FARM PROGRAMS AND LAND VALUES IN MOUNTAIN STATES: ALTERNATIVE PANEL ESTIMATORS

BY

SALEEM SHAIK
215E Lloyd-Ricks, West Wing
Department of Agricultural Economics
Mississippi State University
Mississippi State, MS-39762
Phone: (662)325-7992; Fax: (662)325-8777
E-mail: shaik@agecon.msstate.edu

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Abstract

The relative proportion of agricultural land values generated by farm program payments, farm returns, and non-farm activities for the mountain region and the U.S. are estimated for the period 1939 to 2005. Results suggest the contribution of farm program payments to agricultural land values in the mountain region and the U.S. is quite similar and robust across the four alternative panel estimators for the period 1939-2005. The contribution of farm returns to the value of land is lower in the mountain region compared to the U.S. The contribution of non-farm activity to land values is higher for the U.S. compared to the mountain region. The relationship between farm program payments and farm returns is positive in mountain region and negative for the U.S.

JEL classification:

Keywords: Mountain region and U.S, agricultural land values; farm program payments; farm returns, non-farm activity, alternative panel estimators, historical data, 1939-2005.

FARM PROGRAMS AND LAND VALUES IN MOUNTAIN STATES: ALTERNATIVE PANEL ESTIMATORS[1]

Federal farm programs and their affects on farm economic structure have been the subject of research since they were introduced during the first year of the administration of President Franklin D. Roosevelt in 1933. Over the last two decades, attention has focused on the cause and effect of farm programs on land values or farm real estate. Farm real estate comprises approximately 80 percent of farm assets and a large share of the value of farm payments is believed to be capitalized into these values. One of the principal papers presented at the 2005 AAEA meetings estimated the contribution of farm program payments and crop returns to agricultural land values at the U.S. level. Using the same dataset, Shaik, Atwood and Helmers (2005) estimate the contribution of farm payments and farm returns to the value of land at the regional level. Empirical application to the south and other regions provides evidence of the contribution of farm program payments to land values. Furthermore, the contributions of farm returns to the value of land in the south and other region were similar. However, the south reveals an increasing trend in the contribution of farm program payments compared to the downward trend in other regions.

In this paper, first I extend their research to examine the contribution of nonfarm activity along with farm programs and farm returns to the value of agricultural land in the mountain region. The mountain region is comprised of Arizona, Colorado, Idaho,

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Montana, Nevada, New Mexico, Utah, and Wyoming. In addition, I compare the contributions of farm program payments, farm returns, and non-farm activities in the mountain region to the U.S estimates. Second, I use four alternative panel estimators to examine the robustness of the contributions of farm program payments, farm returns and non-farm activities. For the four alternative panel estimators, I use an estimated generalized least squares procedure that involves estimating the variance components in the first stage and then using the estimated variance--covariance matrix to apply generalized least squares to the data. Several possibilities exist for the first stage, namely the use of pooled OLS residuals (Wallace and Hussian); within residuals (Amemiya); within, between cross-sectional residuals and between time-series residuals (Swamy and Arora); or within LSDV residuals (Nerlove) in the estimation of alternative panel estimators. For details on the four alternative panel estimators see Baltagi (1981, 2001, 2002) and Krishnakumar (1988, 1996).

Some regions in the U.S. are more dependent on farm program payments for farm income due to differences in the type of agriculture, supported commodities produced, and non-farm activities. Total farm program payments received by producers and total farm receipts for the mountain region and U.S. in billion dollars (real 2000 dollars) are presented in table 1. From 1939 to 2005, the mountain region received $47.20 billion, which constitutes only 8 percent of total U.S. farm program payments of $589.87 billion. During the same period, the mountain region generated 7.65 percent of the $12.70 trillion in total U.S. farm receipts.

For the mountain region, total farm program payments represent 4.86 percent of total farm receipts for the time period 1939 to 2005. However, this percentage varies across farm bill periods, from a high of 8.34 percent from 1985 to 1989 to a low of 1.31 percent from 1948 to 1953. In comparison, total farm program payments are 4.65 percent of total farm receipts for the other regions from 1939 to 2005. This level was less than 1 percent from 1948 to 1955 and reached a high of 8.43 percent from 1985 to 1989. Given the similarities between total farm program payments and total farm receipts, should one expect similar contributions by expected farm returns and farm program payments to agricultural land values in both the mountain region and the U.S?

