SUPPLY RELATIONSHIPS IN THE SOUTH—WHAT HAVE WE LEARNED?

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Accurate estimation of the responsiveness of agricultural commodity supplies is vitally important. Government policy negotiations rely on supply estimates in predicting both commodity and intercommodity effects of changing programs and in anticipating their consequent social benefits and costs. Individual farmers and agribusiness firms need them and associated price predictions in making investment and production decisions.

Much research has been devoted to agricultural supply response. In 1977, Askari and Cummings cited 190 studies that had applied econometric models to time series data in order to estimate agricultural supply relationships. Numerous additional supply studies have been conducted since then.

Despite substantial investment by the profession in supply analysis of the agricultural industry, developments over the last 10-12 years have demonstrated serious limitations in our ability to provide accurate and useful intelligence to policymakers, producers, and agribusiness firms. During this period, international food supplies have shifted quickly from surplus to shortage and back to surplus again. Energy costs have both skyrocketed and plummeted. Extreme variability in agricultural product and input prices has resulted. The period has provided an acid test for supply analysts. Unfortunately, our performance in anticipating commodity responses in this environment has been less than sterling.

As a case in point, early predictions of participation in the 1983 paid dairy diversion program missed actual participation by more than 50 percent. And this error was for a commodity produced mainly on single-product farms. It is frequently argued that product prices and government programs affecting other farm commodities would have little impact on milk production except as they are translated through the market system for dairy inputs. With this magnitude of error for the dairy industry, however, it is not surprising that we also have difficulty anticipating supplies of other commodities that are more highly interrelated in production.

In this setting, it is clearly time to examine where we are in supply analysis research in the South, articulate what we *think* we have learned, and identify issues that obviously warrant additional attention. These are the concerns addressed in this paper.

Because it is impossible to cover every important issue on southern agricultural supply in 30 minutes, I have chosen to focus on output supply elasticities. Although no one would expect elasticities to be the same for all geographic areas, for all time, nor for all estimation procedures, examination of elasticities can provide important insights. For example, if elasticities for a certain commodity have performed well in previous predictions and have been generally robust to geography, time, and method of estimation, we might feel comfortable placing a high degree of unqualified confidence in such estimates for further policy and price prediction purposes. On the other hand, if elasticities vary over the board, we must be more specific about the domain over which we would want to rely on a particular estimate.

This paper is divided into three unequal parts. In the first, a number of southern agricultural supply elasticities reported in relatively recent literature are briefly reviewed.

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In the second, unpublished elasticities are presented from current studies that formally maintain the theory of the competitive firm in estimation. In the final section, the current state of knowledge about agricultural supply response in the South is evaluated.

PUBLISHED COMMODITY ELASTICITIES

Of the 190 supply studies surveyed by Askari and Cummings, only four address supply response in the Southern United States. Own-price commodity supply elasticities reported by Askari and Cummings are listed along with those from several more contemporary articles in Table 1.[1] A total of 18 articles are cited that report elasticities for 16 different commodities, including seven field crops, six vegetable crops, and three livestock commodities. Elasticities are reported by more than one study for all field crops, two vegetable crops, and two livestock commodities. Most are based on post-World War II data, but one study begins with 1905. All but three use annual data.

The cited studies obtained supply elasticity measures in various ways. All but two were based on econometric estimations. Most were of the single-equation, single-price form. Few included alternative product prices, variable input prices, or fixed output or input quantities. Thus, the elasticities are generally of the *mutatis mutandis* (or total elasticity) form where other price adjustments would be expected to occur as they have historically in response to a change in the price variable of direct concern.

Cross-output supply elasticities are reported in six of the articles. Except for Taylor and Shonkwiler's study of potato and cabbage supply in Hastings, Florida, these studies all focus on interrelationships in field crop production. Those price elasticities between commodities where southern estimates are available from at least two sources are reported in Table 2. Extreme variability exists in signs and magnitudes of these elasticities, due at least in part to differences in maintained hypotheses, estimation methods, geographic areas, and data periods. All sources were completely consistent as to sign for only one of the eight cross-price elasticities.

