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## Did the Federal Agriculture Improvement and Reform Act of 1996 Affect Farmland Values?

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**Abstract:** Farmland values are affected by numerous factors, including farm policy, shifts in demand for agricultural output both foreign and domestic, monetary policy and urban pressure. In this study we use an information measure to examine whether the shift toward a more market-oriented policy in 1996 changed the relationship between farmland values and government payments. The results indicated that the shift in agricultural policy resulted in significant shift in this relationship.

**Keywords:** agricultural policy; entropy; farmland value; government payments

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### 1. Introduction

In this study we use an information measure to examine whether the shift toward a more market-oriented policy in 1996 changed the relationship between farmland values and government payments [1]. The Federal Agricultural Improvement and Reform (FAIR) Act of 1996 represented a major market oriented shift in price support policies which started with the Agricultural Adjustment Act of 1933 [2]. Specifically, the New Deal farm bills included a number of policy instruments which linked farm production decisions to policy variables. For example, the Agricultural Adjustment Act of

1938 included acreage allotments and marketing quotas. Farmland is the most important asset in the farm business and in the farm household investment portfolio. Nationally, in 2009 real estate accounted for more than three-fourths of total farm business assets. On the other hand, the average investment portfolio of a typical farm household was worth \$895,756 in 2009. Of this worth, real estate comprised 75 percent of its value. For landowners who operate farms, the value of land as a business asset helps to secure operating and expansion loans. For landowners that do not operate farms, the income from renting farmland often represents an important component of household income. Hence, farmland occupies a uniquely important role in the performance of the agricultural sector because of its dominance on agriculture's balance sheet. Therefore, any changes in the farm program payments will affect farmland values. Further, any changes in farmland values can have significant consequences for the sector solvency and, hence its financial viability.

The issue of farmland valuation for agricultural purposes is a perennial topic of interest for policymakers and farmers. Federal farm policy is a direct contributor to farmland value appreciation. Economists have understood for some time that the value of farm program payments are capitalized into land values as these payments become a component of expected future returns [3]. Over time significant changes in agricultural policy were introduced which brought about more production choice. The Agricultural and Consumer Protection Act of 1973 introduced target prices for wheat, feed grains, and upland cotton. The Agricultural and Food Act of 1981 eliminated the system of allotments, replacing them with base acreages. In a sense, the market orientation of agricultural policies reached a zenith with the enactment of FAIR Act of 1996. The FAIR Act implemented Agricultural Market Transition Assistance (AMTA) payments based on historical yields on base acreages.

## 2. Literature Review

Much of the rise in farmland value is attributed to farm programs, under which farmers received government payments that are capitalized in the farmland [3–11]. The capitalization of government programs into land prices has also been discussed in the literature [12–16]. Tweeten *et al.* [14] concluded that pressures to increase farm size and the capitalized benefits of farm programs could explain 52% of the variation in land prices. Traill [17] notes that capitalizing the full benefits of a support program will not affect net farm income in the short-run. Clark *et al.* [18] also found that government subsidies as well as market-based income were capitalized into land values for Saskatchewan using a cointegration approach. In another study, Just *et al.* [19] developed a structural model of farmland prices based on 1963–1986 data, which included the multi-dimensional effects of inflation on capital erosion, saving-return erosion, and real debt reduction as well as the effects of changes in the opportunity costs of capital. Their results showed that inflation and changes in real return on capital were major explanatory factors in farmland price swings. In addition, Just *et al.* [19] estimated that government payments account for approximately 15 to 20% of the capitalized value of land in U.S., but only a small part of the fluctuations. Moss *et al.* [20] used Bayesian vector analysis to investigate the effect of government payments on real agricultural assets values. Their analysis focused on the informational content of government payments. The authors concluded that in the short-run, government payments and asset values were negatively correlated. However, in the long-run, government payments had little positive effect on real asset values. Using a different scenario,

Featherstone *et al.* [21] estimated that a move to a free market from the 1985 farm programs would reduce land prices in the U.S. by approximately 13% in five years.

A plethora of literature on the factors affecting farmland values has been published and the empirical relationship is well recognized in the agricultural economics literature. These include the income capitalization model [22–24] and hedonic models [25–27]. Analysis included empirical application to macro economic variables like interest rate and inflation [19], specific farm programs and crops [18,22,28–32], farm program bases [6,29,33] and historical farm program payments [11,34] using historical data, (1938–2006). Falk [34] studied the plausibility of the constant expected returns version of the present value model as a tenable explanation of farmland prices. The research by Melichar [16] and others lead to the acceptance of the relationship between cash rents and land values.

