Supply Response of Crops in the Southeast

Rachel Smith
Department of Agricultural Economics and Rural Sociology
Auburn University
202 Comer Hall
Auburn University, AL, 36849-5406
334-844-5636
Email: kichlrd@auburn.edu

Patricia Duffy
Department of Agricultural Economics and Rural Sociology
Auburn University
202 Comer Hall
Auburn University, AL, 36849-5406
334-844-5629
Email: duffypa@auburn.edu

James Novak
Department of Agricultural Economics and Rural Sociology
Auburn University
202 Comer Hall
Auburn University, AL, 36849-5406
334-844-3512
Email: novakjl@auburn.edu

Norbert Wilson
Department of Agricultural Economics and Rural Sociology
Auburn University
202 Comer Hall
Auburn University, AL, 36849-5406
334-844-5616
Email: wilsonl@auburn.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31-February 3, 2009

Abstract

An econometric model was used to estimate the supply response of corn, cotton, and soybeans in the Southeast United States. The analysis includes state-level data from 1991-2005 for Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia, taking into account the effect of wealth, revenue risk, and farm program provisions. Estimated elasticities were low and many parameters were not statistically significant.

Key words: Supply Response, Government Programs, Risk, Wealth

Supply Response of Crops in the Southeast

For row crops, the estimation of how supply will change in response to changes in market conditions is complicated by farm programs. Farm programs have historically provided producers with incentives to either increase or reduce production of covered commodities, often through changing the overall profitability of the enterprise and/or by reducing downside risk, either for the specific crop or for the farm firm as a whole. Programs have thus affected both the expected returns and the variability of returns. The degree to which producers respond to farm-program-induced risk reduction is an important consideration in determining the effect of farm programs on the supply of farm program commodities. Building on a study by Lin and Dismukes (2007), one that estimated supply response of row crops in the North Central United States, this paper estimates the supply response of row crops in the Southeast United States. Because there have not been any recent publications on supply response in the Southeast since Duffy, Shalishali, and Kinnucan (1994), this paper will provide updated estimations for the supply response of corn, cotton, and soybeans.

Supply response models take into account farmers' expected planting decisions, expected prices, expected yields, costs of inputs, farm programs, risk, and wealth. Government programs may include specific provisions that impact these decisions. Acreage reduction programs (ARP), which were in effect prior to the 1996 farm bill, required producers to set aside a specific amount of their "base" acreage to gain eligibility for loan benefits (Pollack et al., 1991; Lin et al., 1995). Marketing loan programs, which are still in effect, contain a specific loan rate under which producers can use their crop as collateral to receive a loan from the government.

The loan rate is a guaranteed price the producer receives, when the market price falls below the loan rate. Alternatively, farmers may choose to sell their crops at the market price and receive a loan deficiency payment, which is the difference between the market price and the loan rate (Westcott et al., 2002). These farm programs serve to reduce the risk that farmers face when making planting decisions. The producers' initial wealth may also impact their planting decisions, by allowing them to bear more risk.

Given the changes in both the market and institutional environment for row crops over the last decade, there is a strong need for more current research on this topic. This study analyzed supply response of cotton, soybeans, and corn in seven Southeast states, using a model based primarily on work by Chavas and Holt (1990) and Lin and Dismukes (2007). The effects of selected farm program provisions are taken into account as well as changes in expected market prices that affect row crop supply. Variables to capture the changes in farm program provisions that occurred over the study period are included in the estimated models.

Theoretical Background

Several previous studies have been published pertaining to this topic. This analysis used the framework from Chavas and Holt (1990) as well as modifications from Lin and Dismukes (2007). Chavas and Holt (1990) used expected utility maximization to develop a supply response model when estimating corn and soybean acreage on a national basis. Their model took risk (using revenue uncertainty), wealth effects, and government programs into account. First, it was assumed that the farm household has preferences represented by a von Neumann-Morgenstern utility function, and that the household maximizes expected utility subject to a budget constraint in which income is determined both by nonfarm sources (or wealth) and net returns from farming. These assumptions lead to a maximization problem expressed as:

(1) $$\max_{A_i} \{EU(w + \Sigma_{i=1} \pi_i A_i)\} \text{ s.t.}$$

(2) $$f(A) = 0.$$

where EU is expected utility, A_i is the number of acres devoted to the ith crop, A is a vector representing all the A_i, w is normalized initial wealth, π_i is normalized profit per acre of the ith crop, and f(A), the constraint, limits plantings to available acreage. For normalization, all prices are deflated by a price index. Profits depend on prices, yields, and costs. Prices and yields are unknown at planting time, so expectations are formed based on information available at the time, such as past yields and futures prices. If the household is not risk neutral, higher moments of the profit distribution (e.g. variance and co-variances) will influence decisions.