ELASTICITIES CONSISTENT WITH THEORY OF THE FIRM

Much attention has been devoted in the last few years to estimating output supply and input demand relationships consistent with underlying economic theory. The advent of well-developed duality concepts and use of flexible functional forms (generally second-order Taylor expansions) have permitted coherent estimation of output supplies and input demands that maintain or test the theory.

Unfortunately, estimation subject to the theory is complex, frequently requiring nonlinear systems estimation because of cross-equation and nonlinear restrictions. For example, when it is desired to either maintain or test the competitive theory of the firm in econometric estimation, the full system of relevant output supply and variable input demand equations must be consistent with an underlying profit function. Since single-equation estimates are seldom fully consistent with this theory, estimation generally requires that the equations be estimated as a system. Further, although homogeneity and symmetry properties can generally be accommodated by linear restrictions and/or normalization, curvature properties required to assure that a profit-maximizing solution exists typically require nonlinear constraints. This greatly complicates the econometric estimation process. Consequently, all properties required for empirical estimates to be consistent with the theory have seldom been maintained in econometric estimation.

This limits our ability as a profession to test the theory by determining how far theoretically consistent estimates abstract from reality. Without satisfaction of all the theoretical properties in one set of estimates, we cannot conduct nested statistical tests to determine the seriousness of their implications when imposed on the data. Overcoming this limitation is a necessary step both in building economic science and in using it for normative purposes.

Except for the forthcoming two-output vegetable supply analysis by Taylor and Shonkwiler, it appears that no published supply estimates for the Southern United States have been fully consistent with the theory

[1] This survey of the literature is not exhaustive. Besides the Askari and Cummings citations, it is limited mainly to articles appearing in relatively recent issues of the Southern and American Journals of Agricultural Economics.

TABLE 1. OWN-PRICE OUTPUT SUPPLY ELASTICITIES REPORTED FOR THE SOUTHERN UNITED STATES

Commodity	Area	Time period	Authors	Elasticity: Short run	Elasticity: Long run
Field crops:					
Corn	Delta	1947-69	Penn & Irwin[a]	−.13	−.16
	Kentucky	1960-79	Reed & Riggins[b]	−.20 to +.56	−.26 to +2.07
	Texas	1946-76	Shumway & Powell[c]	+.50	
	Texas	1957-79	Shumway[d]	+.07	
Cotton	Southeast	1905-32	Brennan[e]	+.33	
	Delta	1905-32	Brennan[e]	+.31	
	Delta	1947-69	Penn & Irwin[a]	+.36	+.41
	Texas	1946-76	Shumway & Powell[c]	+.15	
	Texas	1957-79	Shumway[d]	+.25	
Hay	Texas	1946-76	Shumway & Powell[c]	−.28	
	Texas	1957-79	Shumway[d]	+.10	
Rice	Delta	1947-69	Penn & Irwin[a]	+.14	
	Texas	1946-76	Sumway & Powell[c]	+.01	
	Texas	1957-79	Shumway[d]	+.72	
	Miss.	1950-82	Grant, et al.[f]	−.09	
	Texas	1950-82	Grant, et al.[f]	+.14	
	Louisiana	1950-82	Grant, et al.[f]	+.14	
	Arkansas	1950-82	Grant, et al.[f]	+.06	
Sorghum	Texas	1946-76	Shumway & Powell[c]	+.54	
	Texas	1957-79	Shumway[d]	+.62	
Soybeans	Delta	1946-66	Houck & Subotnik[e]	+.75	
	Atlantic	1946-66	Houck & Subotnik[e]	+1.70 to +3.30	
	Delta	1947-69	Penn & Irwin[a]	+.16	.84
Wheat	Texas	1948-74	Morzuch, et al.[g]	+.40 to +.46	
	Oklahoma	1948-74	Morzuch, et al.[g]	+.35 to +.46	
	Texas	1946-76	Shumway & Powell[c]	+.03	
	Texas	1957-79	Shumway[d]	+.43	
Vegetable crops:					
Cabbage	Virginia	1925-55	Nerlove & Addison[e]	+.20	+.23
	Hastings, Florida	1951-82	Taylor & Shonkwiler[h]	+.16 to +.31	
Celery	Florida	1972-78	Shonkwiler & Pagoulatos[i]	+.50	
Onions	Louisiana	1925-55	Nerlove & Addison[e]	+.12	+.31
Potatoes	Hastings, Florida	1951-82	Taylor & Shonkwiler[h]	+.15 to +.22	
Tomatoes	Florida	1961-79	Shonkwiler & Emerson[j]	+.92	
	South	1954-77	Hammig[k]	+.27 to +.45	
	Southeast	1954-77	Hammig[k]	+.28 to +.65	
Watermelons	Florida	1972-76	Wall & Tilley[l]	+.60	
Livestock:					
Beef	South East	1969	Nix, et al.[m]		Very large
	Texas	1977	Angirasa, et al.[n]	+.43	+1.32
Feeder pigs	Southeast	1971-80	Reid & Reed[o]	+.03	+.27
Milk	South Atlantic	1931-54	Halvorson[e]	−.01 to +.22	
	South Central	1931-54	Halvorson[e]	+.06 to +.19	

