Comparing Land Values and Capitalization of Cash Rents for Cropland and Pasture in Georgia

by

Archie Flanders, Fred C. White, and Cesar L. Escalante

Author Affiliations: Archie Flanders is post-doctoral associate, Fred C. White is Department Head and D.W. Brooks Distinguished Professor, and Cesar L. Escalante is assistant professor, Department of Agricultural and Applied Economics, University of Georgia, Athens, GA.

Contact:
Archie Flanders
Department of Agricultural and Applied Economics
Conner Hall
University of Georgia
Athens, GA 30602

Phone: (706) 542-0751
Fax: (706) 542-0739
E-mail: aflanders@agecon.uga.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Tulsa, Oklahoma, February 14-18, 2004

Comparing Land Values and Capitalization of Cash Rents for Cropland and Pasture in Georgia

by

Archie Flanders, Fred C. White, and Cesar L Escalante

Abstract:

Nonagricultural factors impact land values to cause a divergence of discounted cash rents for agricultural land and land values. Focus is given to the portion of land values attributable to discounted cash rents. Unique characteristics for cropland and pasture lead to differences in capitalization rates. Nonagricultural factors are greatest for pasture.

Key Words: land values, cash rents, capitalization, discounted cash rents, cropland, pasture

Comparing Land Values and Capitalization of Cash Rents for Cropland and Pasture in Georgia

Introduction

Land is a limited resource, and with continuous population increases, land availability may be viewed as a diminishing resource. It is the primary input of crop and livestock production, representing a significant portion of total costs. Values and cash rents represent returns to land inputs for production and are indicators of the financial condition of the agricultural economy. In addition to a production input, land ownership represents wealth to owners. Thus, factors that determine the return of land inputs to production enhance potential for increases in total long-term net farm income.

A report from the Economic Research Service (ERS) summarizes much of the previous research concerning the relationship between land values and farm income (Stam). Divergence in land values and cash rents occurs when changes in discounted cash rents do not fully explain changes in land values. One explanation is that broad economic trends outside of the farm sector have an impact on land values. Changes in land values are due to market forces that are not related to agricultural productivity. Another possible cause of divergence is expectations of increased land values by owners and potential purchasers. Expectations that become self-fulfilling despite prevailing market conditions are termed rational bubbles. Empirical studies do not provide definitive evidence for rational bubbles, and questions regarding their existence remain to be resolved.

Asset pricing theory assumes that land is valued only for its economic return and specifies that there is a precise equivalence between land values and the discounted income from that land. Besides rational bubbles, there are several market factors that can cause a divergence

in land values and discounted rents. Among causes of divergence in values and rents are market forces such as risk aversion, government programs, taxes, and borrowing constraints, as well as nonpecuniary benefits from land, all of which have empirically similar appearances as rational bubbles (Clark, Fulton, and Scott).

Previous research on farmland value determination is notable for a lack of consensus (Robison and Koening). Farmland value models have tended to work well for a respective data set, but unsatisfactorily for alternative time periods and/or locations (Stam). Robison and Colyer reach a similar conclusion for land value models, despite the increasing complexity of applied formulations. Clark, Fulton, and Scott examined the relationship between values and rents in application of time series analysis. They show that the standard capital asset pricing model is appropriate only when values and rents have identical orders of integration.

Capitalization rates for cash rents indicate the importance of net farm income to maintaining the wealth of agricultural landowners. A standard capital asset pricing model utilizing cash rents for land focuses implications of the research results on issues related to agricultural productivity and income derived from land. The objective of this analysis is to compare the capitalization of cash rents into land values for cropland and pasture.

Data

Cash rents and values are reported for cropland and pasture from 1967 to 1994 by the Economic Research Service (ERS). Values are continued since 1996 and cash rents since 1997 by the National Agricultural Statistics Service (NASS). Missing data years are estimated by interpolation. All nominal monetary data are converted to real values by the GDP implicit price deflator of the Bureau of Economic Analysis. Prevailing interest rates are represented by the prime rate of the Federal Reserve. Real interest rates are calculated by deducting the percent

change from the preceding period of the implicit price deflator. Land values and cash rents represent levels during the early months of each year, while interest rates are published at the end of each year. Thus, real interest rates are lagged one year to achieve correspondence with values and rents. Annual data are available from 1967 to 2002 for a total of 36 observations.