Chavas and Holt (1990) denote $A^*(w; \pi; \alpha)$ as the optimal number of acres per crop, which is dependent on wealth, expected profit per acre, and the higher moments of the profit distribution (α). The decision of A* made by famers under risk is homogenous of degree zero in initial wealth (w), output price (p), input cost (c), and a consumer price index (q). Chavas and Holt (1990) show that a zero-wealth effect implies constant absolute risk aversion.

Cross Equation restrictions are needed for consistency with expected utility maximization. The matrix of compensated effects is symmetric and positive definite (Chavas and Holt, 1990).

Price supports, such as loan rates, set a floor under market prices. The truncated distribution of the crop price takes into account the effects of the price supports of the crop.

Chavas and Holt (1990) generated the variance for untruncated normalized prices by calculating equation (3):

$$(3) \qquad VAR(P_{it}) = \sigma_{pii,t} = \Sigma\, \lambda_j\, [\, P_{i,t-j} - E_{t-j-1}\, (P_{i,t-j})]^2$$

where E is the expectations operator and P is the normalized market price.

Duffy, Shalishali, and Kinnucan (1994), who referenced Chavas and Holt (1990), generated the expected mean of the ith crop and variance of the truncated distributions:

$$(4)\ \bar{p}_{it} = PS_{it}^{e}\, \Phi(h_i) + \sigma_{pii,t}^{1/2}\varphi(h_{it}) + P_{it}[1-\Phi(h_{it})]$$

$$(5)\ \bar{\sigma}_{pii,t} = (PS_{it}^{e})^2\, \Phi(h_{it}) + \sigma_{pii,t}h_{it}\, \varphi(h_{it}) + 2P_{it}\sigma_{pii,t}^{1/2}\, \varphi(h_{it})$$
$$+ (P_{it}^{2} + \sigma_{pii,t})*(1- \Phi(h_{it}))-p_{it}^{2}$$

Where the i represents the crop, t represents time and h is the price support defined as follows:

$$(6)\ h_{it} = (PS_{it}^{e} - P_{it})/\, \sigma_{pii,t}^{1/2},$$

Φ (.) is the standard normal density function and φ (.) is the distribution function. And:

$$(7) \qquad \pi_{jt} = E_{t-1}\{Pi_{t} * Y_{jt} - C_{jt} \mid P_{it} \geq PS_{t}^{e}\}.$$

Overall, Chavas and Holt (1990) concluded that estimates from the model above indicated that risk and wealth effects were important in the choosing acreage allocation of corn and soybeans.

Using the model developed by Chavas and Holt (1990), Duffy, Shalishali, and Kinnucan (1994) analyzed supply response for corn, cotton, and soybeans in the Southeast states of Alabama, Georgia, North Carolina, and South Carolina. Three sets of equations were estimated including variables to capture the diversion payments for cotton and corn. They also estimated a set of time-varying parameter models. Results suggested that over time cotton acreage had become more price inelastic.

In their study of supply response in the North Central region of the United States, Lin and Dismukes (2007) used futures prices when generating the expected crop prices, rather than lagged market prices. The household wealth variable was generated from the farm operator household net worth from the USDA's Agricultural Resource Management Survey which included both farm and non-farm sources instead of farm value of proprietor equity, which was used by Chavas and Holt (1990). The estimations included a lagged dependent variable as an explanatory variable to take into account the cost of making adjustments in production over time. Their expected yields were generated by regressing actual yields on a trend variable. In addition to the cross-equation symmetry restrictions, Lin and Dismukes restricted the parameter on expected net returns of soybeans to 0.0090 in the soybean equation due to a high collinearity between corn and soybeans net returns. In the estimations of their model, risk did not prove to have strong effects across commodities in the North Central region of the U.S. However, increased initial wealth lead to increased acreage planted of crops.