Recent literature on farmland values has focused on the effect of government payments. In the last two decades, studies of government payment impacts have also included those of specific crops and specific programs [28,30]. Payments linked to program bases and resulting impacts on agricultural land values were examined by [5]. The effect of eliminating government payments on agricultural land values was analyzed by [8]. Their county-level, cross-sectional examination of government payment effects on land values used data from the U.S. Department of Agriculture's 2000 Agricultural Resource Management Survey (ARMS). Based on their analysis of eight U.S. agriculture production regions, eliminating government programs would reduce agricultural land values by 12% to 69%. Weersink *et al.* [9] and [10] found that government payments increased agricultural land values. Goodwin, Mishra, and Ortalo-Magne [29] and Lence *et al.* [35] concluded that government payments positively affected cash rents.

Shaik *et al.* [11] cited problems with earlier studies caused by identification issues introduced by counter-cyclical farm program payments and farm returns. The issue results from the misuse of farm program payments as exogenous variables in land valuation models. The authors [11] concluded that farm program payments and crop receipts represented 30% and 70% of agricultural land values, respectively. Furthermore, they found that the contribution of farm program payments to land values declined from a high of 30% to 40% during the 1938 to 1980 period to about 15% to 20% in subsequent farm bill periods. Shaik [33] found similar results using four alternative panel estimators. Shaik *et al.* [36] using a dynamic framework and data from 1933–2006 found payments have a positive direct in the short run and a positive indirect impact (via farm returns) in the long run on farmland values. Finally, Goodwin *et al.* [37] using farm-level data and expectations modeling approach investigated the impact of farm programs payments, along with different types of farm programs payments, on farmland values, cash and share rents. The authors concluded that farm programs payments have significant impact on farmland values and rental rates. Further, [38] point out that ignoring expectations and differences across payments types makes some existing work questionable.

### 3. Model

Most empirical evaluations of the determinants of land values adopt a present value model, where the value of a productive asset is given by the capitalized values of current and expected future streams

of net income generated by the asset. Under standard assumptions, farmland values are determined by the present value of future rents:

$$V_t = \sum_{i=1}^{\infty} \frac{E[CF_{t+i} | \Omega_t]}{\prod_{j=1}^i (1+r_{t+j})} \quad (1)$$

where  $V_t$  is the value of farmland,  $E[CF_{t+i} | \Omega_t]$  is the expected cash flow from farmland (typically the Ricardian rent defined as the excess of returns over the variable factors of production), and  $r_t$  is the discount rate parameterized as the weighted average cost of capital. Expanding this formulation to consider government payments:

$$V_t = \sum_{i=1}^{\infty} \frac{E[CF_{t+i}^M | \Omega_t] + E[GP_{t+i} | \Omega_t]}{\prod_{j=1}^i (1+r_{t+j})} \quad (2)$$

where  $E[CF_{t+i}^M | \Omega_t]$  are the expected cash flow from the market, and  $E[GP_{t+i} | \Omega_t]$  are the cash inflows from government payments. The conjecture (hypothesis) is that the passage of FAIR represented a structural break in the time series of  $E[GP_{t+i} | \Omega_t]$  and possibly affects  $E[CF_{t+i}^M | \Omega_t]$ .

#### 4. Data and Methods

This study uses the United States Department of Agriculture, Economic Research Service net valued added data for government payments and farm income. In addition, we use the United States Department of Agriculture's data on total farmland values (data on values per acre were taken from various issues of [39] and the acreage in each state is taken from the [38]).