A plot of cropland and pasture values is presented in Chart 1. Each value increased from 1967 to the late 1970's at similar rates. Decreases followed during the next decade of the 1980's, and resulting values were similar to 1967 levels. Land values have increased since 1991. Cropland values have increased at an average annual rate of 2.8% for a total increase of 102% since 1967, and pasture values have increased 321% for an average rate of 8.9%. Chart 2 shows a 28% decrease in real cash rents for cropland during 1967-2002 that is an average annual rate of 0.8%. During this period, pasture rents decreased at an annual average of 1.2% for a total decrease of 42%. Except for the decade preceding the late 1970's, trends for real cash rents generally correspond to trends for values. By 1979, real values had more than doubled, while rents were unchanged. Cropland values and rents declined by approximately 50% during the 1980's. Since 1990, cropland values have increased by 100%, but rents have increased only by 50%. Pasture trends were similar to those of cropland until 1990. Since 1990, pasture values have increased at a faster rate than cropland values. Pasture rents have decreased, while cropland rents have increased.

Capitalization of cash rents is calculated by dividing rent by a discount factor, usually an appropriate interest rate. Chart 3 and Chart 4 show a close relationship between land values and discounted rents until 1973 for cropland and pasture, respectively. Differences in values and discounted rents have increased over time, especially for pasture since 1990.

Two primary causes of divergence between values and discounted rents are increasing incomes of potential land buyers and encroachment onto agricultural land for nonagricultural uses. Comparing data from the University of Georgia and the U.S. Census Bureau indicates that real household median income increased by 16 percent from 1989 to 1999. During this period, population increases into rural areas is signified by an increase in the number of Georgia counties classified as metropolitan areas. There were 70 counties classified as metropolitan areas by the 2000 Census, a 67 percent increase from 1990 when 42 counties were counted as metropolitan. These data can be compared to previous Census data for income and population changes. From 1969 to 1979, real household median income increased by 8.3 percent, while the increase from 1979 to 1989 was 21.2 percent. Of the 159 counties in Georgia, only 13 were classified as metropolitan in 1970. A 146 percent increase brought the total to 32 in 1980, but only 20 percent of all counties were classified as metropolitan. This was followed by a 31 percent increase in 1990 when 26 percent of all counties were metropolitan. By 2000, 44 percent of counties in Georgia were metropolitan areas, causing pressure for increased land values in the remaining farming areas. Thus, increased income and population have been factors for a divergence in land values and discounted rents since the mid 1970's, and the effects of population and commercial expansion have increased as an influence in recent years.

The Model

Rent is the income that is derived from land and represents the return as an input. A discount rate represents the rate of return from invested capital that could be alternatively applied for land rental. Expected capital gains from land ownership must be at least equal to discounted rental rates in order for purchasing to be a viable investment alternative (Clark, Fulton, and Scott). Some of the changes in land values over time are from factors that are not readily

quantifiable for empirical representation. Examples of these variables are anticipated effects of current and future government programs, risk aversion, and the expected value of land due to the supply and demand relationship between a limited resource and an increasing population. To the extent that these unmeasured variables are stable, they are represented by a constant term in regression analysis.

The standard capitalization formula is

$$(1) \qquad V_t = \frac{1}{r_t} R_t,$$

where V_t is the value of land, R_t is the cash rent, and r_t is the real interest rate, all prevailing during period t. Purchasers of land are likely to respond to proportional changes in factors that are relative to land values, and a multiplicative model specification is more appropriate than an additive specification (Burke). By designating unmeasured factors of land values as N, a regression model is derived from (1) as

$$(2) \qquad V_t = (z_t^{\beta_1} R_t^{\beta_2})N,$$

where $z_t = r_t$.

Taking natural logarithms of (2) results in a model to estimate β_1 and β_2, and these parameter estimates for the model specified in logarithms may be directly interpreted as elasticities. A parameter estimate for N is applied as a constant term and represents the constant component of the annual change in land values from expected capital gains. Dickey-Fuller tests for land values, cash rents, and real interest rates do not reject the hypothesis of unit roots that indicate nonstationarity. Results are -1.82 for cropland values and -1.26 for rents. For pasture, the Dickey-Fuller results are -0.34 for land values and -0.68 for rent. Real interest rates have a test statistic of -0.96. A second Dickey-Fuller test on the first differences indicates that each

variable is I(1), and application of first differences induces stationarity (Greene). Unit roots are rejected for first differences of cropland values, cropland rents, pasture values, pasture rents, and real interest rates with test statistics of -6.97, -5.02, -4.64, -5.82, and -4.98, respectively. The estimated equation is

$$\Delta \ln V_t = N + B_1 \Delta \ln z_t + B_2 \Delta \ln R_t + \varepsilon_t, \quad (3)$$

where ε_t represents residuals that are independent and assumed normally distributed. A Jarque-Bera test does not reject a normal distribution of residuals for (2), and maximum likelihood estimation (MLE) with first order autocorrelation is applied for estimation.

As income from cash rents increases, land value as an asset increases, and expectations are for cash rents and values to have a positive relationship. Higher interest rates cause the effective cost of purchasing land to increase for all values, and a negative relationship should exist between real land values and real interest rates. Real land values have more than doubled over time, and unmeasured factors should lead to a positive sign for the estimated N coefficient.

