 1998 there were 30,000 fewer farms in the US than 1979 (National Commission on Small Farms (1998)). This long term trend encouraged a belief in increasing returns to scale in US agriculture, it also promoted the concern that the small family farm could soon be extinct.

Many explanations have been offered for economies of scale in agriculture. Hayami and Ruttan (1985) attribute economies of scale in agriculture to the lumpiness or indivisibility of fixed capital. A similar explanation was offered by Bieri, de Janvry, and Schmitz (1972), who expected farm size to increase with the size of farm equipment. Kislev and Peterson (1996) theorized the indivisibility of entrepreneurial ability, and labor, as the main reason for growth in farm size. As off farm wages rise, farmers need larger farms to gain parity with incomes earned off farm, and this drives growth of farm size.[3]

"A Time to Act" (January 1998), a report by the National Commission on Small

[3] It is important to note that the empirical literature studying economies of scale in agriculture has not come to a consensus. Authors have found diseconomies of scale, neutrality of scale, and even economies of scale all using different methods and different data sets (see amongst others Capablo (1988), Kislev and Peterson (1996) and Townsend et. al. (1998)).

Farms of the United States Department of Agriculture blamed US government policy for the 'disappearing small farm'. To quote "..these (farm programs) have historically been structurally biased toward benefiting the large farms. Farm payments have been calculated on the basis of volume production, thus giving a greater share of payments to larger farms, enabling them to further capitalize and expand their operations." Regarding the system of transition payments (under the 1996 Farm Bill) the report asserts "the present system of transition payments perpetuates the large farm bias because the amount of payment is based on historical payment levels."

Such a concern is not entirely without basis. Orden et al. (1999) presents statistics on government payments distributed by farm size. Their Table 4. (page 33) is reproduced as Table 1 in this paper. While large farms make up only 6% (approximately) of all farms, they receive around 32.2% of all direct government payments. In contrast small farms make up almost 74% of all farms but receive only 27% of total government payments. At a preliminary level such numbers can raise suspicions about the neutrality of government policy.

There exists a theoretical basis for such concerns. Olson (71) in the "Logic of Collective action" discussed the importance of large beneficiaries in a group for successful collective action. If organized lobbying of the legislature is an important reason for farm support, then large farms are likely to be the primary players in the political game. In such a case there may be a good reason for one to expect government payments to be biased towards the large farm.

The primary objective of this paper is to study the effect of government payments in US agriculture. This study involves two distinct parts. Using data from the 1998 Agricultural and Resource Management Study (ARMS) of the Economic Research Service of the United States Department of Agriculture we first evaluate the empirical determinants of government payments per farm. For this purpose three dependant variables are considered, these are aggregate government payments per farm, government payments per acre cultivated, and government payments per dollar sale. Results from these regressions indicate the importance of crop choice, soil productivity, and operator age, and education in the ability of a farm to earn higher government payments. The significance of human capital measures (education, and age) in these regressions reflects the learning process involved in exploiting existing government programs.

In the second part using a non-parametric method of analysis, we calculate farm level efficiency for US agriculture. These efficiency scores are used to test for assumptions on returns to scale, and .the impact of government payments on farm level efficiency. In order to calculate efficiency we employ Data Envelopment Analysis (DEA), which is based on distance function techniques.[4] Using this method the sample of farms is used to construct a non-parametric frontier from output-revenue,

[4]Färe et. al (1988) provides a detailed explanation of this method.

and input-expense combinations. Efficiency is measured as the inverse of the radial distance from the frontier, farms on the frontier are most efficient, and farms inside the frontier are less efficient.

The aim of this part is to evaluate if government payments cause a change in the basic structure of US agriculture. In other words, do government payments induce previously inefficient farms to be profit efficient in a manner that could influence the size distribution of US agriculture? To answer this question two production frontiers are constructed. The first frontier considers conventional input and output combinations, that is, government payments are excluded from the calculation of the frontier. The second frontier includes government payments as revenue for the farm. These two frontiers are compared in terms of a gain in efficiency across farm size, and also tested for any changes in their basic structure (by comparing the returns to scale across the two frontiers). We call this 'the direct effect of government payments on efficiency'. In other words does the inclusion of farm payments as a source of farm revenue induce one or more types of farm to become more or less efficient than the other farm types?

We find that government payments do not cause structural change in US agriculture. An intermediate step towards this conclusion is a test for returns to scale in US agriculture. For this test our sample is fairly large, is drawn from different farm types (crop and livestock farms), and is drawn from different geographical areas of the country. This combination of a large, and varied sample with the use of non-parametric methods makes our test for returns to scale fairly unique in the literature. We find that US agriculture is characterized by constant returns to scale when government payments are not included as revenues of the farm. We also find that the inclusion of government payments as revenue does not change the basic structure of US agriculture. US agriculture is characterized by constant returns to scale technology even when government payments are included as revenue for farms.

One must note that government payments can also influence efficiency by allowing farmers to undertake greater risk, and by providing funds to undertake investment in the absence of well functioning credit markets. We call this the 'indirect effect of government payments on efficiency'. We investigate this indirect effect on efficiency by regressing farm level efficiency scores (calculated without the inclusion of government payments as output) on government payments in a second stage regression. We find that government payments can have a significant indirect effect on farm efficiency (as calculated without including government payments as output). Farms gaining greater government payments are likely to be more efficient. However, this gain in efficiency decreases with farm size (as measured by gross sales from the farm).

2 Empirical Analysis

Aggregate government payments to a farm in the US consist of several components. Before describing the data, and empirical methodology a brief overview of these components (as they existed in 1998) is warranted.

The Federal Agriculture Improvement and Reform (FAIR) act of 1996 was an attempt to move US farm policy away from distortionary commodity price intervention.[5] Transition payments to each farm were based on the production patterns in the years leading up to 1995. Thus if a farm was historically a rice producer, transition payments would be correlated with payments for a rice farmer in the years before 1995. Also if a farm grew supported crops before 1995, and still used this land for agricultural purposes today, it would qualify for a transition payment.

Most livestock farming (besides dairy farming) was not directly supported before the FAIR act. This did not change substantively after FAIR. Further, price supports on dairy products were removed with the FAIR act. However, several distortionary policy instruments persisted in the FAIR act. The price support program for tobacco was not removed. More importantly, loan deficiency payments, conservation reserve and wetland protection (CRP and WRP) programs, disaster payments, and the Environmental Quality Incentives Program (EQIP) existed even after FAIR. Some of these programs (CRP, WRP, and EQIP) were also expanded at the same time as the

[5] For a discussion of the FAIR act see Stuart and Runge (1997).

FAIR act.

The loan deficiency program allows the farmer to draw a loan in lieu of a planted commodity. If the loan is not settled before maturity, the producer forfeits the collateral commodity to the government, which has no recourse other than to accept the commodity in lieu of repayment. Also the farmer can repay the loan at USDA-specified rates that are intended to approximate local market prices. If that repayment rate is below the original USDA loan rate, the farmer captures the difference as a marketing loan gain. This loan is limited to $75,000 per person. This program provides loans for Corn, Sorghum, Barley, Oats, Wheat, Rice, Cotton, Soybeans, and other oilseeds.

In summary, transition payments, loan deficiency payments, disaster payments CRP, WRP, and EQIP were the main components of government payments to farmers in 1998.

2.1 Data

Data for this exercise is drawn from the 1998 Agricultural and Resource Management Study (ARMS-a nationwide farm level survey) of the Economic Research Service (ERS) at the United States Department of Agriculture. This survey is conducted every year with a sample of about 10,000-12,000 farms. It collects data on input expenses, output quantities and receipts, government payments, and a host of contracting and household characteristics.