In the next section, a brief discussion of the earlier literature on the role of farm program payments on land values is presented, followed by the extended income capitalization model estimated by the triangular-structure simultaneous equations econometric model. Empirical results of the application to state-level data for the mountain region and the U.S. are presented. Eight and 48 states form the cross-sectional units for the mountain region and the U.S., respectively, and the time series consists of the period 1939 to 2005. Policy implications of the research are presented in the conclusions.

Earlier Literature

Early empirical research in explaining agricultural land values involved the use of individual farm data (Haas, Ezekiel) and county data (Wallace). These early studies were followed by a large number of analyses directed at quantifying variables impacting agricultural land values. These studies emphasized the capitalization of expected long run changes in farm returns into agricultural land values. The impacts of inflation, debt financing, and financial speculation received considerable attention as agricultural land values increased rapidly during the late 1970s followed by a significant decline in values after 1981. Other studies addressed the increase in urban and environmental influences on land values. This paper primarily emphasizes the impact of government payments on agricultural land values. Hence, the literature with respect to government payments is cited largely to the exclusion of the many general studies of agricultural land values.

Studies focusing on the impact of government payments on agricultural land values have received renewed attention. In 1969 Reynolds and Timmons found that government payments were capitalized into land values, followed by studies examining price support influences (Harris) and the financial impacts of federal programs on farm firms. In the last two decades studies of government payment impacts have included those of specific crops and specific programs (Goodwin and Ortalo-Magne; Shoemaker; and Vantreese, et al.). Payments linked to program bases and the resulting impact on agricultural land values was examined by Duffy, et al. The elimination of government payments and the resulting impact on agricultural land values was analyzed by Barnard, et al. and Gertel. The overall impact of government payments relative to crop returns was examined by Weersink, et al. Featherstone and Baker (1988) analyzed the effects of income support on land values and rents. A cross-sectional examination by county of government payment effects on land values by Barnard, et al. in 2001 used the United States Department of Agriculture’s 2000 Agricultural Resource Management Survey.

Based on their analysis for the eight regions, eliminating government programs would reduce agricultural land values 12 to 69 percent, or $104 to $903 per acre. Gardner, using 315 counties over a longer time period, examined the role of government payments in increasing agricultural land values. Papers presented at the 2003 ASSA meetings related to government payments and agricultural land values included the use of a capitalization model by Goodwin, et al.. Lence and Mishra examined the effect of government payments on cash rents, while a similar study by Roberts, et al. focused on general rents.

Recently Shaik, Helmers, and Atwood estimated the contribution of farm program payments and crop returns to agricultural land values with an empirical application to 48 U.S. states from 1940 to 2002. Their conclusions indicate the contributions of farm program payments and crop receipts to agricultural land values were 30 and 70 percent, respectively. Furthermore, they found the contribution of farm program payments to land values has actually declined from a high of 30 to 40 percent during the 1938 to 1980 period to about 15 to 20 percent during subsequent farm bill periods. However, the results provide implications only at the U.S. level. In a recent paper Shaik et al. compared the contributions of farm program payments, farm returns and other returns to agricultural land values in the southern states and the rest of the U.S. Results suggest the contribution of farm program payments to agricultural land values in the southern region is always less than in other regions. However, the South revealed an increasing trend in the contribution of farm program payments compared to the downward trend in other regions.

Extended Income Capitalization Model

The representation of the extended income capitalization model for land values explicitly differentiating returns into three components can be represented as:

(1) $$V = f\left((c, nf, g),\, r^{-1}\right)$$

where V is land value, c is expected farm returns, nf is the returns from non-farm activities, g is expected farm program payments, and r is the real interest rate. To account for the growing nonfarm demand for land due to urban expansion, the real land value equation includes non-farm activities. Due to the increased demand for land, non-farm activities are expected to be positively related to the value of land.

The extension of the model faces identification issues introduced by the counter-cyclical or inverse relationship between *c* and *g*. The inverse relationship between *c* and *g* may lead to insignificant or even a negative estimated relationship between farm program payments and land values. Jointly estimating a land value equation and an expected farm program payment equation overcomes the identification issue and provides a more accurate estimate of the income capitalization model.