Data and Methods

Equation (8) is the acreage model to be estimated in this study for cotton, soybeans, and corn. Equation (9) is the shared acreage model for cotton, soybeans, and corn:

$$(8) \qquad A_i = a_i + b_{ij} \sum_{j=1}^{3} Expre_{ij} + c_{ij} \sum_{j=1}^{3} Var_{ij} + d_i\, Idle_i + e_{ij} \sum_{j=1}^{3} Cov_{ij} + f_i\, Wealth_i + g_i\, Lpa_i + h_i\, AL_i + i_i\, GA_i + j_i\, FL_i + k_i\, NC_i + l_i\, SC_i + m_i\, TN_i + n_i\, VA_i + o_i\, Policy_i + \mu_i$$

$$(9) \qquad sA_i = a_i + b_{ij} \sum_{j=1}^{3} Expre_{ij} + c_{ij} \sum_{j=1}^{3} Var_{ij} + d_i\, Idle_i + e_{ij} \sum_{j=1}^{3} Cov_{ij} + f_i\, Wealth_i + g_i\, Lpsa_i + h_i\, AL_i + i_i\, GA_i + j_i\, FL_i + k_i\, NC_i + l_i\, SC_i + m_i\, TN_i + n_i\, VA_i$$

$+ o_i \text{ Policy}_i + \mu_i$

where:

(10) $\sum_{j=1}^{4} SA_i = 1.$

The variables from the models above are listed in Table 1, which also contains their definitions. Dummy variables were created for each state to allow for different intercepts, with Alabama arbitrarily selected as the "base state" without a dummy variable.

The estimation used time-series and cross-sectional data from 1991-2005. For the period 1991 to 1995, which represents the old farm program regime, a dummy variable was included. Data for cotton, soybeans, and corn were collected from the Southeast states of Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia. Market prices for each row crops for each state from 1987-2005 was collected from the United States Department of Agriculture's Quick Stats: Agricultural Statistics Data Base website (2008). Data was collected for years outside the estimation period for use in generating expected yields and variances.

The planted acreage for cotton, corn, and soybeans was used in the linear model. The shared acreage variable was developed by dividing the planted acreage for the crop of interest by the total acreage for cotton, corn, soybeans, wheat, and the other crops. The other crops included peanuts, barley, oats, potatoes, rye, sorghum, and sweet potatoes which were collected from the USDA's Quick Stats: Agricultural Statistics Data Base website (2008).

All prices were normalized to 2005 levels using Producer Price Indexes for Farm Products. The Producers Price Index for farm products was found at the Bureau of Labor Statistics (2008) website.

To generate the expected price, an average of three days of futures prices was taken for each crop from a specific time period with relation to the time of year the producers make their planting decisions. The futures data were collected for the period of 1989-2005 from Price Data (Price-Data, 2008). December cotton futures prices were collected in January on the second Tuesday, Wednesday, and Thursday. September corn futures prices were collected in January on the second Tuesday, Wednesday, and Thursday. November soybean futures prices were collected in January for the second Tuesday, Wednesday, and Thursday. The average basis for each crop in each state was calculated. The average basis was then subtracted from the three-day average futures price to get the expected price.

Costs of production, on a regional basis, were gathered from the USDA website Commodity Costs and Returns: U.S. and Regional Cost and Return Data (2008). Costs of production for 1991-1995 were collected from Southeast region. In 1996, this series ended and was replaced by a new series with different regional names. The costs of production for 1996-2005 were thus collected from the Southern Seaboard region. Since the USDA changed the format of the costs of production from the original 1991-1995 data, the data from 1996-2005 were standardized to 1991-1995 data by adding hired labor and subtracting interest paid on capital to operating costs.

From 1990 to 1995, the loan rates were found in Cotton: Background for 1995 Farm Legislation (Edward et al., 2005) and Feed Grains: Background for 1995 Farm Legislation (Lin et al., 1995) by the USDA. After 1995, they were found in Provisions for the Federal Agriculture Improvement and Reform Act of 1996 (Federick et al., 1996) by the USDA for 1996-2001. The 2002-2005 loan rates were found in The 2002 Farm Act: Provisions and Implications of Commodity Markets (Westcott et al., 2002) published by the USDA. The Acreage Reduction Programs rates were found in Cotton: Background for 1995 Farm Legislation (Edward et al., 2005), USDA's Federal Register: Rules and Regulations (USDA, 1995), and Feed Grains: Background for 1995 Farm Legislation (Lin et al., 1995) by the USDA. The wealth variable used farm equity and was from the Agricultural Resource Management Survey of the USDA. A variable for non-farm wealth was not available for these states over this time period.

Expected Yields

The yield data from 1971-2005 was used to generate expected yields by equation (11):

(11) $E(Y_t) = \alpha + \beta_1 Y_{t-1} + \beta_2 T.$

where Y_t is the yield, Y_{t-1} is the lagged yield, and T is the trend variable. The yield data were gathered from the USDA Quick Stats: Agricultural Statistics Data Base website. The trend variable takes the value of 1 in 1971, 2 in 1972, and so on. In each year of subsequent estimation, a new year of data was added to the model.