The information measure applied is based on [1] measure of income inequality. The information approach assumes that the two sets of probabilities embody the effect of a signal. Our formulation allows for a regional decomposition of the information in farmland value changes. The informational measure is then applied to farmland values in the United States. Specifically, we define the informational content of government payments in explaining farmland values as:

$$I_t = \sum_{i=1}^n p_{it} \ln \left( \frac{p_{it}}{q_{it}} \right) \quad (3)$$

where  $p_{it}$  is the  $i^{\text{th}}$  state's share of total farmland value at time  $t$  and  $q_{it}$  is the  $i^{\text{th}}$  state's share of total government payments to agriculture. As described by Theil *et al.* [40], the informational measure in Equation (3) measures the difference in information between a prior distribution,  $q_i$  (the probability distribution of the event, E, before the signal arrives) and a posterior distribution,  $p_i$  (the probability distribution of the event, E, after the signal has been observed). If the posterior information is the same as the prior distribution there is no information in the signal. As  $I_t \rightarrow 0$  the government payments perfectly predict the distribution of farmland values across states while as  $I_t \rightarrow \infty$  government payments contain little information regarding the distribution of farmland values. Following Theil's [1] general formulation of the information measure of inequality, we define the regional inequality for information measure in Equation (1) as:

$$I_{gt} = \sum_{i \in g} \left( \frac{p_{it}}{\sum_{j \in g} p_{jt}} \right) \ln \left( \frac{\frac{p_{it}}{\sum_{j \in g} p_{jt}}}{\frac{q_{it}}{\sum_{j \in g} q_{jt}}} \right) \tag{4}$$

where  $I_{gt}$  is the regional inequality in government payments within region  $g$ . Based on these grouping, we then define information inequality across regions as:

$$I_{Rt} = \sum_g \left( \sum_{i \in g} p_{it} \right) \ln \left( \frac{\sum_{i \in g} p_{it}}{\sum_{i \in g} q_{it}} \right) \tag{5}$$

The average inequality across regions is then defined as:

$$\bar{I}_{Rt} = \sum_g \left( \sum_{i \in g} p_{it} \right) I_{gt} \tag{6}$$

The total inequality in Equation (1) can be expressed as the sum of the results of Equations (5) and (6).

$$I = \bar{I}_{Rt} + I_{Rt} \tag{7}$$

To test for the significance of the changes in agricultural payments due to FAIR we estimate a simple model using ordinary least squares:

$$I_t = \alpha_0 + \alpha_1 t + \alpha_2 D_t + \alpha_3 IPR_t + \varepsilon_t \tag{8}$$

where  $t$  is a time trend,  $D_t$  is a dummy variable which is equal to 0 if  $t < 1996$  and equal to 1 if  $t \geq 1996$ ,  $IPR_t$  is the index of prices received by farmers. The maintained hypothesis is that FAIR had no effect on the relationship between farmland values and government payments, or  $H_0 : \alpha_2 = 0$ . The alternative hypothesis is that FAIR changed the relationship between farmland values and government payments  $H_0 : \alpha_2 \neq 0$ . Through the analysis [Equation (8)] we investigate if the implementation of FAIR Act has significantly affected the relationship between the share of farmland values and the share of government payments for all US, between, and across regions.

## 5. Results

In order to analyze the effect of FAIR on the relationship between government payments and farmland values we start with an analysis of the ten Economic Research Service regions. These regions aggregate states by agronomic characteristics. Hence, the same portfolio of crops is typically produced in each region. After analyzing the data for each region, we then analyze the change in information across regions.

### 5.1. Regional Inequalities

The values of the regional inequalities for each of the ten Economic Research Regions are presented in Table 1. Over time the inequality is highest for the Northeast, Southeast, and Mountain regions.

Arguably, the size of the inequality in these regions may be explained by the relative lack of program crops. In addition, the inequality appears to be highest for the period 1975 through 1980, roughly corresponding with the boom/bust period for farmland in the late 1970s through the financial crisis in the mid 1980s. During that period, the inequality is relatively higher for the Lake States, Corn Belt and Northern Plains.