The extended income capitalization model can be represented as:

(2) $$\begin{aligned} V &= f\left(c, nf, g, r^{-1}\right) \\ g &= f\left(c\right) \end{aligned}$$

To address the difference in the type of production systems and commodities produced, a Herfindahl index of farm revenue ($HIrev$) is included in the farm program payment equation. Predicting the relationship between *HIrev* and farm program payment a priori is difficult. Also included in the program payment equation is the Herfindahl index of crop acreage diversification ($HIpa$) and a farm size variable ($fsize$) to account for the wide range of agricultural crop intensity in the U.S. With these additional variables the extended income capitalization model is:

(3)
$$\begin{aligned} V &= f\left(c, nf, g, r^{-1}\right) \\ g &= f\left(c,\ fsize, HIpa, HIrev\right) \end{aligned}$$

where the variables are as defined above.

To examine the extended income capitalization model as defined in equation (3), the following pooled triangular-structure simultaneous equation model is proposed:

(4)
$$\begin{aligned} V_{it} &= \alpha_1 + \beta_{1,c}\, c_{it} + \alpha_g\, g_{it} + \beta_{1,r}\, r_{it} + \beta_{1,nf}\, nf_{it} + \varepsilon_{1,it} \\ g_{it} &= \alpha_2 + \beta_{2,c}\, c_{it} + \beta_{2,fsize}\, fsize_{it} + \beta_{2,herfA}\, HIpa_{it} + \beta_{1,herfR}\, HIrev_{it} + \varepsilon_{2,it} \end{aligned}$$

where i and t represent the cross-sectional and time series dimensions, and V , c , nf , g , r , $HIrev$, $HIpa$, and $fsize$ are as defined above. Further, the sum of the elasticities for expected farm returns, expected farm program payments and non-farm activities should equal unity.

Four alternative panel estimators of the triangular-structure simultaneous equations model as defined in equation 4 are estimated using the following traditional three-stage least square estimator.

Step 1: Regress each endogenous variable $\left(V_{it}\ and\ g_{it}\right)$ against all the exogenous variables $\left(c_{it}, r_{it},\ nf_{it},\ fsize_{it},\ HIpa_{it},\ and\ HIrev_{it}\right)$ and get the predicted endogenous variables $\left(\widehat{V_{it}}\ and\ \widehat{g_{it}}\right)$. This step results in the reduced form equations:

(5a) $$V_{it} = f\left(c_{it}, r_{it}, nf_{it}, fsize_{it}, HIpa_{it}, HIrev_{it}\right) + u_{1,i} + v_{1,t} + w_{1,it}$$

(5b) $$g_{it} = f\left(c_{it}, r_{it}, nf_{it}, fsize_{it}, HIpa_{it}, HIrev_{it}\right) + u_{2,i} + v_{2,t} + w_{2,it}$$

Step 2: Regress original structural equations, replacing endogenous explanatory variables $\left(V_{it}\ and\ g_{it}\right)$ with predicted values and $\left(\widehat{V_{it}}\ and\ \widehat{g_{it}}\right)$ to get

(6a) $$V_{it} = f\left(c_{it}, r_{it}, \widehat{g_{it}}, nf_{it}\right) + u_{1,i} + v_{1,t} + w_{1,it}$$

(6b) $$g_{it} = f\left(c_{it}, fsize_{it}, HIpa_{it}, HIrev_{it}\right) + u_{2,i} + v_{2,t} + w_{2,it}$$

The saved residuals from these regressions are labeled $\left(\widehat{w_{1,it}}\ and\ \widehat{w_{2,it}}\right)$.

Step 3: Re-estimate structural equations with $\left(\widehat{w_{1,it}}\ and\ \widehat{w_{2,it}}\right)$ included as explanatory variables. Because $\left(\widehat{w_{1,it}}\ and\ \widehat{w_{2,it}}\right)$ are correlated, $\widehat{w_{2,it}}$ provides information for explaining $\left(V_{it}\right)$ and $\widehat{w_{1,it}}$ provides information for explaining $\left(g_{it}\right)$. Including this information improves the estimates.