Truncated Price Distribution

Because the loan rate "cuts off" the lower tail of the price distribution, the mean and the variance of price will be affected. Using the same formula as Lin and Dismukes (2007), the mean of the truncated price variable is defined by equation (12):

(12) $E(TP) = sp + \Phi(\gamma) + \sigma_p^2 * (1/\sqrt{(2*\pi)})^{(-.5*\gamma*\gamma)} + ep*(1-\Phi(\gamma)).$

where sp is the support price; ep is the expected market price; σ_p is the untruncated variance of price, calculated as a moving weighted average of the deviations of expected market price from actual market price, using a three-year lag and the weights (0.5., 0.3., and 0.2); γ is defined as (sp – ep) / σ_p and Φ is the standard normal distribution. The truncated variance and covariances were created following the formula found in Greene (1990), as applied by Lin and Dismukes (2007).

Expected Revenue

The formula for expected net revenues, taking into account the truncation of prices by the loan rate is defined by equation (13):

(13) $\text{Expre} = E(Y) * E(TP) - CP + (1- \Phi(\gamma)) * (\zeta / \surd\, \sigma_y^{2} * \sigma_p^{2}) * \sigma_y * \surd \sigma_{tp}^{2}.$

E(Y) is the expected yield, CP is the lagged costs, ζ is the correlation between untruncated price and yields, σ_p^2 is the variance of untruncated yields, σ_p is the standard deviation for untruncated prices, σ_y is the standard deviation for untruncated yields, and σ_{tp}^2 is the truncated variance of price.

Results

Equations were first estimated in Ordinary Least Squares (OLS) and then estimated in Seemingly Unrelated Regressions (SUR). Two different SUR models were estimated, one with cross-equation, theoretical restrictions on the truncated revenues and one without cross-equation restrictions.

The OLS equations are displayed in Table 2. Each equation had 105 observations. The cotton model estimated in OLS contained the largest number of significant parameters in both the linear and the shared equations. However, the own-revenue variable was not significant in these equations.

Paradoxically, an increase in the required set-aside in the acreage reduction program (ARP) appeared to lead to higher cotton acreage. This could be a result of farmers dropping out of the farm program in years of high ARP requirements and increasing their cotton acreage to build their base acreage for cotton. The policy dummy variable was only significant in the OLS estimations. Both the linear and the shared equations of cotton had the policy variable significant at the 1% level. The policy variable in the linear corn equation was significant at the 5% level.

Table 3 presents the linear acreage equations estimated in SUR with and without symmetry restrictions in SUR. Again, the cotton equation had the most significant parameters, but again own-revenue was not significant. The SUR restricted model imposed the symmetry restrictions. However, all three of the restrictions were rejected. Rejection of the restrictions provides some indication that the theoretical model applied here may not fit the decision-making process of Southeast producers very well.

Table 4 contains the shared acreage equations. These sets of equations were estimated in the same manner as the linear equations. The cotton equations continued to have the most significant parameters, but again own-revenue was not significant. The symmetry restrictions were the same as stated above; however, in this case only two of the restrictions were rejected. The corn-soybean restriction was not rejected.

Wealth was positive and significant in all of the estimation except for the OLS linear model. Wealth was also significant in the linear equations for corn, indicating that initial wealth impacts planting decisions. Similar results were found in Lin and Dismukes (2007). The lagged planted acreage for each equation in the all of the estimations was significant, indicating that producers adjust slowly to changes in the market (Lin and Dismukes, 2007). These changes can include but are not limited to technological updates, expected climate, futures and market prices, and biological diseases within the plants.

The short-run and long-run own-revenue elasticities from the various models are reported in Table 5. Few equations had significant own-revenue parameters. These were corn and soybeans under OLS, corn in the linear acreage formulation without restrictions, and soybeans in the shared acreage formulation with restrictions. Other elasticities were not significantly different from zero, but they are presented in the table. The long-run elasticites were calculated by dividing the coefficient of the own-profit by one minus the coefficient of the lagged acreage (Duffy, Richardson, and Wolhgenant, 1987).

The short-run own-profit elasticity estimated by OLS was 0.073 for soybeans and 0.081 for corn. The corresponding long-run own-profit elastcities for soybeans and corn were .229 and .203, respectively. The SUR without restrictions model estimated own-profit elasticites for corn as .080 in the short-run and .237 in the long run. The SUR with restrictions model estimated own-profit shared elasticites for soybeans as 0.125 and 0.221 for the short run and the long run, respectively. None of the cotton elasticities were significantly different from zero.