[a] Estimated a Nerlovian partial adjustment model by 2SLS with three alternative crops.
[b] Estimated Nerlovian partial adjustment models for 14 areas of the State; one alternative crop.
[c] Estimated loglinear supply equations derived locally from a constant-elasticity-of-transformation revenue function; five alternative crops.
[d] Estimated linear product supply and input demand equations derived from a normalized quadratic profit function; five alternative crops; elasticities reported for 1979.
[e] Elasticities reported by Askari and Cummings.
[f] Estimated separate acreage and yield equations. Elasticities reported for 1982.
[g] Estimated for years 1948-49, 1951-53, 1965-74.
[h] Estimated a translog revenue function; one alternative crop.
[i] Elasticity of quantity supplied in 1 week given a one-time change in price in the previous week.
[j] Estimated a rational expectations acreage response model; winter tomatoes.
[k] Estimated a Nerlovian adaptive expectations supply model by mixed estimation using quarterly data; elasticity priors = +.05 ± 0.5 with .95 probability.
[l] Elasticity of planted acreage computed with respect to price lagged 1 year.
[m] From a regional LP model.
[n] From a firm-level LP model.
[o] Estimated a Nerlovian partial adjustment model using semiannual data.

of the competitive firms. Of course, not all properties of that theory necessarily transfer in a straightforward way to geographic aggregates. Only if the geographic unit of analysis faces perfectly elastic input supplies and output demand and is composed of competitive firms should those properties all apply.

In the following estimates, output demands are presumed to be perfectly elastic to the geographic unit. Inputs are divided into those that are presumed variable to the firm over the production period (in each case, a year) and those that are quasi-fixed. Input supplies of the variable inputs also are assumed perfectly elastic to the geographic unit. For consistency with the firm-level assumptions, supplies of the quasi-fixed inputs are assumed perfectly inelastic. Thus, these elasticities are of the *ceteris paribus* (i.e., partial elasticity) form where the prices of other outputs and variable inputs and the quantities of quasi-fixed inputs are unaffected by a chance in the price variable of concern.

FLORIDA VEGETABLE CROPS

The two-output supply model for Hastings, Florida potatoes and cabbage estimated by Taylor and Shonkwiler is consistent with an underlying revenue function with fixed levels of all inputs. Both of their own-price supply elasticities, reported in Table 1, are positive. Since the revenue function is homogeneous in output prices, this is sufficient for curvature properties to be satisfied. Cross-price elasticities are of the same magnitude as the own-price elasticities but of opposite sign.

TEXAS FIELD CROPS

Output supply and variable input demand equations for Texas field crops were reestimated using the same data (1957-79) and functional form (normalized quadratic profit) previously used by Shumway. The only differences were (a) the system of equations was stacked with symmetry restrictions maintained in the first stage (OLS) estimation, and (b) curvature (convexity) of the underlying profit function was maintained in the estimation. The Cholesky procedure of Talpaz et al. was employed to maintain curvature along with symmetry and homogeneity in the econometric estimation.