**Table 1.** Regional inequality ( $\times 1,000$ ) between land values and government payments.

Year	Northeast	Lake States	Corn Belt	Northern Plains	Appalachia	Southeast	Delta	Southern Plains	Mountain	Pacific States
1950	75.3	9.4	46.2	20.1	3.7	86.6	61.7	5.2	104.2	2.2
1951	73.1	31.7	44.8	48.7	2.0	57.5	68.9	16.8	66.7	3.0
1952	51.9	25.2	93.2	35.7	9.3	74.2	64.1	25.5	79.7	12.9
1953	63.9	2.0	57.9	51.4	39.0	21.5	23.0	37.7	181.7	13.7
1954	51.9	1.3	62.3	23.9	37.9	73.3	74.6	1.3	89.2	24.1
1955	100.0	12.1	25.0	26.3	3.0	151.2	70.3	4.6	146.2	6.6
1956	42.1	13.8	75.5	126.7	65.9	107.7	52.5	0.6	131.3	14.6
1957	24.1	7.8	65.5	12.0	28.3	333.4	1.7	5.1	90.9	35.0
1958	21.0	6.0	82.1	27.3	64.2	519.0	4.2	4.0	99.0	24.9
1959	102.6	4.7	88.7	99.0	60.9	277.3	1.7	1.6	187.2	81.2
1960	123.0	0.9	82.3	125.9	34.4	284.8	7.2	9.1	249.8	107.8
1961	129.1	7.0	26.8	4.5	25.0	285.3	2.7	1.3	146.7	104.5
1962	118.4	7.6	31.1	11.6	15.4	312.1	9.8	14.6	162.1	206.2
1963	110.6	24.7	30.3	13.0	18.7	239.8	12.5	12.2	176.7	132.2
1964	107.1	35.2	51.5	10.9	19.6	267.9	35.3	12.1	211.1	308.4
1965	97.8	24.2	37.2	6.7	25.9	250.5	33.9	9.9	173.5	316.9
1966	110.0	19.4	55.9	16.0	69.1	404.3	56.8	2.6	41.5	89.1
1967	98.3	13.4	46.2	32.3	82.9	387.3	72.9	3.2	44.9	71.1
1968	95.9	20.9	27.0	12.2	68.8	328.3	59.2	5.9	34.3	79.3
1969	103.7	38.4	16.8	15.5	62.2	304.1	63.1	5.8	41.6	51.4
1970	85.8	38.7	23.0	17.0	63.0	327.0	72.5	9.4	45.6	40.0
1971	99.6	51.8	10.0	17.1	70.5	303.3	69.8	4.9	53.0	50.0
1972	105.3	68.9	20.3	26.1	55.5	279.3	83.6	5.5	52.9	42.5
1973	106.3	54.1	18.4	19.8	81.9	252.1	69.7	21.5	59.3	20.6
1974	143.6	0.1	10.8	155.5	15.3	7.0	65.9	17.1	82.5	47.9
1975	153.7	17.7	79.7	49.2	65.8	32.9	21.3	62.3	53.2	26.1
1976	123.2	37.4	26.4	220.5	27.9	169.4	17.6	5.5	89.3	26.0
1977	102.0	37.8	51.1	83.4	97.6	127.9	35.7	22.7	160.0	65.5
1978	201.2	56.6	42.2	21.1	113.5	330.1	31.9	0.2	163.7	173.4
1979	281.5	26.7	88.1	16.3	8.6	190.5	38.6	63.1	82.2	14.1
1980	106.6	35.8	30.3	65.5	38.0	306.6	16.6	60.1	264.4	87.5
1981	86.3	80.2	64.5	88.0	14.0	238.7	60.4	0.5	216.0	341.5
1982	202.1	57.0	36.9	15.9	81.4	369.6	4.4	21.6	117.4	61.1
1983	158.9	54.0	37.5	16.9	39.9	497.2	20.9	0.0	138.2	30.3
1984	74.4	8.3	19.0	16.6	26.0	167.4	18.6	10.2	108.0	44.0
1985	111.1	53.0	51.2	18.4	39.1	216.3	26.1	8.9	125.4	40.1
1986	115.4	65.9	66.3	10.6	34.7	377.1	33.1	32.0	179.8	115.9

Table 1. Cont.