Lin and Dismukes (2007) reported own-profit elasticity of 0.170 for corn and 0.295 for soybeans, respectively, in the Midwest. Because Chavas and Holt (1990) and Duffy, Shalishali and Kinnucan (1994) did not include lagged acreage as an explanatory variable, they did not distinguish between short-run and long-run elasticities. Chavas and Holt (1990) reported own-profit elasticity for corn of 0.158 and soybeans of 0.441, for the U.S. Duffy, Shalishali, and Kinnucan (1994) reported a corn own-revenue elasticity of 0.095, similar to the short-run own-revenue elasticity estimated here. The soybeans short-run own-profit elasticity from this study is considerably lower than the one estimated in Duffy, Shalishali, and Kinnucan (1994), however.

Conclusion

This paper identified a theoretical model for supply response of cotton, soybeans, and corn in seven Southeast states based primarily on work by Chavas and Holt (1990). Modifications were made to the model from literature by Duffy, Shalishali, and Kinnucan (1994) and Lin and Dismukes (2007), such as the use of futures prices, variances of revenues, and covariance of revenues in the expected truncated net returns and including the dependent variable as lagged explanatory variables. Also, changes to the farm program variable and the wealth variable were made from the original model by Chavas and Holt (1990). Linear and shared equations were estimated in OLS, SUR without restrictions, and SUR with cross-equation restrictions using data from 1991-2005.

Few own-revenue effects were found to be significant, regardless of the specification. No specification produced a significant own-revenue effect for cotton. Symmetry restrictions were rejected for the linear model and the shared model rejected two of the three cross-commodity restrictions. The corn-soybean restriction was the only restriction that was not rejected. None of the expected return variables were significant in the linear restricted model. Thus, the theoretical model which appears to fit well to Midwest data, may not be applicable in the Southeast. Further empirical work could include more row crops that are competitive with cotton, soybeans, and corn in the southeast such as wheat. The updated estimates of elasticities for these commodities should prove useful for subsequent policy analysis.

Overall, results from these models indicate that acreage of cotton, corn, and soybeans in the Southeast would not respond quickly, if at all, to changes in price or profitability. However, in recent years, corn acreage did increase significantly in much of the Southeast in response to higher prices. The theoretical model used here did not appear to fit the data well, which may explain the lack of significance. Alternatively, the use of futures prices, rather than lagged market prices, in the formulation of expected revenue may be a problem if Southeast farmers take their prices signals more from lagged market prices. An alternative calculation of expected own-revenue, using lagged market prices, will be made in future work.

REFERENCES

Bureau of Labor Statistics. Producer Price Index. Available at http://www.bls.gov/ppi/. Accessed May 2008.

Chavas, J.P., and M.T. Holt. "Acreage Decisions under Risk: The Case of Corn and Soybeans." American Journal of Agriculture Economics 72(1990): 529-38.

Duffy, P. A.; K. Shalishali, H.W. Kinnucan. "Acreage Response under Farm Programs for Major Southeastern Field Crops." Journal of Agriculture and Applied Economics 26(1994): 367-78.

Duffy, P., J.W. Richardson, and M.K. Wolhgenant. "Regional Cotton Acreage Response." Southern Journal of Agricultural Economics 19(1987): 99-108.

Edward, H.G. Jr., L.A. Meyer, and S. MacDonald. Cotton: Background for 1995 Farm Legislation. USDA-ERS. Agricultural Economic Report No. (AER706), April, 1995.

Frederick, N.J. and L.P. Schertz. Provisions of the Federal Agriculture Improvement and Reform Act of 1996. USDA-ERS. Agriculture Information Bulletin No. (AIB729), September, 1996.

Greene, W.H. Econometric Analysis. New York: Macmillan Publishing Company, 1990.

Lin, W., P. Riley, and S. Evans. "Feed Grains: Background for 1995 Farm Legislation." USDA, ERS. Agricultural Economic Report No. (AER714), April, 1995.

Lin, W. and R. Dismukes. "Supply Response under Risk: Implications for Counter-Cyclical Payments' Production Impact." Review of Agricultural Economics. 29(2007):64-86.

Pollack, S.L. and L. Lynch. Provisions of the Food, Agriculture, Conservation, and Trade Act of 1990. USDA-ERS. Agriculture Information Bulletin No. (AIB624), June, 1991.

Price Data. www.price-data.com. Marietta, GA, 2008.

U.S. Department of Agriculture. Commodity Costs and Returns: U.S. and Regional Cost and Return Data. Available at http://www.ers.usda.gov/Data /CostsAndReturns/TestPick.htm. Accessed June 2008.

U.S. Department of Agriculture, "Rules and Regulations", *Federal Register*. 60, 116 (1995): 1.