(7a) $$V_{it} = f\left(c_{it}, r_{it}, \widehat{g_{it}}, nf_{it}\right) + u_{1,i} + v_{1,t} + w_{1,it} + \widehat{w_{2,it}}$$

(7b) $$g_{it} = f\left(c_{it}, fsize_{it}, HIpa_{it}, HIrev_{it}\right) + u_{2,i} + v_{2,t} + w_{2,it} + \widehat{w_{1,it}}$$

Each of the three-stages is estimated using the four alternative panel estimators: Fuller and Battese, Wansbeek and Kapteyn, Wallace and Hussain, and Nerlove (for details refer to Baltagi, 2001). In the first stage, pooled OLS residuals are used by Wallace and Hussian; within residuals by Amemiya; within, between cross-sectional residuals, and between time-series residuals by Swamy and Arora, Fuller and Battese, and Wansbeek and Kapteyn; or within LSDV residuals by Nerlove.

Table 2 provides summary statistics of the variables used in the analysis for the mountain region and the U.S. The average mountain farm real estate value of $367 per acre is lower than the average farm real estate value for the U.S. ($1,207). During the same time period, the average expected farm receipts per acre of $71.77 and the average farm program payments of $3.09 per acre are lower than the U.S. average. The non-farm employment per acre in the mountain region is lower than the U.S. due to larger-sized farms, as the average farm size of 2,254 acres in the mountain region is relatively large compared to the average farm size in the U.S. of 595 acres. I assume that producers across the U.S. face the same real interest rate. The value of the Herfindahl index of farm revenue for the mountain region is 32.5 percent, higher than that of the U.S, indicating more revenue is derived from specialized crops and livestock in the mountain region. In contrast, the Herfindahl index of program crop acreage has a value of 43 percent, slightly lower for the mountain region than the U.S., indicating more diversification of program crop acreage.

Empirical Results

The parameter coefficients and the partial elasticity measures estimated from the pooled model (equation 4) for the mountain region and the U.S. are presented in table 3. The parameter coefficients and the partial elasticity measures estimated from the four alternative panel models (equations 5, 6, and 7) are presented in tables 4 and 5 for the mountain region and the U.S., respectively. In the discussion of the results and comparisons across the models, I use partial elasticity measures due to ease of interpretation.

The expectations of the variables for farm returns, farm program payments, real interest rates, and farm real estate were estimated by an autoregressive process for each variable in each state rather than using an ad hoc lag length. The order of the autoregressive error model is selected by a stepwise autoregression. The stepwise autoregression method initially fits a high-order model with many autoregressive lags and then sequentially removes autoregressive parameters until all remaining autoregressive parameters have significant *t*-tests. The predictions from the autoregressive error model form the expectations of the variables. The third-order autoregressive error model for the value of land can be represented as:

$$\begin{aligned} &V_t = \alpha + \beta t + \varepsilon_t \\ &\varepsilon_t = -\varphi_1 \varepsilon_{t-1} - \varphi_2 \varepsilon_{t-2} - \varphi_3 \varepsilon_{t-3} + \nu_t \\ &\nu_t \sim IID\left(0, \sigma^2\right) \end{aligned} \tag{8}$$

The notation $\nu_t \sim IID\left(0,\sigma^2\right)$ indicates that each ν_t is normally and independently distributed with mean zero and variance σ^2. By simultaneously estimating the regression coefficients β and the autoregressive error model parameters $\varphi_1, \varphi_2, and\ \varphi_3$, the procedure corrects the regression estimates for autocorrelation. This time-series method is referred to as autoregressive error correction or serial correlation correction.

Results for the pooled extended income capitalization model presented in table 3 indicate expected signs on the variables in both of the equations for agricultural land values and farm program payments, but the real interest rate is the exception. Based on the elasticity, a ten percent decrease in expected farm returns is expected to reduce agricultural land values by 5.4 percent in the mountain region and 4.5 percent for the U.S.. A ten percent decrease in expected farm program payments implies decreases of 0.08 and 2.3 percent in average agricultural land values in the mountain region and the U.S., respectively. The sign on the non-farm activities variable was positive and significant, indicating the non-farm economy positively influenced the value of agricultural land. In an income capitalization model the real interest rate is expected to be negatively related to the value of land. Results indicate a positive sign for the mountain region and the U.S., but real estate is a significant variable only for the U.S.