Output supply elasticities for the six field crops (corn, cotton, hay, rice, sorghum, and wheat) derived for 1979 are reported in Table 3. The own-price elasticities for half the commodities are higher than those cited in Table 1, but only the elasticity for corn is far outside the previous range. It is more than double all other estimates for the Southern United States.

For the cross-price relationships with previous elasticity estimates reported in Table 2, all have the same signs and are higher in absolute value than the estimates by Shumway without convexity maintained. Like the reported nonconvex estimates, the corresponding convex elasticities are significant at the 5 percent level.

It is not surprising that several estimated own-price elasticities are larger with convexity maintained than without it. Convexity of the profit function requires all own-price supply elasticities and principal minors of the output-output elasticity matrix to be positive. It is of interest, however, that many of the estimated cross-price elasticities are also higher in absolute value when convexity is maintained in the estimation.

TABLE 2. CROSS-PRICE OUTPUT SUPPLY ELASTICITIES REPORTED FOR THE SOUTHERN UNITED STATES

		Elasticity Reported by:				
Quantity	Price	Brennan	Penn & Irwin	Reed & Riggins	Shumway & Powell	Shumway[a]
Corn	Cotton		−.81		−.31	+.52
Corn	Rice		−.83		−.04	−.59
Corn	Soybeans		+.91	−1.00 to +.23		
Cotton	Corn	−.09	+.12		−.04	+.11
Cotton	Hay	−.84 to −.47			+.02	+.01
Cotton	Rice		+.11		+.01	−.04
Rice	Corn	+.34			−.03	−.88
Rice	Cotton		−.22		+.04	−.28

[a] The column and row headings in Shumway, Table 3, were reversed. The corrected cross-price elasticities are reported here.

COMMODITY GROUPS, THREE SOUTHERN REGIONS

The same procedures used to estimate output supply and input demand equations for Texas field crops were used to estimate output supply for five commodity groups and input demand for four variable input groups

TABLE 3. TEXAS FIELD CROP SUPPLY ELASTICITIES, 1979, ESTIMATED SUBJECT TO THEORY OF THE COMPETITIVE FIRM

	Elasticity with respect to the price of:					
Quantity	Corn	Cotton	Hay	Rice	Sorghum	Wheat
Corn	+1.59	+.71	−.22	−.90	−.74	+.01
Cotton	+.15	+.34	+.04	−.08	−.29	−.04
Hay	−.22	+.18	+.09	+.13	−.15	−.03
Rice	−1.35	−.55	+.20	+.77	+.62	+.01
Sorghum	−.46	−.82	−.09	+.26	+.94	−.01
Wheat	+.01	−.14	−.02	+.01	−.01	+.35

for three southern regions. In addition, the quadratic demand equation for the numeraire input (hired labor) was included in the system of estimation equations. The output categories (feed grains, food grains, oil crops, miscellaneous crops, and livestock) were comprehensive in that they included aggregated production data for all commodities. The variable input categories (hired labor, machinery, energy, and materials) were also comprehensive in including all inputs used in agriculture except two that were treated as quasi-fixed (family labor and real estate). The regions were the three USDA farm production regions in the South-Southeast, Delta, and Southern Plains. Annual data for the period 1951-82 were used in the estimation.

Own and cross-price supply elasticities for 1982 are reported in Table 4 for each region. The own-price elasticities for each of two commodity groups varied relatively little among regions: oil crops estimates were .12 to .34 (.15 to .34 for elasticities significant at the 5 percent level), and livestock estimates were .11 to .15 (all significant). Own-price elasticities for food grains and miscellaneous crops varied much more (.15 to .51 and .01 to .60, respectively) but the significant elasticity range was very narrow (.40 to .51 and .51 to .60, respectively). Own-price elasticities for feed grains also varied considerable (.06 to .65) but none were significant. Only six of the twenty cross-price elasticities had the same sign in all regions; none were significant in all regions.