U.S. Department of Agriculture. *Quick Stats: Agricultural Statistics Data Base.* Available at http://www.nass.usda.gov/QuickStats/. Accessed May 2008.

Westcott, P., E. Young, and J.M. Price. The 2002 Farm Act: Provision and Implications of Commodity Markets. USDA-ERS. Agricultural Economic Report No. (AER778), November, 2002.

Table 1: Independent Variables and Definitions

Variable	Definitions
A	Acreage Planted where for j cotton=1, corn=2, and soybeans=3
SA	Shared Acreage Planted where for j cotton=1, corn=2, soybeans=3 and other crops=4
Ctexpre	Cotton Truncated Expected Net Returns
Sbexpre	Soybeans Truncated Expected Net Returns
Cnexpre	Corn Truncated Expected Net Returns
Ctrvar	Cotton Truncated Expected Variance of Revenue
Sbrvar	Soybeans Truncated Expected Variance of Revenue
Cnrvar	Corn Truncated Expected Variance of Revenue
Ctidle	Cotton in Acreage Reduction Program in Percentages
Cnidle	Corn in Acreage Reduction Program in Percentages
Covrsbcn	Truncated Expected Covariance of Soybeans and Corn Revenues
Covrsbct	Truncated Expected Covariance of Corn and Cotton Revenues
Covrcnct	Truncated Expected Covariance of Soybeans and Cotton Revenues
Wealth	Lagged Net Worth for Farm Households
Lctpa	Lagged Cotton Acreage Planted
Lsbpa	Lagged Soybeans Acreage Planted
Lcnpa	Lagged Corn Acreage Planted
Lctpsa	Lagged Shared Planted Acreage for Cotton
Lsbpsa	Lagged Shared Planted Acreage for Soybeans
Lcnpsa	Lagged Shared Planted Acreage for Corn
FL	Florida Dummy
GA	Georgia Dummy
NC	North Carolina Dummy
SC	South Carolina Dummy
TN	Tennessee Dummy
VA	Virginia Dummy
Policy	Policy Dummy for pre-1996 Farm Bill

Table 2: OLS Estimations

Variable	Linear Equations: Cotton	Linear Equations: Soybeans	Linear Equations: Corn	Shared Equations: Cotton	Shared Equations: Soybeans	Shared Equations: Corn
Intercept	174.3517	45.98364	38.19505	10.82294	8.65009	8.75784
	3.44***	1.32	0.72	3.71***	3.34***	2.31**
Ctexpre	0.01675	0.12677	0.29325	0.0001658	0.0052	0.02138
	0.14	1.27	2.45**	0.03	0.77	2.51**
Sbexpre	-0.59927	0.56017	-0.38682	-0.03654	0.02619	0.02377
	1.62	1.76*	0.93	2.44**	1.21	0.83
Cnexpre	-0.38438	-	0.41524	-0.01573	-	-0.00649
	1.91*		2.00**	1.94*		0.45
Ctrvar	-2363.45	-	973.66734	-150.31614	-	-36.26757
	1.32		0.41	2.06**		0.22
Sbrvar	-	0.09908	24.41408	-	0.04735	0.13304
		0.01	1.5		0.07	0.12
Cnrvar	-	-	41.20372	-	-	-2.22402
			0.58			0.45
Ctidle	0.02784	-	-	0.0005516	-	-
	5.80***			2.98***		
Cnidle	-	-	0.00254	-	-	0.0003884
			0.42			1.1
Covrsbct	291.24956	195.62529	-	14.45808	5.79842	-
	1.82*	1.84*		2.21**	0.83	
Covrcnsb	-	-	-27.38153	-	-	1.49255
			0.49			0.39
Covrcnct	-2639.5853	-	1638.042	-121.79381	-	79.83946
	5.42***		4.02***	6.17***		2.79***
Wealth	0.05253	-0.04111	-0.0846	0.0062	-0.00217	-0.00454
	0.88	0.77	1.53	2.55**	0.59	1.17
Lctpa	0.83664	-	-	-	-	-
	19.90***					
Lsbpa	-	0.68183	-	-	-	-
		11.500***				
Lcnpsa	-	-	0.60197	-	-	-
			6.18***			
Lctpsa	-	-	-	0.80546	-	-
				15.36***		
Lsbpsa	-	-	-	-	0.43682	-
					4.70***	
Lcnpa	-	-	-	-	-	0.29009
						2.83***
FL	-34.15083	-71.28675	-33.49835	-1.99054	-6.16057	7.34569
	1.08	2.30**	-0.93	1.66	2.96***	2.94***
GA	149.19692	6.49688	41.45547	-0.09488	-4.30204	-2.25822
	3.75***	0.24	1.03	0.08	2.17**	0.85
NC	73.96699	356.08689	234.27721	-3.46352	9.49411	2.79626
	2.54**	5.17***	3.82***	2.57**	4.17***	1.29
SC	-27.69511	86.00331	14.39836	-3.64995	10.56292	3.35979
	1.1	3.24***	0.52	2.76***	4.83***	1.75*
TN	72.58821	252.18078	177.9565	-0.6517	11.01959	4.21441
	1.92*	4.27***	3.70***	0.42	3.69***	1.57
VA	36.78965	57.24095	94.24008	-2.29389	6.61816	8.56782
	0.97	1.58	2.41**	1.17	2.5**	3.03***
Policy	-132.91282	-	56.87587	-4.1636	-	2.0491
	4.81***		2.31**	3.42***		1.19
R^2	0.9806	0.9869	0.961	0.9651	0.9218	0.7028
Adjusted R^2	0.977	0.9852	0.9528	0.9588	0.9117	0.6406