Data from ARMS are unique in the broad coverage of crops and geographical area, and is unparalleled by any other annual survey. The comprehensive nature of this survey makes it feasible to carry out our study without omitting any important input, or output of the farm. The sample of farms used in this analysis includes 11,812 observations. Farms that reported no livestock or crop income for the year, and those reporting that no acres were harvested were left out of our sample. This reduced the sample to 10,032 farms.

Descriptive statistics for the data are given in Table 2. These statistics were weighted to represent the true population of farms in the US. The average farm in 1998 earned $19,135 as net farm income, was given $5,634 in government payments, and for every dollar of crop or livestock sales the farmer received 17 cents in government payments.[6] The average farmer was 54 years old, had completed high school, and operated 237 acres of harvested cropland.

2.1.1 Government Payment Characteristics by Farm Size

We divide farms into seven sale categories, ordered from the smallest to the largest farms (1 is the

[6] Government payments correspond to IGOVT in the data appendix. This variable includes all government payments to the farm including, transition, loan deficiency, CRP, WRP, EQIP, and disaster payments.

smallest, and 7 is the largest sale category).[7] Based on this sale category we first look at the distribution of government payments per dollar sale by farm size (see Figure (1)). Payments per dollar of sales peaked at roughly 38 cents per dollar for an average farm in sales class 3, (farms with sales between $20,000 and $40,000 per year). Payments per dollar sale are sharply lower for all sales classes other than sales class 3, but note that the average farm in the largest sales class (sales class 7: farms with sales above $500,000 per year) got more payments per dollar sold (13 cents), when compared with the average farm in the smallest sales class (sales class 1: farms with sales below $10,000 per year) who got only 11.5 cents per dollar.

Next we look at the distribution of government payments per acre of cropland harvested. Until the final farm sales class (sales class 7), these payments increase with farm size. The highest payments per acre are for an average farm in sales class 6 (farms with sales between $250,000 to $500,000 per year) at $32 per acre harvested. The average payment per acre for an average farm for the whole sample is $17.63, almost half of the maximum.

Government payments per acre cultivated follow an upward trend (almost), but government payments per dollar sale have an inverted U shape. The explanation for this probably lies in the structure of crop and livestock production across farm size. Look at Table 1, large farms in 1995 produced a large proportion of the non

[7] Details of the sales category variable SCLASS are provided in the tables listing regression results.

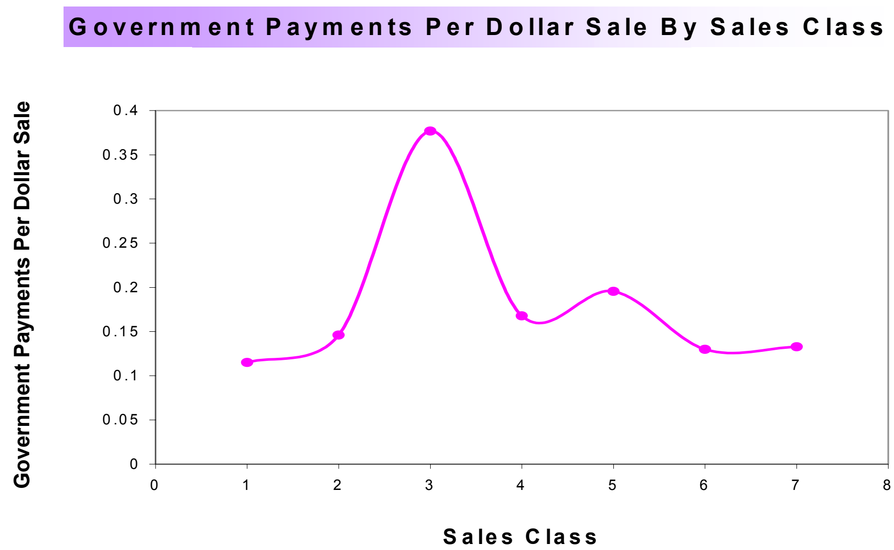

Figure 1: Distribution of Government Payments Per Dollar Sale

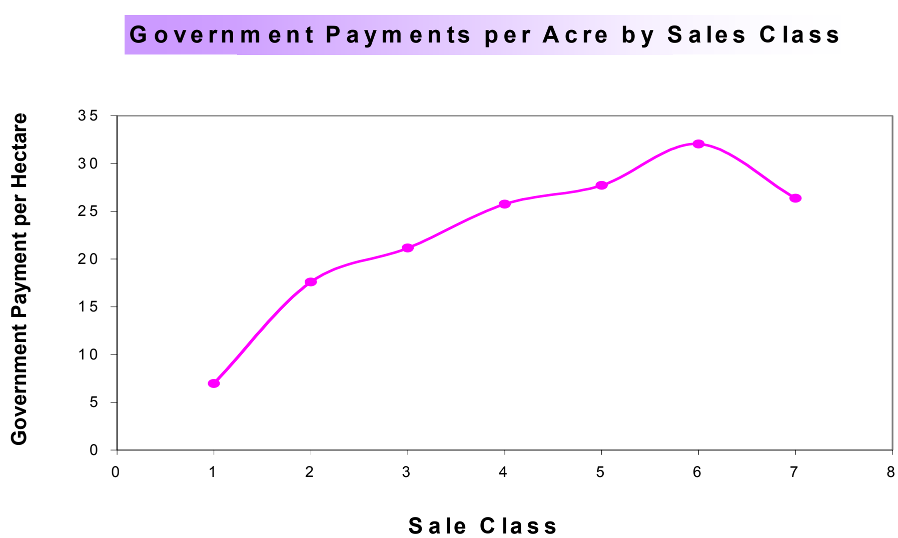

Figure 2: Payments Per Acre

supported crops on their farms (74.8%), they also produced a significant proportion of supported crops (44.9%). If these percentages are correlated with aggregate revenue on the large farms, that is large farms produce more non-supported crops on their farms than supported crops, then government payments per dollar of sales should decline as farm size increases.

2.2 Farm Level Determinants of Government Payments

The simple analysis above does not control for cropping patterns, and other farm characteristics while establishing a relationship between farm size and government payments. In this section we establish the determinants of government payments to a farm by using a set of simple linear regressions. Three regressions where government payments per farm, in aggregate, per acre, or per dollar terms are regressed on a host of cropping, regional, and other farm specific variables (see Table 3, 4, and 5).

Table 3. lists the results from a regression where aggregate government payments to the farm is the dependent variable. Note that farm size as measured by Net Worth (NETW) of the farm has a small, negative and statistically significant coefficient. The mean productivity index (MEANPI),[8] acres harvested, proportion of barley, corn,

[8] To capture input differences across farms, information on soil productivity is used. Using the Natural Resources Inventory (NRI) data produced by the USDA's Natural Resource Conservation Service (NRCS), a soil productivity index is developed in which 0 is the least and 100 the most productive soil averaged at the county level. See Pierce et al. (1983) for details.

cotton, rice, and wheat all have large positive, and statistically significant coefficients. These results are consistent with the fact that large crop farms, located on fertile land, and specializing in supported crops are likely to get greater government payments than the average farm. Coefficients on the proportion of cotton, sugar, and nursery sales were negative as these crops are historically unsupported crops. Interestingly operator education can have a positive impact on the level of government payments paid to the farm. Operators who completed college, or went to graduate school were more likely to gain higher levels of government payments than those who did not complete high school (educ1 omitted from the regression). The positive gains in government payments from education are verified in the remaining two regressions as well.