TABLE 4. COMMODITY GROUP SUPPLY ELASTICITIES, 1982, ESTIMATED SUBJECT TO THE THEORY OF THE COMPETITIVE FIRM FOR THREE SOUTHERN REGIONS

Quantity of commodity group	Elasticity with respect to the price of:				
	Feed grains	Food grains	Oil crops	Misc. crops	Livestock
Feed grains	+.23[a]	−.03	+.27	−.12	−.52
	+.65[b]	+.26	−.49	−.30	−.64
	+.06[c]	+.01	+.01	+.03	+.10
Food grains	−.04	+.15	−.23	−.01	+.11
	+.02	+.51	−.19	−.24	−.23
	+.01	+.40	−.06	−.37	+.16
Oil crops	+.06	−.05	+.12	−.02	−.15
	−.02	−.14	+.15	−.07	+.15
	+.03	−.23	+.34	−.30	+.19
Misc. crops	−.01	−.001	−.01	+.01	+.03
	−,02	−.24	−.11	+.60	−.15
	+.02	−.28	−.06	+.51	−.21
Livestock	+.05	+.01	−.07	+.03	+.15
	+.02	−.12	+.11	−.08	+.15
	+.02	+.05	+.02	−.08	+.11

[a] Southeast region.
[b] Delta region.
[c] Southern Plains region.

EVALUATION OF CURRENT STATE OF KNOWLEDGE

The empirical information cited suggests the wisdom of exercising a great deal of caution before placing general confidence in any particular supply elasticity estimate for southern agriculture.

LEARNING PROCESS

Part of the reason for caution in using available supply elasticity estimates is that the profession is still learning what is important in data, model specification, and estimation methods. For example, it is clear that expected prices of alternative outputs are important in many farmers' decisions about quantity of land to plant to a specific crop. It is also clear that if the firm is a profit-maximizing, price taker, its supply of each commodity is homogeneous of degree zero in relevant output and variable input prices. A major challenge to the analyst, however, is to determine prior to econometric supply estimation which output and input prices are potentially relevant to the producer's decision.

By estimating a cost function (or input demands derived from a cost function) the analyst is implying *a priori* knowledge that output levels are either fixed or somehow determined independently of the economic optimization for outputs.[2] Estimating a revenue function (or output supplies derived from a revenue function) implies the converse about input levels. If the primary concern is to estimate relative ease of movement along isoquants or production possibility surfaces, these specifications may be appropriate. But even if appropriate, the high likelihood of correlation between right-hand variables and the error term warrants formal acknowledgment in selection of statistical estimation method.

It is not completely obvious what we gain by partially maintaining the theory in empirical work. Most econometric studies of agricultural supply that try to build on eco-

[2] An exception is the recent unpublished study of Louisiana crops and livestock production by Lange and Ojemakinde. They explicitly assume marginal cost pricing of outputs by including output share equations in the estimation system.

nomic theory still only maintain homogeneity and symmetry properties in the estimation. Curvature and monotonicity properties are also implied by the theory. Unrestricted empirical estimates are frequently consistent with monotonicity over the data sample, but, when many options are available to the decisionmaker, they are seldom consistent with the curvature required for an optimum to exist.

A related issue to the fixed/variable quantity dilemma is the dominance of the static competitive equilibrium model. Dynamic models offer explicit consideration of adjustment costs and investment time paths. Household production and risk models allow consideration of alternative objective functions. Unfortunately, they also further complicate estimation and increase computational burden.

Because of singularity of the covariance matrix, GLS estimates of systems of share equations (such as those derived from the translog profit or cost function) can only be conducted when one of the share equations is deleted from the estimation system. The choice of equation to delete is arbitrary, but estimates are invariant to that choice when they are iterated on the covariance matrix. Failure to iterate does not affect the asymptotic properties, but invariance is no longer guaranteed.

When equations are unnecessarily deleted from the system, however, efficiency in estimation may be reduced. For example, with the normalized quadratic profit function, all but one of the product supply and input demand equations are linear in normalized prices. Estimation is sometimes conducted only with this system of linear equations (e. g. Shumway). However, there is no fundamental reason, such as a singular covariance matrix, that prevents estimation of the full supply and demand system including the quadratic numeraire equation.