Due to the counter-cyclical nature of expected farm program payments and farm returns in the farm program payments equation, a negative relationship is expected. Results indicate a positive and significant relationship between farm program payments and expected farm returns in the mountain region and the U.S. The negative sign on farm size indicates a ten percent increase in size of the farm is associated with an almost 2.0 percent and 1.5 percent lower per acre farm program payment for each of the respective areas examined. The negative and significant coefficient for the Herfindahl index of program crops acreage indicates farm program payments are lower under greater crop enterprise specialization in both regions. The positive and significant coefficient in the mountain region for the Herfindahl index of farm revenue indicates agricultural land values are higher under greater farm enterprise diversification.

Next, I examine the robustness of the contributions from farm program payments, farm returns, and non-farm activities using four alternative panel estimators. The results of the four alternative panel estimators are presented in table 4 for the mountain region and table 5 for the U.S. Mountain region regression results from table 4 indicate the variables for expected farm returns, farm program payments, and non-farm activities are positive and significantly related to agricultural land values across the four alternative panel estimators with one exception. The farm returns variable is positive but insignificant and is consistent across the four alternative estimators. Estimates for the farm program payments elasticity are 60.8 percent, 44.1 percent, 55.3 percent, and 42.8 percent from the Fuller-Battese, Wansbeek-Kapteyn; Wallace-Hussain; and Nerlove methods, respectively. Although farm returns was insignificant, the elasticity measures from the four alternative panel estimators are 6.4 percent, 17.9 percent, 12.7 percent and 18 percent. Similarly, the estimated elasticity of non-farm activities is 19.2 percent, 17.4 percent, 19.7 percent, and 17 percent from the four alternative estimators. Two (Fuller-Battese and Wallace-Hussain) of the four panel estimators found a negative sign for real interest rates but the variable is insignificant. The sum of the elasticities for farm returns, farm program payments, and non-farm activities ranges from 0.81 to 0.86 across the four alternative panel estimators.

For the farm program equation, the expected farm returns variable is positive and significantly related to farm program payments. The positive sign is consistently found across the four alternative panel estimators and the elasticity ranges from 0.611 to 0.672. The negative significant coefficient for the Herfindahl index of program crop acreage indicates farm program payments are lower under greater crop enterprise specialization. The positive significant coefficient for the Herfindahl index of farm revenue indicates farm program payments are higher under greater crop enterprise specialization. The negative insignificant coefficient for the farm size variable indicates farm program payments are higher for farms with less acreage.

In contrast, results for the U.S. presented in table 5 indicate the expected signs on the variables in both the real land value and farm program payment equations across the four alternative panel estimators. The expected farm returns, farm program payments, and non-farm activities variables are positive and significantly related to agricultural land values across the four alternative panel estimators. The elasticity of farm program payments is estimated to be 56.9 percent, 44.9 percent, 56.4 percent, and 44.1 percent from the Fuller-Battese, Wansbeek-Kapteyn; Wallace-Hussain; and Nerlove methods, respectively. Compared to the mountain region, the farm returns variable was significant for the U.S. and the elasticity estimates from the four alternative panel estimators are 28.5 percent, 29.2 percent, 28.8 percent, and 29.2 percent. Similarly, the estimated elasticity of non-farm activities is 31.5 percent, 30.9 percent, 31.4 percent, and 30.8 percent from the four alternative estimators. Even though the real interest rates variable is insignificant, the four alternative estimators found a negative sign. The sum of the elasticity of farm returns, farm program payments, and non-farm activities ranges from 1.04 to 1.167 across the four alternative panel estimators.

Results for the farm program equation indicate a negative and significant relationship to farm returns. The negative sign is consistently estimated across the four alternative panel estimators and the elasticity ranges from 0.073 to 0.107. The negative significant coefficient for the Herfindahl index of program crop acreage indicates farm program payments are lower under greater crop enterprise specialization. The positive significant coefficient for the Herfindahl index of farm revenue indicates farm program payments are higher under greater crop enterprise specialization. The negative insignificant coefficient for the farm size variable indicates farm program payments are higher for farms with less acreage.

Conclusions

In this paper, I investigate the differential contributions of farm program payments, farm returns, and non-farm activities to the value of land with an empirical application to the mountain region and the U.S. Additionally, this research uses an autoregressive error correction model to estimate the expectations of the variables for historical data from 1939-2005. Overall, the empirical application to eight mountain states and 48 states in the U.S. indicates a positive and significant relationship between expected farm receipts, expected farm program payments and non-farm activities. The real interest rate is negatively related to real agricultural land values with few exceptions.