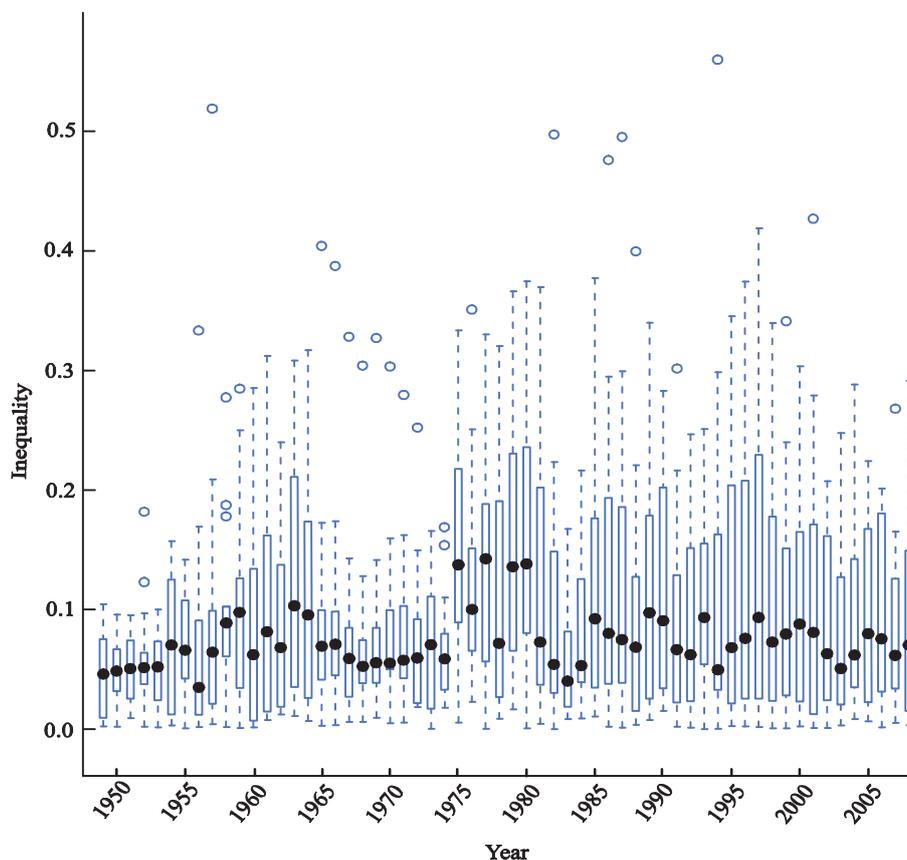
Year	Northeast	Lake States	Corn Belt	Northern Plains	Appalachia	Southeast	Delta	Southern Plains	Mountain	Pacific States
1987	147.1	67.6	80.0	7.6	37.7	476.1	10.4	1.8	202.0	73.7
1988	170.1	38.6	54.5	6.1	45.4	495.0	5.2	1.2	185.8	74.9
1989	127.5	10.3	27.8	15.5	102.2	399.8	3.6	5.9	119.3	15.2
1990	137.6	22.8	32.9	25.5	97.4	339.9	9.8	7.6	178.9	141.4
1991	202.0	27.6	34.1	36.3	74.6	225.7	15.2	16.4	211.0	142.8
1992	92.0	14.3	32.4	22.1	127.9	301.5	2.0	2.8	128.7	37.4
1993	229.4	23.3	44.7	2.9	113.4	151.5	8.0	0.9	107.5	27.7
1994	133.3	82.0	18.5	48.1	74.2	179.0	0.0	0.4	201.8	54.1
1995	162.8	26.3	54.0	2.3	45.8	45.4	49.4	0.2	560.1	32.7
1996	203.8	19.7	21.2	22.2	68.2	345.4	7.3	2.5	260.0	41.0
1997	207.7	26.4	25.3	9.8	67.8	374.3	2.2	2.6	317.7	75.8
1998	229.3	52.6	25.3	7.9	86.3	418.8	2.3	1.6	330.5	93.5
1999	160.4	51.7	23.5	6.0	72.7	284.7	6.1	0.4	339.7	32.4
2000	120.6	63.4	28.1	23.1	79.2	198.4	14.3	0.5	341.0	52.5
2001	158.3	81.6	20.9	16.1	100.7	234.4	22.9	2.2	303.4	35.8
2002	279.1	12.2	12.5	14.7	97.5	426.8	4.9	0.7	226.5	30.4
2003	161.3	30.5	14.7	24.6	70.8	207.4	13.6	0.8	181.0	24.1
2004	127.0	50.5	48.1	6.1	89.2	20.5	11.2	3.0	247.6	33.1
2005	94.4	50.6	34.9	8.3	202.0	61.9	59.0	15.9	288.4	24.2
2006	113.7	22.4	12.9	6.6	167.4	219.1	30.8	6.4	224.1	31.7
2007	100.3	40.8	9.2	19.1	180.3	188.1	31.2	1.2	201.0	39.6
2008	59.5	33.7	14.6	33.9	165.2	125.7	5.2	6.2	267.9	61.5
2009	129.7	11.3	14.7	44.4	150.8	291.3	15.2	3.2	220.3	26.4

Figure 1, a box and whisker graph, shows the inequality measure over time and across regions. The graph shows changes in the quantile range over time. The interquantile range increases during the period 1960 through 1965 and then again after 1975. This later increase corresponds with the introduction of a more market oriented agricultural policies, providing support for the specification in Equation 8.