Table 4. has the results from the regression of government payments per acre of cropland (IGOVT/HA_TOT) with the dependent variables listed therein. Farm size measured by net worth (NETW), and Harvested Acres (HA_TOT) has a negative and significant sign. Note the fact that operator education variables keep their positive coefficient. Farms whose operators had education greater than high school got more government payments per acre when compared to a similar farm whose operator had less education that high school (see EDUC variables, the base variable left out of the regression is EDUC1: operators who did not complete high school). Education seems to allow the operator a greater ability to take advantage of government programs.

Also note that older operators get greater government payments per acre (see age variables, the age category left out was operators aged less than 35 :age1).

Historically supported crops, barley, corn, cotton, rice, wheat, canola, all have positive and significant coefficients. In other words, ceteris paribus, if a farm sells a greater proportion of any of these crops in its total sales it shall gain more payments per acre cultivated. Livestock or other crops that have not been historically supported through direct payments, for example, dairy, cattle, vegetables, and fruit show up with a negative and significant sign. We also see that a farm gained more payments per acre if it was located in a county with more productive soil (MEANPI). Government payments per acre were higher for farms that were in bigger sales classes when compared with the smallest sales class (scls1: less than $10,000). This reflects that if all other variables are equal, that is, mean productivity of soil, specialization ratios, size of assets, and harvested acres, if the farm is in a larger sales class it got more payments per acre. In other words more efficient farms, that is, farms that sold more crops per acre would get higher payments per acre. Also note that operator involvement in the farm reflected by the ratio of owned to operated acres (TENURE) has a positive and significant effect. Operator involvement is also reflected in the results from the inclusion of farm organization variables (organ variables). We find that family farms (organ1 left out of the regression) got more payments per acre harvested than all corporation farms (see organ2-5 variables).

Results from the third regression with Government Payments per Dollar Sale as the dependant variable are listed in Table 5. Farm size measured by net worth (NETW) ceases to have a significant effect, but total harvested area (HA_TOT) has a small but positive sign. This implies that farms that harvest more acres are likely to get greater government payments per dollar sold. Given a fixed proportion of crops greater acres harvested implies a larger production of supported crops, thus the greater payment per dollar sold. Average productivity in each county (MEANPI) still has a positive, and significant effect. Crop specialization ratios still have intuitive signs, with unsupported crops having negative signs and supported crops having positive signs. One should note the robustness of the education and age variable. Even from this regression, ceteris-paribus, more educated farmers gained more government payments per dollar sale (see EDUC variables). Older operators get higher payments per dollar sale. The robustness of both these variables imply that there exists a human capital element to exploiting government payment programs. More experienced, or more educated operators get higher payments per dollar sale. Sales class variables have a positive and significant sign till sales class 4 (farms selling between $40,000-$99,000 per year), and a negative and significant sign for sales class 6 onwards (sales class 5 does not have a significant sign). This is a striking confirmation of the inverted u shaped curve for government payment per dollar visible in figure (1). TENURE does not have a significant coefficient, but family farms (organ1) earn greater government

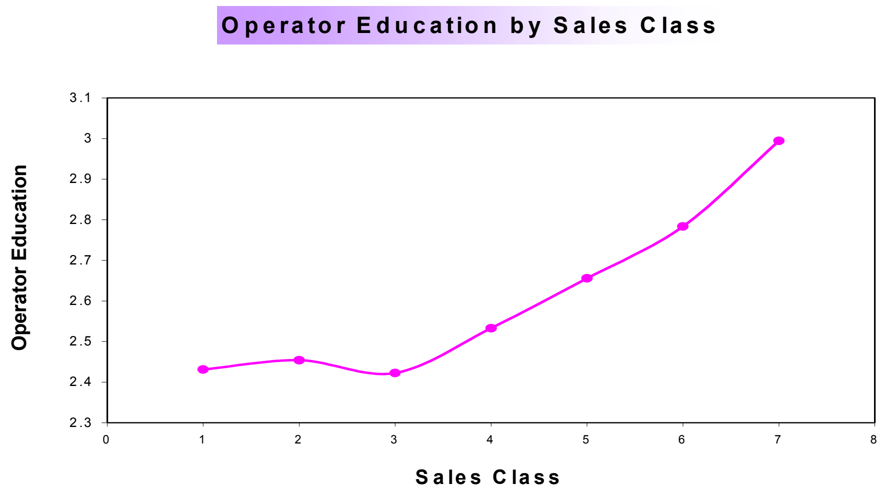

Figure 3: Distribution of Farmer Education by Sales Class

payments per acre than partnership farms (organ2), or other farms (organ5). This combination probably still supports the theory that greater operator involvement implies greater government payments for the farm.

Education, and Productivity Indices By Farm Size Given that education has a positive effect on both government payments per acre, and government payments per dollar sale it may be useful to study the distribution of this index across sales class. Figure 3 plots the average operator education by sales class. The variable clearly follows an upward trend with the sales class.

The mean productivity index of the county is also positively related to both gov-

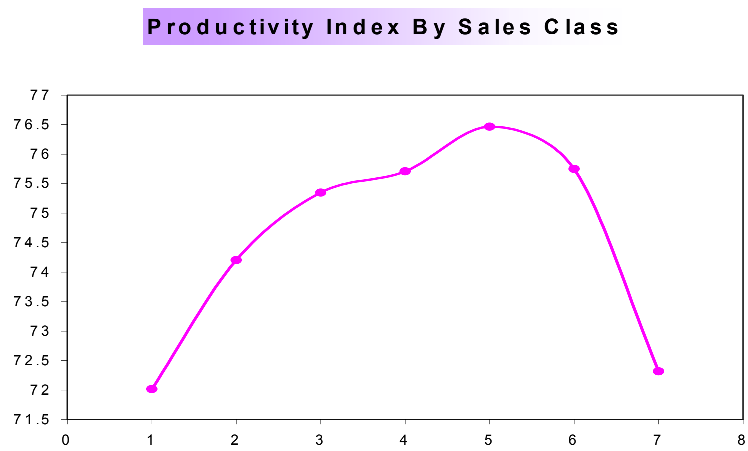

Figure 4: Distribution of the Productivity Index by Sales Class

ernment payments per acre, and per dollar sale. This variable is graphed in Figure 4. MEANPI follows a inverted U shaped trend somewhat similar to the trend of government payments per dollar sale. We suspect this too is related to the crop and livestock patterns. Most crop farms are situated in the fertile counties, livestock and poultry farms (which usually have the largest sales), need not be locate in fertile counties. Livestock and poultry farms are also historically unsupported by government payments.

2.3 Methodology For Efficiency Analysis

The calculation of the efficiency scores in the paper is an application of Data Envelopment Analysis (DEA). DEA has been used in the management science literature to calculate ex post efficiency of production units (Banker, Charnes and Cooper (1984)), and the application to economics was developed by Koopmans (1951), and Farrell (1957).

DEA uses linear programming to measure the minimum distance of the economic unit in the sample from the efficient production frontier. This frontier is a reference technology constructed from the data provided by the sample itself. The approach is a straightforward empirical application of distance functions as measures of efficiency. The reference technology is constructed as the linear envelopment of all data points in the sample. Thus intuitively the most efficient firms in the sample define the frontier. This frontier is then used to calculate the minimum distance of all data points from the frontier. The firms that define the frontier are efficient, and all those firms on the inside of the frontier are inefficient. By definition every firm in the sample is inside the technology. This method can be considered unbiased as long as we can safely assume that all the firms that make up the sample belong to the same technology.