First, the results indicate the contributions to agricultural land values are not only explained by farm returns and farm program payments but also by non-farm activities. This relationship is clearly indicated by results for the U.S., as 30 percent of the contribution to land values is from the non-farm activities variable, while this contribution is only around 20 percent for the mountain region. With respect to the contribution of farm program payments to the value of land, the range is from 42.8 to 61 percent for the mountain region and 44 to 57 percent for the U.S. The contribution of farm returns to the value of land in the mountain region ranges from 6 to 18 percent but this parameter coefficient is insignificant. In contrast, the contribution is almost 30 percent for the U.S.

Second, the estimate of the contribution of farm returns and non-farm activities to the value of land from the four alternative panel estimators for the U.S. seems to deviate little with respect to the elasticity. In the mountain region, even the contributions of the farm returns to land values varies across the four alternative panel estimators. However, the estimates seem to vary quite a bit for farm program payments across the four alternative approaches for the mountain region and the U.S. In the mountain region, the sign on the real interest changes across the four alternative panel estimators. Although the sign on real interest rate does not change, the estimates vary across the four alternative panel estimators. In the second equation, a negative and significant relationship is found between farm payments and farm returns for the U.S., and the elasticity varies across the four alternative panel estimators. In contrast, positive and significant relationship is estimated between farm payments and farm returns and the elasticity did not vary across the four alternative panel estimators.

Third, the contributions of farm program payments to the value of land in the mountain region and the U.S. are in the same range. The contribution of non-farm activities is almost a third less in the mountain region compared to the U.S. The contribution of farm returns to the value of land in the mountain region is insignificant and at least ten percent less compared to the U.S. The estimated elasticity of the real interest rate is more than double for the U.S. compared to the mountain region for two alternative panel estimators. The elasticity of farm returns with respect to farm program payments is positive for the mountain region. The sign on the farm size variable is negative and insignificant for the mountain region. In contrast, the farm size variable is positive for the U.S. for three of the four alternative estimators. The elasticity of the Herfindahl index of program crops is negative for both the mountain region and the U.S., but the elasticity is almost three times larger in the mountain region. Finally, the sign on the Herfindahl index of farm revenue is positive for the mountain region and negative for the U.S.

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Table 1. Total farm receipts and program payments in real 2000 dollars (billion) by farm bill periods, 1939 -2005.

Farm Bill Period	Farm Receipts		Farm Program Payments	
	Mountain	**U.S.**	**Mountain**	**U.S.**
FB1 (1939-1947)	81.734	1,279.413	3.630	53.967
FB2 (1948-1953)	75.456	1,063.777	0.986	8.731
FB3 (1954-1955)	21.463	319.265	0.338	2.617
FB4 (1956-1964)	105.420	1,462.694	4.531	52.369
FB5 (1965-1969)	67.535	898.585	5.446	66.128
FB6 (1970-1972)	48.843	566.017	3.329	37.389
FB7 (1973-1976)	79.998	1,005.464	1.285	13.583
FB8 (1977-1980)	78.346	990.715	1.812	15.964
FB9 (1981-1984)	67.737	884.035	3.150	35.531
FB10 (1985-1989)	77.702	990.196	6.479	83.473
FB11 (1990-1995)	95.809	1,208.706	5.672	63.503
FB12 (1996-2002)	99.436	1,209.777	6.489	95.588
FB13 (2003-2005)	71.476	818.746	4.052	61.030
Total (1939 – 2005)	970.955	12,697.389	47.198	589.874

Table 2. Summary Statistics of the Variables, 1939-2005.

Variables	N	Mean	Std	Min	Max
Mountain Region[1]					
Real land values	536	367	298	48	2,078
Real interest rates	536	3.207	3.414	-7.669	9.394
Farm returns	536	71.755	61.717	13.632	340.773
Farm program payments	536	3.086	3.500	0.098	23.200
Non farm employment	536	23.077	29.452	1.936	194.317
Herfindahl index of Farm Revenue	536	32.553	12.838	15.631	69.886
Farm size	536	2,254	1,500	227	6,645
Herfindahl index of program crops	536	4.357	1.864	1.835	9.841
U.S.					
Real land values	3216	1,209	1,267	48	9,987
Real interest rates	3216	3.207	3.411	-7.669	9.394
Farm returns	3216	296	262	14	1,831
Farm program payments	3216	8.809	10.457	0.098	119.507
Non farm employment	3216	380	1,002	2	8,193
Herfindahl index of Farm Revenue	3216	26.726	10.973	10.742	69.886
Farm size	3216	595	984	52	6,645
Herfindahl index of program crops	3216	5.214	2.819	1.640	10.000

[1]Mountain region consist of the following 8 states - Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.