Table 2 presents the sample statistics for the regional inequalities along with the statistics for the pre-FAIR period (*i.e.*, 1950 through 1995) and the post-FAIR period (*i.e.*, 1996 through 2009). These sample statistics confirm the results from Table 1. The average inequality is highest for the entire sample for the Southeast region followed by the Mountain and then the Northeast regions. Examining the differences in the mean and standard deviation across each subsample, there appears to be significant changes in the inequality for the Corn Belt going from a mean 67.4 and standard deviation of 50.7 for the pre-FAIR period to a mean of 21.9 and standard deviation of 10.4 in the post-FAIR period. In the Northern Plains, the mean declines from 37.9 to 17.3 and the standard deviation declines from 44.6 to 11.5. In the Southern Plains the mean falls from 12.2 to 3.4 and the standard deviation falls from 15.9 to 4.1, and in the Pacific states the mean falls from 76.3 to 43.0 and the standard deviation falls from 80.3 to 20.8. On the other hand, the mean of the inequality increases from 50.6 in the pre-FAIR period to 114.2 in the post-FAIR period and the Mountain region where the mean

inequality increases from 137.9 to 267.8. Thus, the overall sample statistics support a general change in the relationship between government payments and farmland values.

**Figure 1.** Inequality measure over time across regions.



The bottom of Table 2 presents the ordinary least squares estimates (with the standard deviations and confidence levels estimated using a jackknife procedure [41,42] to correct for the possibility of non-normality and heteroscedasticity in the data) of the model presented in Equation (8). The results for the Lake States, Corn Belt, Southern Plains, Mountain, and Pacific regions reject the null hypothesis of no structural shift. For the Lake States, Corn Belt, and Southern Plains indicate that the shift to FAIR is associated with a reduction in the information inequality. Thus, after the introduction of FAIR the farmland values in these regions were distributed more like the direct government payments. Results from this study are consistent with the findings in recent literature [36,37]. This is not the case with the Mountain region where the distribution of farmland values became less similar to the distribution of direct government payments.

The results also indicate that the trend variable is statistically significant and positive for the Northeast, Lake States, Corn Belt, Appalachia, and Southern Plains, and statistically significant and negative for the Southeast. In addition, the relative index in prices received is significant and positive for the Corn Belt, Northern Plains, and Southern Plains, and statistically significant and negative for the Southeast region.