Other errors in tests, model specification, and reported results that could confuse and misdirect the unwary user appear in many recent articles on agricultural supply. For example, the homotheticity test for the two-output cost function specified by Ray is really a test for homothetic separability between outputs and inputs. The share equations derived by Garcia et al. are not consistent with the form of the profit function they specify. Errors in reported elasticities appear in Shumway and in Weaver; although homogeneity in prices was maintained in the estimations, the reported price elasticities do not sum to zero for each supply and demand equation. They must under the stated estimation conditions. Errors in summation indexes appear in Ray and errors are undoubtedly also present in other published supply literature.

ELASTICITY EXPECTATIONS

What hypotheses should be placed on agricultural commodity supply elasticities? Hammig used 0.5 as the own-price elasticity prior in his mixed estimation analysis of tomato supply in regions of the United States. Of the short-run own-price supply elasticities reported in Table 1, more than 80 percent are 0.5 or less. The average own-price elasticity for the six Texas field crops with all theoretical properties maintained in the estimation is higher--0.68, see Table 3. Which are likely to be closest to the true elasticities?

Although we don't know that all farmers are profit maximizing price takers, we have strong reason to believe the competitive model closely approximates the agricultural firm. Therefore, we would probably place higher initial confidence in the estimates consistent with the competitive theory. That does not mean, however, that the estimates obtained without formal incorporation of the theory are inappropriate for specific uses.

The theoretically consistent elasticities reported in Table 3 are all partial elasticities. The prices of all six field crops and three variable inputs are presumed exogenous. Most of the earlier elasticities in Table 1 are more like total elasticities in that alternative output and input prices were not included in the estimation equations.

Which is the more appropriate for policy or investment purposes depends upon several factors: (a) What is the purpose for which the elasticity is being used? (b) Is the geographic area being evaluated small enough that the exogenous prices and quantities are really independent of changes in the price(s) of concern? (c) Were the hypotheses maintained in specification and the procedures used in estimation of the econometric model such that reasonable confidence can be placed in the empirical estimates? (d) How long is the adjustment period available for response? (e) How well did the elasticity predict previous responses? and, (f) What production technology likely underlies the supply relationships?

Regarding the last issue, it may be of interest to note that extremely high elasticities are implied for the competitive firm by reasonable parameters on some very popular production functions. For example, the functional form most frequently used in production analysis has been the single-commodity, homogeneous, linear-elasticity-of-substitution Cobb-Douglas. Most Cobb-Douglas production functions estimated for agricultural commodities have exhibited returns to scale in excess of 0.8. For a competitive firms, the own-price supply elasticity for the Cobb-Douglas is entirely determined by returns to scale $[k/(1-k)]$, where k is returns to scale. For $k = 0.9$, the own-price supply elasticity is 9; for $k = 0.8$, it is 4, and for $k = 0.5$, it is 1. These high elasticities do not even consider the possibility of substituting more of one output for another as relative prices change.

Other production functions offer a much wider range of implied own-price elasticities under competitive production for comparable returns to scale. The flexible functional forms also permit more reasonable modeling of multiple-product production and dual functions. Most permit both substitute and complementary inputs and/or outputs. When substitute output options are available to the producer but are ignored in modeling supply and when output prices tend to move in the same direction, the estimated own-price supply elasticity could be expected to underestimate the true partial elasticity. When complementary output options are available but are ignored, the estimated elasticity could overestimate the true elasticity.

CONFIDENCE IN REPORTED ELASTICITIES

The number of short-run own-price supply elasticities identified for the Southern United States are reported along with the number of significant elasticities and elasticity ranges in Table 5. The largest number of elasticities were reported for corn and tomatoes. They also had two of the three largest ranges in elasticities. Only four commodities (cotton, cabbage, potatoes, and milk) and two commodity groups (oil crops and livestock) with multiple elasticity estimates had own-price elasticity ranges of less than .25.

Rice, wheat, and tomatoes had the largest number of elasticity estimates significant at the 5 percent level. Five commodities (cotton, wheat, cabbage, potatoes, and milk) and four commodity groups significant elasticity ranges of less than .25.