A constant returns to scale reference technology is constructed by the following linear programming formulation.

$$T(C,S) = \left\{ \left(x^j, y^j\right) : z'O \geq y^j, z'I \leq x^j, z \in \Re^J_+ \right\} \tag{1}$$

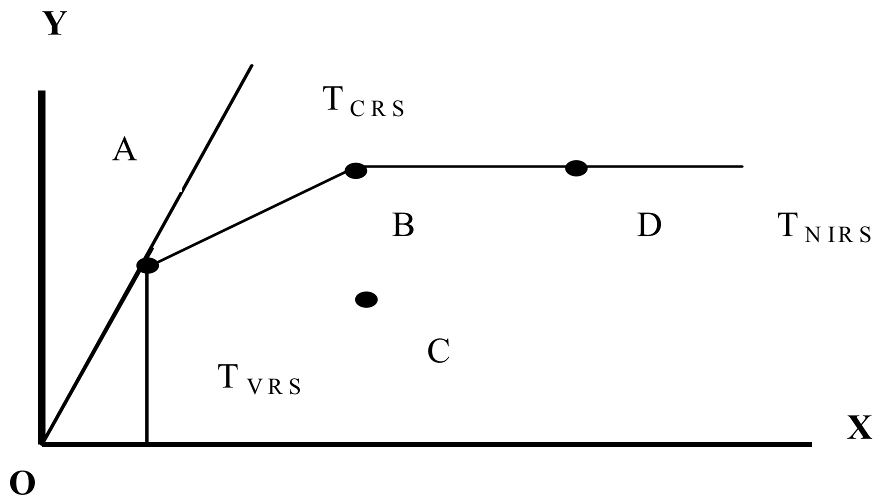

Figure 5: The Reference Technology and Returns to Scale

Where O is a J by M matrix of outputs for the whole sample, I is a J by N matrix of inputs for the whole sample, and z is a vector of intensity indicators for each firm in the sample. The above formulation incorporates constant returns to scale (C) and strong disposability of output (S). By allowing the z to be any number in the real space, we are allowing the frontier to be completely determined by the most efficient firms.

Other assumptions on returns to scale are formulated as below. Non-increasing returns to scale requires that $\sum_j z^j \leq 1$, that is, the sum of the intensity indicators sum to less than one. This allows the technology to build a frontier by contracting the most efficient firm, but does not allow the technology to expand it..

$$T(N,S) = \left\{ \left(x^j, y^j\right) : z'O \geq y^j, z'I \leq x^j, z \in \Re^J_+, \sum_j z^j \leq 1 \right\} \tag{2}$$

The assumption of variable returns to scale is formulated by

$$T(V,S) = \left\{ \left(x^j, y^j\right) : z'O \geq y^j, z'I \leq x^j, z \in \Re^J_+, \sum_j z^j = 1 \right\}. \tag{3}$$

This allows the technology to have sections of constant, non-increasing, and increasing returns to scale.

Different assumptions on returns to scale are illustrated in Figure 5. The technology formalized above can be illustrated graphically for the case with a single input, and output (figure is taken from Färe et al. (1988)). Points A, B, C, and D in the figure are the input, output combinations for four farms. Under constant returns to scale the technology is a ray from the origin, to and beyond A, as A is the most efficient amongst the firms. Under non-increasing returns to scale the technology cannot expand the most efficient point indefinitely, thus the technology is given by OADB. Variable returns to scale require that the input use of farm j be no less than the smallest quantity of inputs used by any farm in the sample, this allows for the possibility of increasing returns to scale. This prevents the contraction of point A to the origin and the new frontier is given by the straight line from A to the X-axis, and by the non-increasing frontier from the point A onwards.

Using the reference technology above we can calculate Farrell efficiency measures.

The input efficiency measure for firm $j(\alpha^j)$ under the assumption of constant returns to scale and strong disposability is defined as.

$$F_I(x^j, y^j | C, S) = \min\left\{\alpha^j : z'O \geq y^j, z'I \leq \alpha^j x^j, z \in \Re^J_+\right\} \tag{4}$$

The output efficiency measure for firm $j(\theta^j)$ under the assumptions of constant returns to scale and strong disposability is defined as

$$F_O(x^j, y^j | C, S) = \max\left\{\theta^j : z'O \geq \theta^j y^j, z'I \leq x^j, z \in \Re^J_+\right\} \tag{5}$$

Both measures require no assumption on the form of technology. Different assumptions on returns to scale and disposability can be included as they were in the definition of technology. Note that adding any non-constant returns to scale assumptions requires constraining the above problems. Thus, we have the following relation for the input efficiency measures under different assumptions of returns to scale.

$$F_I(x^j, y^j | C, .) \leq F_I(x^j, y^j | N, .) \leq F_I(x^j, y^j | V, .) \tag{6}$$

And the following relation for the output efficiency measures

$$F_O(x^j, y^j | C, .) \geq F_O(x^j, y^j | N, .) \geq F_O(x^j, y^j | V, .) \tag{7}$$

The input, and output measures above (equations (4), and (5) respectively) have been defined in input, and output quantities. These measures calculate technical inefficiency. For this analysis we use input expense and output revenue data to construct these measures. This implies that the input measure includes both technical and cost efficiency, and the output measure includes both technical and revenue efficiency. If quantity data was available these scores could be disaggregated into pure technical and cost/revenue efficiencies (see Färe et. al. (1988)), but the ARMS data does not contain complete quantity data. For that reason cost and revenue data was used. The input and output scores calculated in this paper are denoted F_e for expense, and F_r for revenue.

In order to evaluate efficiency in terms of both expense and revenue terms a transformation function is used. This transformation function is calculated as below

$$t\left(x^j, y^j \middle| \, ., .\right) = F_e\left(x^j, y^j \middle| \, ., .\right) - F_r\left(x^j, y^j \middle| \, ., .\right) \tag{8}$$

The transformation function is defined as the difference between the input and output efficiency measure. It is always non-positive, and is zero for firms that are both output and input efficient. We can get the following relation for transformation functions differing in their returns to scale.

$$t(x^j, y^j | \, C, .) \leq t(x^j, y^j | \, N, .) \leq t(x^j, y^j | \, V, .) \tag{9}$$

2.4 The Direct Effect of Government Payment Programs

In this section we test whether government payments cause a structural change in US agriculture. In this method two production frontiers are calculated. The first frontier is constructed with conventional input and output combinations, that is, government payments are excluded from the calculation of the frontier. The second frontier is constructed after including government payments as an output of the farm. These two frontiers are informally compared in terms of a gain in efficiency across farm size, and are also formally tested for any changes in their basic structure (by comparing the returns to scale across the two frontiers). In other words does the inclusion of farm payments in the calculation of overall efficiency induce one or more types of farm to become more or less efficient than the other farm types?

Each farms efficiency score is calculated using its radial distance from the frontier. In order to keep farms within similar technologies, for the purpose of efficiency calculation, the data is divided according to farm type using ERS's TYPEVP variable. TYPEVP classifies farms on the basis of their production. It is assumed that that regardless of geographical differences farms belonging to the same type have fairly similar technology.[9] Farms are divided into general cash grain farms (typevp=1 which includes barley, rice, sorghum and oats), wheat farms (typevp=2), corn farms (typevp=3), soybean farms (typevp=4), specialized rice farms (typevp=6), tobacco farms (typevp=7), cotton farms (typevp=8), beef farms (typevp=14), hog farms (typevp=15), and dairy farms (typevp=18). Seperately and within each farm type efficient frontiers are calculated and transformation functions (interchangeably re-

[9] Such an assumption can be justified if the farms are assumed to compete in the same market. If all wheat farms have to sell in the same national or international market then their relative inefficiency or effiiciency with respect to each other is important.

ferred to as efficiency scores) are calculated.