Results

Estimates for the capitalization of cash rents are presented in Table 1. Constant unmeasured factors, including expectations of land purchasers, lead to increases through capital gains for cropland and pasture. Cash rents are capitalized into cropland values at a rate of 0.51% for cropland and a rate of 0.79% for pasture due to a one percent change in cash rents. Cash rents have decreased from 1967 levels, and increases in per acre land values are attributable to capital gains, rather than increased income per acre. Realized declines in cash rents have served to diminish the value of farmland. One-tailed tests on t-statistics for interest rates indicate that a negative coefficient sign meets theoretical expectations only in the cropland estimate. Increases in interest rates lead to decreases in cropland values, although there is wide variability between

years. Other factors, such as availability of credit from lenders, likely cause the expected negative relationship to not be realized in some years. Interest rates are not statistically significant for pasture values. R-square results show that cash rents explain more variability in values for cropland than pasture, indicating that nonfarm factors have greater influence on pasture values.

A stronger result (in terms of the model's explanatory power) for the cropland rent model can be attributed to two important factors: government payments and urban influence. Compared to pasture farms, crop farms have enjoyed more government support for over 50 years through either counter-cyclical subsidy payments that provided an income-stabilizing safety net mechanism for these farms or ad-hoc emergency payments for business rehabilitation after incurring losses caused by major natural disasters. The long-term existence of these programs minimizes crop revenue uncertainty and reinforces the landowners' and farmland buyers' expectations about the certainty and stability of this particular income source for crop farms. The same circumstance does not apply to pasture farms, which do not enjoy steady government support.

Significance of the pasture rent capitalization model is also diminished by the urban influence factor. In Georgia, relatively more pasture land than cropland is closer to urban areas, especially in the fringes of metropolitan Atlanta. In these areas, the faster appreciation of land values can be attributed more to the strong demand for the conversion of land to housing and recreational purposes.

These divergent trends in the returns to cash rent and market value of farmland provide interesting implications on recent structural changes in the farming sector. Cash rents are determined from expected net returns from production and could be bounded by the so-called

"break-even" rent, which is the remaining amount of money after cash operating costs have been covered by the farm's revenues (Lazarus). The persistent risks that farmers experienced through the years, through low commodity prices and unpredictable weather, among other factors, have apparently kept "break-even" rent at low levels through the years, thereby restricting the landlord's tendency to charge cash rents that are synchronized with the accelerating trend in farmland prices.

Econometric results for cropland suggest that increases in interest rates may lead to decreases in land values, although there is wide variability between years. Other factors, such as availability of credit from lenders, likely cause the expected negative relationship not to be realized in some years. In other situations, lenders resort to risk-adjusted loan pricing practices, in addition to non-pricing tools for credit risk management, as an effective tool for rationing credit, especially during periods of high financial stress in the farm sector where the proportion of highly risky farm borrowers is increasing. Moreover, liquidity-constrained investors are more likely to postpone investments on farmland during periods of rising interest rates in favor of other alternative short-term investments that provide a more reliable liquidity cushion.

Future trends in land values will be affected by changes in nonagricultural household income and population changes. The 1990's was a period of extremely high income growth that does not presently appear sustainable. This should diminish the effective demand for agricultural land from nonagricultural factors. Population trends are difficult to predict, but trends related to housing density have influence over agricultural land prices. Increasing population density in areas already classified as metropolitan will dampen the demand for land conversion out of agriculture. However, continued increase in the number of counties classified as metropolitan will lead to increased land values due to increased demand.

Farmland Control Arrangements and Risk-Sharing

The structure and conditions of the farmland leasing market have also changed through time as other forms of leasing arrangements have evolved. The 1992 and 1997 Census of Agriculture report declining ratios of rented land to total land operated by farmers in Georgia. Moreover, farmers have started considering share and hybrid leasing contracts as alternative options to the usual cash leasing arrangement. These circumstances indicate a declining demand for traditional cash rental arrangements.

Share leasing, for example, offers a viable farmland control alternative and is considered an even more highly risk efficient financing alternative for farmers compared to cash leasing and land ownership with debt financing. The risk benefit arises from the positive correlation between the value of production and the resulting rental obligation to the landowner under a share lease contract which ultimately is an effective tool for stabilizing farm incomes (Barry, et al.). Share leases also relieve tenant farmers of liquidity burden as rental payments to landlords are paid only when income is realized (with cash receipts flowing in as landlords disburse their share in production expenses) while partial payments of cash rents might be demanded by landlords in advance (for example, before the crop is harvested), probably more so when farm financial conditions are tight. As a result, the risk and liquidity benefits of share leases could lure farmers away from cash renting, especially during periods of increasing production and income risk. Risk-averse landlords, however, who might also be unwilling to be involved in farming decisions, would probably be inclined to settle with reduced cash rent levels than lose a sizable portion of the potential clientele of land renters.