**Table 2.** Analysis of regional inequality between land values and government payments.

	Northeast	Lake States	Corn Belt	Northern Plains	Appalachia	Southeast	Delta	Southern Plains	Mountain	Pacific States
<b>Full Sample</b>										
Min	21.0	0.1	9.2	2.3	2.0	7.0	0.0	0.0	34.3	2.2
Quartile 1	97.3	13.1	24.9	11.9	32.9	163.4	7.3	1.5	90.5	26.3
Median	112.4	26.6	41.1	18.8	65.0	260.0	22.1	5.2	162.9	41.8
Quartile 3	154.9	52.0	76.6	34.4	83.8	330.9	59.5	12.1	217.1	79.8
Max	281.5	37.4	230.3	220.5	202.0	519.0	17.6	63.1	560.1	341.5
Mean	125.1	35.2	56.8	33.1	65.4	249.5	34.9	10.2	168.2	68.6
Std. Dev.	55.0	29.1	48.6	40.3	45.2	130.1	37.1	14.5	97.9	72.2
<b>1950–1995 Subsample</b>										
Min	21.0	0.1	10.0	2.3	2.0	7.0	0.0	0.0	34.3	2.2
Quartile 1	93.0	10.8	32.5	13.6	25.9	155.5	9.8	2.0	82.3	26.0
Median	106.9	25.0	52.8	20.0	42.7	272.6	33.5	5.9	127.1	49.0
Quartile 3	136.5	52.7	82.3	45.2	70.2	329.7	63.9	16.0	179.6	88.7
Max	281.5	137.4	230.3	220.5	127.9	519.0	217.6	63.1	560.1	341.5
Mean	116.5	34.0	67.4	37.9	50.6	251.6	40.6	12.2	137.9	76.3
Std. Dev.	51.1	31.4	50.7	44.6	32.5	133.2	39.9	15.9	87.9	80.3
<b>1996–2009 Subsample</b>										
Min	59.5	11.3	9.2	6.0	67.8	20.5	2.2	0.4	181.0	24.1
Quartile 1	115.4	23.4	14.6	8.0	74.3	190.7	5.4	0.9	224.7	30.7
Median	144.0	37.3	21.1	15.4	93.4	226.8	12.4	2.4	264.0	34.5
Quartile 3	193.2	51.4	25.3	22.9	161.6	331.9	21.0	3.2	314.1	49.6
Max	279.1	81.6	48.1	44.4	202.0	426.8	59.0	15.9	341.0	93.5
Mean	153.2	39.1	21.9	17.3	114.2	242.6	16.2	3.4	267.8	43.0
Std. Dev.	59.6	20.4	10.4	11.5	47.9	123.9	15.6	4.1	53.3	20.8
<b>Regression Results</b>										
Constant	72.31 (107.10) <sup>2</sup>	-3.82 (60.95)	-122.69 <sup>*1</sup> (167.88)	-129.64 (153.80)	39.74 (62.12)	854.44 <sup>**</sup> (843.20)	-36.64 (95.41)	-47.29 <sup>**</sup> (66.28)	187.40 (247.73)	157.49 (168.79)
Trend	1.98 <sup>**</sup> (2.04)	1.09 <sup>**</sup> (1.34)	2.24 <sup>**</sup> (2.75)	1.60 (1.90)	1.15 <sup>**</sup> (1.43)	-5.39 <sup>**</sup> (5.60)	0.27 (1.22)	0.68 <sup>*</sup> (0.87)	0.86 (2.32)	-0.67 (1.57)
FAIR	-23.51 (32.92)	-22.39 <sup>**</sup> (26.92)	-55.78 <sup>**</sup> (60.39)	-14.61 (19.10)	22.48 (28.50)	-44.59 (77.99)	-3.24 (18.30)	-11.17 <sup>**</sup> (13.32)	75.30 (95.59)	-40.35 (54.00)
Prices Received	-0.01 (0.28)	0.06 (0.24)	0.71 <sup>**</sup> (0.86)	0.67 <sup>**</sup> (0.75)	-0.08 (0.21)	-2.46 <sup>**</sup> (2.43)	0.37 (0.50)	0.23 <sup>***</sup> (0.30)	-0.36 (0.65)	-0.34 (0.42)

1. \*\* and \* denotes statistical significance at the 0.05 and 0.10 levels of confidence. Statistical significance levels are computed using Jackknifing.

2. Numbers in parenthesis denote standard error, computed through jackknifing.

## 5.2. Aggregate Inequalities

Table 3 presents the aggregate measures of the inequality between the distributions of farmland values and government payments. The total inequality measure is relatively stable until 1976 when it increases from 169.0 in 1975 to 333.4. It then stays relatively high through 2001. The decomposition

indicates that the variation in information is largely due to changes in the inequality between regions (as depicted in column 2).

**Table 3.** Aggregate inequality ( $\times 1,000$ ) between land values and government payments.

Year	Regional Inequality	Average Inequality	Total Inequality
1950	68.7	35.9	104.4
1951	58.2	37.6	95.6
1952	44.9	50.6	95.1
1953	43.0	54.4	96.8
1954	57.7	42.0	100.1
1955	92.2	65.7	157.2
1956	79.6	62.0	141.8
1957	114.3	54.4	169.4
1958	134.2	74.0	208.9
1959	90.6	87.2	177.8
1960	92.7	97.5	190.1
1961	134.2	62.3	197.0
1962	118.7	81.5	200.9
1963	137.3	68.2	206.1
1964	157.2	103.3	261.3
1965	150.6	95.5	246.8
1966	99.5	72.0	172.5
1967	104.1	68.8	173.8
1968	84.7	57.0	142.7
1969	74.4	52.4	128.0
1970	84.5	55.7	141.4
1971	102.8	55.2	159.6
1972	103.0	57.5	162.2
1973	92.0	55.4	149.7
1974	95.4	70.6	165.7
1975	110.2	58.8	169.0
1976	196.7	136.8	333.4
1977	250.6	100.0	351.1
1978	188.3	117.0	306.0
1979	248.6	71.6	320.5
1980	216.9	149.0	366.1
1981	235.7	138.3	374.5
1982	204.5	72.8	278.3
1983	148.5	73.1	223.5
1984	81.7	40.1	123.0
1985	150.7	58.5	211.2
1986	176.2	92.3	270.9
1987	193.4	98.0	294.8
1988	202.7	92.4	299.2
1989	149.0	68.6	220.7
1990	178.5	89.7	271.2

Table 3. Cont.