While constructing the frontier several inputs, and ouputs are used. Inputs variables are fixed within crop and livestock farms. In crop farms a total of eleven (11) inputs are used. These variables are seed expenses(evseed), fertilizer expenses(evfertc), total fixed capital expenses(eftot), fuel and utility expenses(evfu), maintainence and depreciation expenses(evmdep), other expenses (a sum of all other variable expenses listed for the farm), operator hours(ophrs), total harvested acres(ha_tot), value of total current assets(actot), and the value of total non-current assets (antot). For livestock farms ten (10) inputs are used. These include all the variables listed for crop farms other than seed, and fertilizer expenses. These two variables are replaced by a single variable feed expenses (evfeed). When the frontier is calculated without government payments, three agricultural outputs are included. The first is the revenue from the main crop or livestock output of the farm, the second is the aggregated revenue from all other crop and livestock production (csothr), and the third other non-crop related income (ioth). When the frontier is constructed with government payments, aggregate government payments (igovt) received by the farm are included as an additional output.

We first calculate the efficiency frontier using Data Envelopment Analysis (DEA), without including government payments as an output. Each farm is assigned an efficiency score based upon its distance from this frontier. This exercise is repeated after including government payments as an output (source of revenue).

In order to test for structural change, returns to scale assumptions for the two frontiers are tested (Banker (1996)). The tests are based on two statistics, one derived from the hypothesis that $F_O - 1$ follows the half normal distribution. The resulting statistic

$$T_{AB} = \frac{\sum_{j=1}^{N} (F_O(B) - 1)}{\sum_{j=1}^{N} (F_O(A) - 1)}$$

(where A(null hypothesis), and B are returns to scale assumptions) follows the F distribution with $(2N, 2N)$ degrees of freedom. The second test statistic is derived from the assumption that $F_O - 1$ follows the exponential distribution. This statistic

$$TE_{AB} = \left[\frac{\sum_{j=1}^{N} (F_O(B) - 1)}{\sum_{j=1}^{N} (F_O(A) - 1)}\right]^2$$

(where A(null hypothesis), and B are returns to scale assumptions) follows the F distribution with (N, N) degrees of freedom.

Table 6 provides the results from the first rounds of tests. In these tests efficiency scores based on a frontier that does not include government payments as an output is used. Test 1 uses the assumption of an exponential distribution, and Test 2 assumes the distribution to be half normal. Using both tests variable returns to scale and non-increasing returns to scale are rejected in favor of constant returns to scale.

Table 7 provides results from the second rounds of tests. In this round government payments are included as an output in the calculation of efficiency. If government payments cause a structural change in the production structure of agriculture, one

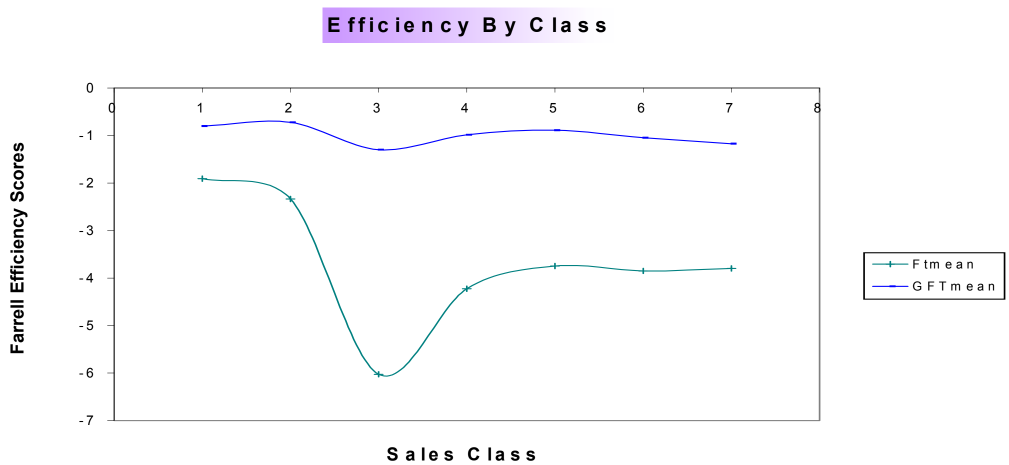

Figure 6: Efficiency means by sales class

should see a change in returns to scale from including government payments. As earlier Test 1 uses the assumption of an exponential distribution, and Test 2 assumes the distribution to be half normal. Once again we find that variable returns to scale and non-increasing returns to scale are rejected in favor of constant returns to scale.

Using our sample of farms we find evidence of constant returns to scale in US agriculture. The inclusion of government payments as an output in the calculation of the efficient frontier does not change this result leading us to believe that government payments do not cause structural change in the production structure of US agriculture.

Figure (6) illustrates informally the change in mean efficiency scores across sales classes when government payments are included as an output.

The series FTmean is the mean efficiency score for each sales class when government payments are not included as an output. When government payments are included (GFTmean) the mean efficiency scores improve for all sales classes, but the improvement in most marked for sales class 3 (farms that have revenues between 20, and 40 thousand US dollars). The percentage improvement in efficiency varies from 58% (sales class=1) to 78% (sales class=3). From this informal graphing exercise it does not seem that government payments are benefiting large farms alone.

2.5 The Indirect Effect of Government Payment Programs

Government payments can also influence efficiency by allowing farmers to undertake greater risk, and by providing funds to undertake investment in the absence of well functioning credit markets. Nevertheless if government payments are based upon poor performance they may also encourage inefficiency in order to gain these payments. In this case government payments affect efficiency indirectly by making farmers more or less profit efficient in the production of crops. In this subsection we investigate this possibility by using the frontier constructed without including government payments as an output. Government payments are used as an independent variable in a second stage regression explaining the efficiency scores from this frontier.

Table 8 includes the results from a tobit regression analyzing the determinants of the transformation function FTMEAN mapped in Figure (6). Variables included in this regression are those that were excluded in the calculation of the efficiency scores (that is input and output indicators are not used in the second stage), but those that are expected to influence farm level efficiency. These include farmer education, soil productivity for the region, geographical region dummies etc.

In the regression a -FT is used as a dependant variable. Efficiency scores near zero imply greater efficiency than higher scores. For that reason negative coefficients imply positive impact on productivity. We find that soil productivity, operator involvement based on the TENURE all improve efficiency in production. We also find that all farms belonging to sales classes greater than sales class 1 (farms with sales less than US$ 10,000) are more efficient (positive coeffients on all variables scls variables). With regards to government payments in aggregate, we find that there exists an indirect and positive impact of government payments on farm level efficiency. Farms that get higher levels of aggregate government payments are more efficient than others. This improvement in efficiency is reduced by increases in size, and this is evident from the positive and significant coefficient on the cross product of government payments and aggregate farm level revenues.

3 Conclusion

This analysis of the government payment program in the US reveals several interesting results. While analyzing the determinants of government payments to the farm we find that human capital variables like education, or age of the operator allow the farm to better exploit government payment programs. All else being equal, these farms gain bigger government payments in aggregate, per acre, and per dollar of sale. This implies that there exists a learning process involved in farm programs. We also find that grain crops gain larger government payments, in aggregate, per acre harvested, and per dollar of farm sale than other farms. Farmers that grow previously supported crops still get the largest government payments. These results imply that farmers that grew supported crops before the adoption of the FAIR act had similar harvesting patterns in 1998.