Table 3. Pooled Estimates of the Extended Income Capitalization Model.

	Mountain States		**U.S.**	
Variables	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity
Intercept	28.041		**91.214**	
Real interest rates	**11.427**	**0.104**	**10.577**	**0.029**
Farm returns	**2.762**	**0.545**	**1.843**	**0.455**
Program payments	9.774	0.083	**30.441**	**0.224**
Non farm employment	**2.955**	**0.190**	**0.662**	**0.214**
Intercept	1.321		**12.389**	
Farm Returns	**0.037**	**0.856**	**0.004**	**0.150**
Farm size	**-0.00027**	**-0.200**	**-0.002**	**-0.147**
Herfindahl index of program crops	**-0.261**	**-0.375**	**-0.803**	**-0.485**
Herfindahl index of farm revenue	**0.026**	**0.002**	0.015	0.045

Table 4. Alternative Panel Estimators of the Extended Income Capitalization Model for Mountains States.

	Fuller-Battese		Wansbeek-Kapteyn		Wallace-Hussian		Nerlove	
Variables	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity
Intercept	58.899		63.938		50.495		67.038	
Real interest rates	-3.133	-0.028	3.069	0.028	-2.066	-0.019	3.809	0.035
Farm returns	0.322	0.064	0.905	0.179	0.645	0.127	0.911	0.180
Program payments	**71.729**	**0.608**	**51.981**	**0.441**	**65.242**	**0.553**	**50.470**	**0.428**
Non farm employment	**2.979**	**0.192**	**2.702**	**0.174**	**3.060**	**0.197**	**2.644**	**0.170**
Intercept	3.511		4.116		3.270		4.394	
Farm Returns	**0.028**	**0.658**	**0.027**	**0.625**	**0.029**	**0.672**	**0.026**	**0.611**
Farm size	-0.00004	-0.030	-0.00001	-0.007	-0.00005	-0.037	-0.00001	-0.007
Herfindahl index of program crops	**-0.714**	**-1.024**	**-0.853**	**-1.225**	**-0.662**	**-0.950**	**-0.908**	**-1.303**
Herfindahl index of farm revenue	**0.022**	**0.002**	**0.023**	**0.002**	**0.022**	**0.002**	**0.024**	**0.002**

Bold indicates parameter coefficients are significant at or less than the 0.05 level.

Table 5. Alternative Panel Estimators of the Extended Income Capitalization Model for U.S.

Variables	Fuller-Battese		Wansbeek-Kapteyn		Wallace-Hussian		Nerlove	
	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity	Parameter Coefficient	Elasticity
Intercept	-116.104		-25.039		-113.944		-18.168	
Real interest rates	-25.380	-0.070	-10.440	-0.029	-24.992	-0.069	-9.357	-0.026
Farm returns	**1.153**	**0.285**	**1.183**	**0.292**	**1.167**	**0.288**	**1.182**	**0.292**
Program payments	**77.398**	**0.569**	**61.152**	**0.449**	**76.767**	**0.564**	**60.032**	**0.441**
Non farm employment	**0.975**	**0.315**	**0.954**	**0.309**	**0.970**	**0.314**	**0.953**	**0.308**
Intercept	**13.441**		**13.614**		**13.384**		**13.636**	
Farm Returns	**-0.003**	**-0.084**	**-0.003**	**-0.105**	**-0.002**	**-0.073**	**-0.003**	**-0.107**
Farm size	0.00012	0.008	**0.00041**	**0.029**	-0.00001	-0.001	**0.00043**	**0.030**
Herfindahl index of program crops	**-0.615**	**-0.372**	**-0.648**	**-0.392**	**-0.607**	**-0.367**	**-0.651**	**-0.393**
Herfindahl index of farm revenue	**-0.036**	**-0.111**	**-0.036**	**-0.110**	**-0.036**	**-0.111**	**-0.036**	**-0.110**

Bold indicates parameter coefficients are significant at or less than the 0.05 level.