Note: The t-ratios are listed below the coefficient estimates in parentheses. The asterisks indicate a 1%, 5%, and 10% significance different from zero by ***, **, and *, respectively.

Table 3: SUR Crop Equations						
	Without Symmetry Restrictions			With Symmetry Restrictions		
Variable	Cotton	Soybeans	Corn	Cotton	Soybeans	Corn
Intercept	31.93441	8.634487	107.8987	15.14901	66.43726	128.0363
	0.67	3.23***	2.42**	0.3	1.5	2.94***
Ctexpre	0.1846556	0.005806	0.208921	0.094209	0.039286	-0.00663
	1.41	0.85	1.75*	0.66	0.37	0.06
Sbexpre	-0.68341	0.024778	-0.57462	0.039286	0.30907	-0.0031
	1.69*	1.12	1.45	0.37	0.87	0.02
Cnexpre	-0.38623	-	0.409907	-0.00663	-0.0031	0.147419
	1.76*		2.05**	0.06	0.02	0.88
Ctrvar	-32.0663	-	-1283.32	-96.2875	484.9831	-1938.56
	0.02		0.59	0.04	0.21	0.84
Sbrvar	-	0.045989	36.70157	-8.2654	2.627833	22.0564
		0.07	2.69***	0.52	0.16	1.74*
Cnrvar	-	-	50.83467	-25.0599	43.0092	43.88111
			0.82	0.5	0.67	0.73
Ctidle	0.017267	-		0.018314	-	-
	4.36***			4.74***		
Cnidle	-	-	-0.00073	-	-	0.002102
			0.14			0.43
Covrsbct	118.403	7.969351		118.8057	227.2888	-
	0.74	0.99		0.65	1.64	
Covrcnsb	-	-	27.7093	-	-15.9225	2.997552
			0.59		0.3	0.07
Covrcnct	-872.601	-	886.3721	-905.304	-	552.97
	1.90*		2.68***	1.73*		1.81*
Wealth	0.157914	-0.00254	-0.14099	0.118032	-0.05276	-0.1122
	2.45**	0.68	2.58**	1.84*	-0.95	2.07**
Lctpa	0.82752	-		0.847396	-	-
	19.18***			20.07***		
Lsbpa	-	0.442481		-	0.721724	-
		4.76***			12.65***	
Lcnpa	-	-	0.663813	-	-	0.611603
			7.26***			7.12***
FL	-60.6668	-5.97608	-7.4153	-74.8826	-62.226	-37.1369
	1.76*	2.81***	0.21	0.0672	1.87*	1.12
GA	124.4285	-4.1415	54.79808	88.00091	3.062677	80.0829
	2.95***	2.05**	1.42	2.15**	0.08	2.16**
NC	63.12395	9.501877	216.6658	26.18114	317.3661	230.3912
	1.97*	4.15***	3.72***	0.84	4.56***	4.07***
SC	-35.308	10.4572	7.457972	-24.0569	64.27818	12.80385
	1.28	4.77***	0.28	0.79	2.01**	0.6246
TN	74.0515	11.08239	174.5667	-10.6908	225.6954	159.8548
	1.77*	3.70***	3.74***	0.3	3.83***	3.55***
VA	23.68096	6.704653	97.70228	-52.041	55.46795	76.0358
	0.57	2.56**	2.53**	1.28	1.5	2.11**
Policy	-	0.130056	-	-	-11.8186	-
		0.11			0.57	

Note: The t-ratios are listed below the coefficient estimates in parentheses. The asterisks indicate a 1%, 5%, and 10% significance different from zero by ***, **, and *, respectively.