While analyzing the bias created by government payments we find that the pure profit efficiency effect of the payment program is not strong enough to cause structural change in US agriculture. We use DEA (a multi-output, and multi-input non-parametric framework) to calculate efficiency scores, and then use these efficiency scores to test for returns to scale with and without the inclusion of government payments as a source of revenue. The inclusion of government payments does not alter returns to scale in US agriculture. US agriculture is characterized by a constant returns to scale technology.

Nevertheless, we find evidence of an indirect effect of government payments on efficiency. Using efficiency scores calculated without including government payments as a dependent variable in a second stage regression we find that farms that received greater government payments on aggregate were more efficient than other farms. This positive impact on efficiency falls with an increase in farm sales, that is, farms with larger sales get smaller efficiency benefits from an extra dollar of government payments than farms with smaller sales.

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Table 1: Modern Farm Sector Economic Characteristics, 1995

	Annual Sales Value		
	Less than $50,0000	$50,000-$249,999	$250,000 or more
Number of Farms	1534000	414000	122000
Farm Characteristics (% of total)			
Farms	74.10%	20.00%	5.90%
Total Sales	10.50%	31.40%	58.00%
Government Supported Crops	11.90%	43.30%	44.90%
Non Supported Crops	6.20%	18.90%	74.80%
Livestock	8.90%	29.00%	62.10%
Direct Government Payments	27.00%	40.80%	32.20%
Operator Characteristics			
Primary Occupation Farming (%)	39.60%	90.90%	96.70%
Net Cash Income from Farming	-$2,900	$38,000	$303,000
Government Payments	$1,275	$7,130	$1,903
Off-farm family income	$30,000	$18,000	$21,000
Total Income	$27,100	$56,000	$324,000
Net Worth	$225,000	$501,000	$1,020,000

Note: *Net Cash Income from farming* includes government payments, net worth refers to 1991.
Source: US Department of Agriculture, Economic Research Service, *Farm Business Economics Report (1996)* and *Farm Costs and Returns Survey (1991)*.

Table 2: Descriptive Statistics

Variable	Sample Size	Mean
Net Farm Income	10032	$19,135
Crop and Livestock Sales	10032	$87,668
Government Payments	10032	$5,634
Property and Estate Taxes	10032	$2,467
Government Payments per Dollar Sale	10032	17 cents
Government Payments per Acre	10032	$17.63
Operator Age	10032	54
Operator Education	10032	High School
Harvested Acres	10032	237
Owned to Operated Acres	10032	0.67

Table 3: Dependant Variable Government Payments By Farm (OLS)

Observations		Degrees of Freedom		F Value	Pr>F
9796		9737		248.61	<0.0001
Dependent Mean		R Squared		Adj R Squared	
5423.5035		0.601		0.5986	
Variable	Label	Estimate	Error	t Value	Pr > |t|
Intercept		-1643.5583	1273.4204	-1.29	0.1969
HA_TOT	Harvested Acres	19.3112	0.3138	61.53	<.0001
NETW	Net Worth	-0.0001	0.0000	-3.33	0.0009
MEANPI	Mean Productivity Index-County	47.9221	11.2709	4.25	<.0001
MEAN	Average Monthly Rainfall (1960-92)	-1.9185	0.4953	-3.87	0.0001
CV	CV month to month	-3756.4717	1498.5305	-2.51	0.0122
geog2	Northern Crescent	-613.5406	403.2506	-1.52	0.1282
geog3	northern great plains	-2397.6279	628.8314	-3.81	0.0001
geog4	prairie gateway	954.1009	466.5724	2.04	0.0409
geog5	eastern uplands	-2.9566	435.7645	-0.01	0.9946
geog6	southern seaboard	-183.5437	549.0864	-0.33	0.7382
geog7	fruitful rim	848.2125	621.5238	1.36	0.1724
geog8	basin and range	229.5115	887.2044	0.26	0.7959
geog9	missisipi portal	2197.5475	664.6288	3.31	0.0009
educ2	completed high school	62.8673	337.6521	0.19	0.8523
educ3	some college	25.6071	377.3034	0.07	0.9459
educ4	completed college	1373.4596	431.4665	3.18	0.0015
educ5	graduate school	1035.1232	576.7161	1.79	0.0727
age2	1 if 35< age <45	483.9527	470.1030	1.03	0.3033
age3	1 if 35< age <55	413.3934	466.0813	0.89	0.3751
age4	1 if 55< age <65	97.7434	484.8890	0.20	0.8403
age5	1 if 65< age	187.7061	522.8785	0.36	0.7196
organ2	partnership farm	331.2044	434.4917	0.76	0.4459
organ3	family corporation farm	-836.7704	591.1720	-1.42	0.157
organ4	non-family corporation farm	-7550.1790	1857.8969	-4.06	<.0001
organ5	other farms	-2318.8061	1319.3318	-1.76	0.0789
manager	hired manager	-1608.5865	951.4185	-1.69	0.0909
else	neither farmer, manager or retired	-520.8578	327.5247	-1.59	0.1118
retired	retired farmer	-127.0563	408.8351	-0.31	0.756
scls2	$10,000-$19,999	-191.3284	349.4988	-0.55	0.5841
scls3	$20,000-$39,999	-136.8421	376.5455	-0.36	0.7163
scls4	$40,000 -$99,999	387.7428	391.0139	0.99	0.3214
scls5	$100,000 -$249,999	3210.7876	449.4288	7.14	<.0001
scls6	$250,000-$499,999	8242.0678	609.9063	13.51	<.0001
scls7	$500,000 or more	14333.0000	790.9744	18.12	<.0001
OPHRS	Operator Hours	-0.5138	0.1390	-3.70	0.0002
TENURE	Owned to Operated Farmland	508.8098	319.6647	1.59	0.1115
EFTAXES	Property and Estate Taxes	-0.0901	0.0152	-5.91	<.0001
rbarley	ratio of barley sales to farm sales	8293.0269	3309.0389	2.51	0.0122
rcorn	ratio of corn sales to farm sales	2443.1984	596.1371	4.10	<.0001
rcot	ratio of cotton sales to farm sales	18465.0000	2031.5454	9.09	<.0001
rpeanut	ratio of peanut sales to farm sales	386.3615	2477.6467	0.16	0.8761
rpotato	ratio of potato sales to farm sales	-5626.5742	5527.3296	-1.02	0.3087
rrice	ratio of rice sales to farm sales	20870.0000	3350.0735	6.23	<.0001
rsoyb	ratio of soybean sales to farm sales	-63.9539	544.3188	-0.12	0.9065
rsorgh	ratio of sorghum sales to farm sales	-2638.8430	1889.0492	-1.40	0.1625
rsugar	ratio of sugar sales to farm sales	-14581.0000	4879.0472	-2.99	0.0028
rtob	ratio of tobacco sales to farm sales	-239.6042	644.9999	-0.37	0.7103
rwheat	ratio of wheat sales to farm sales	4601.1380	780.4615	5.90	<.0001
rcanola	ratio of canola sales to farm sales	15247.0000	6489.6574	2.35	0.0188
roats	ratio of oats sales to farm sales	-2043.2767	4017.4715	-0.51	0.611
rothcrp	ratio of other crop sales to farm sales	1959.3177	1160.1800	1.69	0.0913
rfruit	ratio of fruit sales to farm sales	-999.4239	708.7101	-1.41	0.1585
rhay	ratio of hay sales to farm sales	-506.6787	438.5900	-1.16	0.248
rnur	ratio of nursery sales to farm sales	-1623.5061	634.4933	-2.56	0.0105
rveg	ratio of vegetable sales farm sales	-709.6368	1010.5804	-0.70	0.4826
rcatt	ratio of cattle sales to farm sales	-210.6294	111.6760	-1.89	0.0593
rhogs	ratio of hogs sales to farm sales	1007.8021	791.6307	1.27	0.203
rdairy	ratio of dairy sales to farm sales	-2357.7061	635.1138	-3.71	0.0002
regplt	ratio of eggs and poultry farm sales	-298.2175	1932.7269	-0.15	0.8774