Year	Regional Inequality	Average Inequality	Total Inequality
1991	189.5	90.6	282.9
1992	147.3	66.3	216.4
1993	181.5	62.2	246.7
1994	155.3	93.3	251.0
1995	193.7	102.6	298.5
1996	152.5	86.3	241.1
1997	164.3	98.9	265.6
1998	172.3	108.6	283.0
1999	177.7	87.7	267.2
2000	151.1	87.1	239.9
2001	164.9	87.7	254.7
2002	80.6	89.2	171.2
2003	114.0	62.9	178.3
2004	130.7	66.3	198.5
2005	142.2	83.6	227.3
2006	122.1	79.7	202.8
2007	116.5	75.3	192.9
2008	84.0	78.8	163.5
2009	70.1	78.7	149.3

Table 4 presents the ordinary least squares (again using jackknifing to correct for non-normality and heteroscedasticity in the data) results for the linear specification in Equation (8) applied to the aggregate information measures.

Table 4. Aggregate inequality between land values and government payments.

Year	Regional Inequality	Average Inequality	Total Inequality
Constant	96.45 <sup>1</sup> (111.59) <sup>2</sup>	46.43* (69.16)	147.00 (177.80)
Trend	2.34** (2.63)	0.85** (0.84)	3.21** (3.89)
FAIR	-80.54** (87.00)	-13.86 (16.07)	-95.72** (99.05)
Prices Received	-0.08 (0.27)	0.05 (0.14)	-0.05 (0.46)

1. \*\* and \* denotes statistical significance at the 0.05 and 0.10 levels of confidence, respectively. Statistical significance levels are computed using Jackknifing
2. Numbers in parenthesis denote standard error, computed using Jackknifing.

The results indicate that the FAIR dummy is statistically significant for the regional inequality measure (*i.e.*, the inequality measure between regions) and not for the average inequality measure across all regions. Hence, the results support the contention that the implementation of FAIR has significantly affected the relationship between the share of farmland values and the share of

government payments between regions. However, the results indicate that distribution of farmland values has become more like the distribution of government payments. Results from this study are consistent with the findings in recent literature [36,37].

## 6. Conclusions

The passage of the Federal Agricultural Improvement and Reform (FAIR) Act of 1996 was touted as a major move toward a market-oriented agricultural policy. A significant plank in this contention was that production decisions would be largely decoupled from government programs by the move to Agricultural Market Transition Assistance (AMTA) payments. The effect of the shift in agricultural policy on farmland valuation, however, was somewhat more ambiguous. The decoupling of production decisions from government policies would reduce the linkage between agricultural policies and cash flows to farmland from operations, but AMTAs and other direct payments were still distributed based on the base production from pre-FAIR agricultural programs. More recent programs such as the Food Security and Rural Investment (FSRI) Act of 2002 and the Food, Conservation, and Energy (FCE) Act of 2008 contain provisions for Countercyclical payments which are based on the same base acreages and established yields. To analyze these competing forces, this study computes an information measure to analyze the divergence between farmland values and direct government payments and then estimates whether the implementation of FAIR is statistically significant in explaining movements in this informational metric over time. The results indicate that FAIR is associated with a significant decline in the inequality between farmland values and government payments for the Northeast, Lake States, Corn Belt, and Southern Plains, but is associated with an increase in the inequality for Mountain region.

To further investigate the effect of FAIR on the relationship between farmland values and government payments, the study then examines the effect of the FAIR on aggregate information measures. These results indicate that FAIR is significant in explaining the variation in regional inequality. Hence, the introduction of FAIR has reduced the dispersion between farmland values and government payments between regions. The numeric results indicate that the introduction of FAIR is actually associated with the dispersion of farmland values becoming more like the distribution of direct government payments. This may actually be the result of an increased certainty of direct government transfers under FAIR, FSRI, and FCE.

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