Table 4: SUR Shared Crop Equations

	Without Symmetry Restrictions			With Symmetry Restrictions		
Variable	Cotton	Soybeans	Corn	Cotton	Soybeans	Corn
Intercept	4.98868	9.002225	12.19983	6.922701	8.601513	13.59742
	2.02**	3.58***	4.43***	2.56**	2.83***	4.76***
Ctexpre	0.004551	0.00658	0.015097	-0.00538	-0.01254	-0.00646
	0.3595	0.98	1.91*	0.97	2.20**	1.26
Sbexpre	-0.03633	0.025175	0.004979	-0.01254	0.035169	-0.00044
	2.30**	0.253	0.2	2.20**	1.88*	0.05
Cnexpre	-0.01536	-	0.001788	-0.00646	-0.00044	0.005835
	1.81*		0.18	1.26	0.05	0.56
Ctrvar	-106.341	-	-126.612	-58.9007	-39.6023	-211.789
	1.39		1.12	0.54	0.25	1.37
Sbrvar	-	-0.03401	1.085266	-1.07845	-0.66746	1.167699
		0.05	1.22	1.58	0.65	1.35
Cnrvar	-	-	2.528801	2.994425	-0.52882	4.617225
			0.73	1.47	0.12	1.06
Ctidle	0.000235	-	-	0.000251	-	-
	1.45			1.59		
Cnidle	-	-	0.000225	-	-	0.000193
			0.95			0.81
Covrsbct	13.73551	12.31742	-	24.00564	13.45474	
	2.01**	1.79*		2.90***	1.71*	
Covcnsb		-	-2.11027		3.995518	-0.49846
			0.8		1.1	0.15
Covrcnct	-86.7822	-	42.26797	-115.936	-	28.7014
	4.57***		2.24**	5.24***		1.61
Wealth	0.008504	-0.00295	-0.00584	0.007925	-0.00192	-0.00484
	3.42***	0.81	1.6	3.24***	0.51	1.32
Lctpsa	0.8665	-	-	0.842448	-	-
	17.41***			15.82***		
Lsbpsa	-	0.41711	-	-	0.434977	-
		5.35***			5.29***	
Lcnpsa	-	-	0.360738	-	-	0.394804
			4.44***			4.86***
FL	-1.87055	-6.16965	6.208593	-4.2901	-6.31168	5.427194
	1.48	3.05***	2.85***	2.71***	2.86***	2.41**
GA	-0.65297	-4.23082	-2.92692	-2.09549	-3.09929	-2.52004
	0.49	2.16**	1.25	1.57	1.28	1.02
NC	-2.77374	9.911257	2.287072	-5.33231	9.552333	1.996524
	2.00**	4.63***	1.13	3.25***	3.90***	0.98
SC	-2.70321	10.90313	1.944768	-3.85856	10.72593	1.327686
	2.01**	5.47***	1.16	2.53**	4.32***	0.74
TN	0.207705	11.63176	3.523698	-3.91989	9.935034	2.145647
	0.13	4.13***	1.37	2.31**	3.48***	0.94
VA	-0.88611	7.019876	7.275265	-5.38148	5.53445	5.741669
	0.45	2.76***	2.74***	2.36**	2.21**	2.44**
Policy	-	0.679708	-	-	1.580839	-
		0.7			1.37	

Note: The t-ratios are listed below the coefficient estimates in parentheses. The asterisks indicate a 1%, 5%, and 10% significance different from zero by ***, **, and *, respectively.

Table 5: Elasticities of Own-Profit with Significance						
Linear Equations						
	OLS		SUR Unrestricted		SUR Restricted	
Crop	Short-Run	Long-Run	Short-Run	Long-Run	Short-Run	Long-Run
Cotton	0.004	0.024	0.043	0.252	0.022	0.145
Soybeans	0.073*	0.229*	0.003	0.006	0.040	0.145
Corn	0.081**	0.203**	0.080**	0.237**	0.029	0.074
Shared Equations						
	OLS		SUR Unrestricted		SUR Restricted	
Crop	Short-Run	Long-Run	Short-Run	Long-Run	Short-Run	Long-Run
Cotton	0.001	0.004	0.023	0.175	-0.028	-0.175
Soybeans	0.093	0.165	0.089	0.153	0.125*	0.221*
Corn	-0.023	-0.032	0.006	0.010	0.020	0.034

Note: The significance of the expected profit coefficient (different from zero) was used to calculated the elasticites and is denoted by ***, **, and *, at a 1%, 5%, and 10% level, respectively.