Table 4: Dependant Variable Government Payments Per Harvested Acre (OLS)

Observations	Degrees of Freedom		F Value	Pr>F
9796	9737		66.14	<0.0001
Dependent Mean	R Squared		Adj R Squared	
12.50996	0.2861		0.2818	

Variable	Label	Estimate	Error	t Value	Pr > |t|
Intercept		-1.7827	2.2823	-0.78	0.4348
HA_TOT	Harvested Acres	-0.0034	0.0006	-5.97	<.0001
NETW	Net Worth	-0.0000001	0.0000	-1.62	0.1062
MEANPI	Mean Productivity Index-County	0.1121	0.0202	5.55	<.0001
MEAN	Average Monthly Rainfall (1960-92)	-0.0054	0.0009	-6.06	<.0001
CV	CV month to month	-6.5542	2.6871	-2.44	0.0147
geog2	Northern Crescent	-4.7216	0.7276	-6.49	<.0001
geog3	northern great plains	-2.0147	1.1341	-1.78	0.0757
geog4	prairie gateway	1.8732	0.8477	2.21	0.0271
geog5	eastern uplands	-4.7428	0.7921	-5.99	<.0001
geog6	southern seaboard	-0.9609	0.9902	-0.97	0.3318
geog7	fruitful rim	-4.5230	1.1273	-4.01	<.0001
geog8	basin and range	-4.7882	1.5989	-2.99	0.0028
geog9	missisipi portal	0.2288	1.1971	0.19	0.8485
educ2	completed high school	1.2544	0.6036	2.08	0.0377
educ3	some college	1.8456	0.6754	2.73	0.0063
educ4	completed college	3.8540	0.7720	4.99	<.0001
educ5	graduate school	2.3207	1.0299	2.25	0.0243
age2	1 if 35< age <45	1.8263	0.8451	2.16	0.0307
age3	1 if 35< age <55	2.3507	0.8391	2.80	0.0051
age4	1 if 55< age <65	3.1595	0.8723	3.62	0.0003
age5	1 if 65< age	3.6079	0.9401	3.84	0.0001
organ2	partnership farm	-2.6317	0.7797	-3.38	0.0007
organ3	family corporation farm	-1.5646	1.0576	-1.48	0.1391
organ4	non-family corporation farm	-6.3539	3.3161	-1.92	0.0554
organ5	other farms	-8.3381	2.3533	-3.54	0.0004
manager	hired manager	1.3803	1.7329	0.80	0.4258
else	neither farmer, manager or retired	-0.4665	0.5863	-0.80	0.4262
retired	retired farmer	-0.6889	0.7330	-0.94	0.3473
scls2	$10,000-$19,999	5.2532	0.6257	8.40	<.0001
scls3	$20,000-$39,999	7.7639	0.6748	11.51	<.0001
scls4	$40,000 -$99,999	10.9410	0.7022	15.58	<.0001
scls5	$100,000 -$249,999	16.5538	0.8064	20.53	<.0001
scls6	$250,000-$499,999	20.4246	1.0931	18.69	<.0001
scls7	$500,000 or more	23.8719	1.4167	16.85	<.0001
OPHRS	Operator Hours	-0.0009	0.0002	-3.70	0.0002
TENURE	Owned to Operated Farmland	3.1889	0.5723	5.57	<.0001
EFTAXES	Property and Estate Taxes	0.00004	0.0000	1.33	0.1841
rbarley	ratio of barley sales to farm sales	26.0721	6.1724	4.22	<.0001
rcorn	ratio of corn sales to farm sales	11.5771	1.1353	10.20	<.0001
rcot	ratio of cotton sales to farm sales	43.8163	3.6585	11.98	<.0001
rpeanut	ratio of peanut sales to farm sales	15.1280	4.4208	3.42	0.0006
rpotato	ratio of potato sales to farm sales	15.9579	9.8618	1.62	0.1057
rrice	ratio of rice sales to farm sales	29.8460	6.1060	4.89	<.0001
rsoyb	ratio of soybean sales to farm sales	12.5929	1.0623	11.85	<.0001
rsorgh	ratio of sorghum sales to farm sales	12.0148	3.4051	3.53	0.0004
rsugar	ratio of sugar sales to farm sales	-5.3597	8.7431	-0.61	0.5399
rtob	ratio of tobacco sales to farm sales	-1.6079	1.1528	-1.39	0.1631
rwheat	ratio of wheat sales to farm sales	19.0497	1.4092	13.52	<.0001
rcanola	ratio of canola sales to farm sales	8.2850	11.6588	0.71	0.4773
roats	ratio of oats sales to farm sales	3.1510	7.1667	0.44	0.6602
rothcrp	ratio of other crop sales to farm sales	12.5932	2.0792	6.06	<.0001
rfruit	ratio of fruit sales to farm sales	-3.7568	1.2659	-2.97	0.003
rhay	ratio of hay sales to farm sales	-1.4532	0.7895	-1.84	0.0657
rnur	ratio of nursery sales to farm sales	-6.6361	1.1353	-5.85	<.0001
rveg	ratio of vegetable sales farm sales	-1.6872	1.8042	-0.94	0.3497
rcatt	ratio of cattle sales to farm sales	-0.3428	0.2006	-1.71	0.0875
rhogs	ratio of hogs sales to farm sales	7.3769	1.4218	5.19	<.0001
rdairy	ratio of dairy sales to farm sales	-2.0631	1.1391	-1.81	0.0701
regplt	ratio of eggs and poultry farm sales	-4.9529	3.4470	-1.44	0.1508

Table 5: Dependant Variable Government Payments Per Dollar Sale (OLS)

Observations	Degrees of Freedom		F Value	Pr>F
9796	9737		54.02	<0.0001
Dependent Mean	R Squared		Adj R Squared	
0.08416	0.2466		0.2421	