Judging the quality of empirical estimates is at best a risky business. However, since production economists are frequently asked to provide supply elasticity estimates for price and policy simulation purposes, there may be value in an attempt to identify those commodities for which reasonable confidence can be placed in a narrow elasticity range. For most commodities, we have either too few elasticity estimates, too few significant estimates, too wide an elasticity range, too few analytical approaches, too few geographic areas, and/or too few time periods to feel comfortable using a particular elasticity (or narrow range) for a wide variety of purposes. Thus, only three commodities are listed. They

TABLE 5. RANGE IN ESTIMATED SHORT-RUN OWN-PRICE SUPPLY ELASTICITIES FOR THE SOUTHERN UNITED STATES

Commodity	Number of estimates reported	Range of estimates	Number of estimates significant at 5 percent level	Range of significant estimates
Field crops:				
Corn	18	−.20 to +1.59	5[a]	+.34 to +1.59
Cotton	6	+.15 to +.36	4[a]	+.25 to +.34
Hay	3	−.28 to +.10	0[a]	
Rice	8	+.01 to +.77	7[a]	+.06 to +.77
Sorghum	3	+.54 to +.94	2[a]	+.62 to +.94
Soybeans	5	+.16 to +3.30	1	+3.30
Wheat	7	+.03 to +.46	5[a]	+.35 to +.46
Feed grains	3	+.06 to +.65	0	
Food grains	3	+.15 to +.51	2	+.40 to +.51
Oil crops	3	+.12 to +.34	2	+.15 to +.34
Vegetable crops:				
Cabbage	3	+.16 to +.31	2[a]	+.16 to +.31
Celery	1	+.50	1	+.50
Onions	1	+.12	0[a]	
Potatoes	2	+.15 to +.22	2	+.15 to +.22
Tomatoes	8	+.27 to +.92	6	+.27 to +.92
Watermelons	1	+.60	1	+.60
Misc. Crops	3	+.01 to +.60	2	+.51 to +.60
Livestock	3	+.11 to +.15	3	+.11 to +.15
Milk	4	−.01 to +.22	2	+.19 to +.22
Beef	1	+.43	0[a]	
Feeder pigs	1	+.03	0	

[a]Standard errors were not reported for one or more elasticity estimates.
[b]LP estimate.

are listed in rank order by the confidence I have that the true current Southern United States own-price supply elasticity is within the range given. Reasons for the elasticity range chosen are also presented.[3]

1. Cotton: +.25 to +.34. A considerable number of estimates exists that cover a wide range of time periods and geographic areas and use a wide variety of specifications and estimation methods. Except for one elasticity based on movements along the production possibilities surface, all empirical estimates for the South have been within or very close to this range.

2. Wheat: +.35 to +.46. Many estimates have been reported based on several estimation methods for two states. With the same exception noted for cotton, all are within this narrow range. Thus, the own-price elasticities for cotton and wheat appear to be the most robust of the commodities considered.

3. Cabbage: +.16 to +.31. Several estimates cover a wide range of time intervals. All are within this range.

The evidence is inadequate to permit narrow bounding at this point of other commodity elasticities. Sorghum elasticities are computed for only one state. Potato elasticities are available for only one local area and are based on movements along the production possibilities curve. Milk elasticities are based on data more than 30 years old. Corn, rice, soybean, and tomato elasticity estimates vary widely. There are few significant estimates for corn (a problem also noted for feed grains when commodities were grouped in the analyses of the three southern regions); there are significant hay elasticities. There is only one elasticity estimate each for celery, onions, watermelons, beef, and feeder pigs. Narrow bounds on significant elasticities were obtained for four of the five commodity groups, but only one specification and estimation procedure was used.

CONCLUSIONS

Agricultural supply research in the Southern United States has historically focused on individual subsectors. More recent research has examined supply response as part of a multiple-output decision problem and built upon economic theory in conducting statistical estimation. However, we have not adequately addressed alternative producer objectives or the dynamics of commodity supplies, we are still learning how to fully maintain and/or test the theory, and the econometric procedures we use are far from perfect. Given the amount of economic research attention given to many agricultural problems in the South, we have not been nearly as comprehensive as one might expect in our analysis of supply relationships. There remains much room for innovative and substantive research on this important subject.

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