Variable	Label	Estimate	Error	t Value	Pr > |t|
Intercept		-0.0247	0.0219	-1.13	0.2605
HA_TOT	Harvested Acres	0.0000196	0.0000	3.64	0.0003
NETW	Net Worth	-0.0000000004	0.0000	-0.59	0.5571
MEANPI	Mean Productivity Index-County	0.0008	0.0002	3.98	<.0001
MEAN	Average Monthly Rainfall (1960-92)	-0.00003	0.0000	-3.88	0.0001
CV	CV month to month	-0.0645	0.0258	-2.50	0.0125
geog2	Northern Crescent	0.0002	0.0070	0.03	0.9784
geog3	northern great plains	0.0685	0.0109	6.29	<.0001
geog4	prairie gateway	0.0544	0.0081	6.68	<.0001
geog5	eastern uplands	-0.0016	0.0076	-0.21	0.8332
geog6	southern seaboard	0.0285	0.0095	3.00	0.0027
geog7	fruitful rim	0.0180	0.0108	1.67	0.0957
geog8	basin and range	0.0050	0.0154	0.33	0.7435
geog9	missisipi portal	0.0340	0.0115	2.95	0.0032
educ2	completed high school	-0.0028	0.0058	-0.49	0.6276
educ3	some college	0.0159	0.0065	2.45	0.0141
educ4	completed college	0.0160	0.0074	2.15	0.0313
educ5	graduate school	0.0034	0.0099	0.34	0.7321
age2	1 if 35< age <45	0.0276	0.0081	3.40	0.0007
age3	1 if 35< age <55	0.0227	0.0081	2.82	0.0049
age4	1 if 55< age <65	0.0255	0.0084	3.04	0.0023
age5	1 if 65< age	0.0121	0.0090	1.33	0.182
organ2	partnership farm	-0.0130	0.0075	-1.74	0.0826
organ3	family corporation farm	0.0110	0.0102	1.08	0.2801
organ4	non-family corporation farm	-0.0294	0.0319	-0.92	0.3565
organ5	other farms	-0.0514	0.0226	-2.27	0.023
manager	hired manager	0.0304	0.0166	1.83	0.0679
else	neither farmer, manager or retired	-0.0134	0.0056	-2.37	0.0176
retired	retired farmer	0.0080	0.0070	1.13	0.2567
scls2	$10,000-$19,999	0.0220	0.0060	3.66	0.0003
scls3	$20,000-$39,999	0.0176	0.0065	2.71	0.0067
scls4	$40,000 -$99,999	0.0184	0.0067	2.73	0.0063
scls5	$100,000 -$249,999	0.0012	0.0077	0.15	0.8782
scls6	$250,000-$499,999	-0.0194	0.0105	-1.85	0.0644
scls7	$500,000 or more	-0.0526	0.0136	-3.86	0.0001
OPHRS	Operator Hours	0.000004	0.0000	1.57	0.1162
TENURE	Owned to Operated Farmland	-0.0022	0.0055	-0.40	0.6888
EFTAXES	Property and Estate Taxes	0.0000001	0.0000	0.45	0.6555
rbarley	ratio of barley sales to farm sales	0.4056	0.0593	6.84	<.0001
rcorn	ratio of corn sales to farm sales	0.1279	0.0109	11.73	<.0001
rcot	ratio of cotton sales to farm sales	0.1879	0.0351	5.35	<.0001
rpeanut	ratio of peanut sales to farm sales	-0.0229	0.0425	-0.54	0.5893
rpotato	ratio of potato sales to farm sales	0.1010	0.0947	1.07	0.2865
rrice	ratio of rice sales to farm sales	0.0694	0.0586	1.18	0.237
rsoyb	ratio of soybean sales to farm sales	0.1016	0.0102	9.96	<.0001
rsorgh	ratio of sorghum sales to farm sales	0.2303	0.0327	7.04	<.0001
rsugar	ratio of sugar sales to farm sales	-0.0255	0.0840	-0.30	0.7612
rtob	ratio of tobacco sales to farm sales	-0.0239	0.0111	-2.15	0.0312
rwheat	ratio of wheat sales to farm sales	0.4041	0.0135	29.85	<.0001
rcanola	ratio of canola sales to farm sales	0.1884	0.1120	1.68	0.0924
roats	ratio of oats sales to farm sales	0.0036	0.0688	0.05	0.9587
rothcrp	ratio of other crop sales to farm sales	0.1846	0.0200	9.24	<.0001
rfruit	ratio of fruit sales to farm sales	-0.0131	0.0122	-1.08	0.2803
rhay	ratio of hay sales to farm sales	0.0059	0.0076	0.77	0.4391
rnur	ratio of nursery sales to farm sales	-0.0206	0.0109	-1.89	0.0592
rveg	ratio of vegetable sales farm sales	0.0003	0.0173	0.02	0.9856
rcatt	ratio of cattle sales to farm sales	-0.0028	0.0019	-1.45	0.1485
rhogs	ratio of hogs sales to farm sales	0.0169	0.0137	1.24	0.2167
rdairy	ratio of dairy sales to farm sales	-0.0329	0.0109	-3.00	0.0027
regplt	ratio of eggs and poultry farm sales	-0.0528	0.0331	-1.60	0.1107

Table 6: Banker Tests for Returns to Scale - Government Payments Not Included

Hypothesis	Test	Value of Statistic	Sample Size	Prob > F
Null: VRS, Alt: CRS	Test 1	1.31382	2055	0
	Test 2	1.72613	2055	0
Null: NIRS, Alt: CRS	Test 1	1.29546	2055	0
	Test 2	1.67821	2055	0
Null: VRS, Alt: NIRS	Test 1	1.01418	2055	0.32594
	Test 2	1.02855	2055	0.26174

Table 7: Banker Tests for Returns to Scale - Government Payments Included

Hypothesis	Test	Value of Statistic	Sample Size	Prob > F
Null: VRS, Alt: CRS	Test 1	1.40134	1183	0
	Test 2	1.96375	1183	0
Null: NIRS, Alt: CRS	Test 1	1.38097	1183	0
	Test 2	1.90707	1183	0
Null: VRS, Alt: NIRS	Test 1	1.01475	1183	0.36088
	Test 2	1.02972	1183	0.30729

Table 8: Tobit Analysis of Efficiency Transformation Function

Dependent Variable: FT (Transformation Function w/o Government Payments)	
Weight Variable: EF_VALL	Distribution: Normal
Observations: 2009	Log Likelihood: -654717.0505

Variable	Label	DF	Estimate	Standard Error	Chi-Square	Pr > ChiSq
Intercept	Intercept	1	1.385040	0.0568	594.86	<.0001
MEANPI	Mean productivity index: county	1	-0.006018	0.0006	110.00	<.0001
IGOVT	Aggregate Government Payments	1	-0.000012	0.0000	403.02	<.0001
IGOCFI	Interaction: Gov. payments*Gross Sales	1	0.000000000001	0.0000	26.29	<.0001
geog3	northern great plains	1	-0.083670	0.0665	1.58	0.2084
geog4	prairie gateway	1	-0.211110	0.0466	20.53	<.0001
geog5	eastern uplands	1	-0.134700	0.0340	15.72	<.0001
geog6	southern seaboard	1	0.139120	0.0358	15.11	0.0001
geog7	fruitful rim	1	1.033300	0.0333	961.43	<.0001
geog8	basin and range	1	2.686250	0.0391	4714.95	<.0001
educ2	completed high school	1	0.533680	0.0226	557.06	<.0001
educ3	some college	1	0.126350	0.0237	28.31	<.0001
educ4	completed college	1	-0.044110	0.0260	2.88	0.0899
educ5	graduate school	1	-0.034110	0.0331	1.06	0.3027
scls2	$10,000-$19,999	1	0.036400	0.0252	2.09	0.1481
scls3	$20,000-$39,999	1	2.542630	0.0285	7969.21	<.0001
scls4	$40,000 -$99,999	1	1.215460	0.0236	2659.51	<.0001
scls5	$100,000 -$249,999	1	2.040550	0.0276	5475.09	<.0001
scls6	$250,000-$499,999	1	1.449440	0.0372	1521.37	<.0001
scls7	$500,000 or more	1	1.828490	0.0357	2620.73	<.0001
TENURE	Owned to Operated Acres	1	-0.094740	0.0223	18.01	<.0001
Scale	Normal scale	1	3.545670	0.0051		