Farm Commodity Program Payments

Among crop farms eligible for government commodity program payments, the impact of these payments on cropland values depends on the nature of farmland control arrangements entered into by the producer. The terms of their share rental arrangements determine the distribution of the payments among landlords and farmer-tenants. Only the portion of the payments captured by the landowners is actually capitalized into cropland values. According to the USDA, the predominant share leasing contracts in most areas of the U.S. are 1/3 - 2/3 and 1/4 - 3/4 where landlords are entitled only to one-third or a quarter, respectively, of the farm's gross revenues (Barnard, Nehring, Ryan and Collender).

In the case of cash rental arrangements, the farm operator receives directly the government payments that accrue to the crop farm. Landlords can, however, increase cash rental rates to capture a share of the subsidy payments, although these incremental rental rates are often not enough to fully capitalize such payments into cropland values (Barnard, Nehring, Ryan and Collender). In a survey of cash rents paid by Georgia farmers in 2002 conducted by Givan, landowners charge a premium to peanut farmers that are entitled to receive government payments under the new Farm Bill. The state average cash rents per acre for dryland and irrigated peanut farms with designated base acreage are $64.58 and $114.58, respectively. For farms that do not have base peanut acreage, the applicable average cash rents per acre are $36.74 and $85.56 for dryland and irrigated farms, respectively.

Summary and Conclusions

The results in this analysis indicate that only a portion of the variation in farmland values can be attributed to cash rent levels, although these values are theoretically regarded as returns to land as an input to farm production. The determination of cash rents depends on expected

returns from farming and the residual “break-even” rent level subjected to high volatility due to fluctuating commodity prices and unpredictable weather patterns. Land values are influenced by nonagricultural factors that lead to a divergence of discounted cash rents and values. Emerging forms of leasing contracts in farming, such as share and hybrid leases, could have also pressured risk averse landlords to charge more competitive cash rental rates that are not aligned to the actual returns structure of farm businesses. Notably, these alternative leasing arrangements provide liquidity and risk reduction benefits that become more attractive to farmers especially during periods of high production and income risk.

The cash rent-farmland valuation linkage was found to be weaker among livestock farms due to urban influence and greater income uncertainty. These farms' relative proximity to major metropolitan centers in the state coincides with nonfarm factors explaining much of the variability in pasture land values. Moreover, the absence of a long history of steady and substantial government support for pasture farms suggests that existing and prospective pasture owners could be more concerned about income uncertainty for livestock farms vis-à-vis crop farms.

References

Barnard, C., R. Nehring, J. Ryan, and R. Collender. "Higher Cropland Value from Farm Program Payments: Who Gains?" *Agricultural Outlook.* Economic Research Service, USDA, November 2001.

Bureau of Economic Analysis. "Price Indexes, Chain-Type". Tables 7.1 and 8.1. Internet site: http://www.bea.doc.gov/bea/nipaweb/nipatableindex.htm#p (Accessed April 16, 2003).

Burt, O.R. "Econometric Modeling of the Capitalization Formula for Farmland Prices." *American Journal of Agricultural Economics.* 68(1986): 10-26.

Clark, J.S., M. Fulton, and J.T. Scott, Jr. "The Inconsistency of Land Values, Land Rents, and Capitalization Formulas." *American Journal of Agricultural Economics.* 75(1993): 147-155.

Economic Research Service. "Agricultural Resources and Environmental Indicators." Ag Handbook No. AH722, February 2003, Chapter 1.2.

Economic Research Service. "Cash Rents for U.S. Farmland." ERS-90025. Internet site: http://www.ers.usda.gov/briefing/landuse/data.htm (Accessed April 14, 2003).

Federal Reserve. "Bank Prime Rate". Internet site: http://www.federalreserve.gov/releases/h15/data/a/prime.txt (Accessed April 16, 2003).

Givan, W. "Cash Rents Paid for Georgia Farmland in 2002." Working Paper, Department of Agricultural and Applied Economics, University of Georgia, April 2003.

Greene, W.H. *Econometric Analysis, Fifth Edition*. Upper Saddle River, New Jersey: Prentice Hall, 2003.

National Agricultural Statistics Service. *Agricultural Cash Rents.* Various annual issues.

National Agricultural Statistics Service. *Agricultural Land Values.* Various annual issues.

Robison, L.J., and D. Coyler. "Reflections on Relevance of Professional Journals," *Journal of Agricultural and Applied Economics,* 26(1994): pp. 19-34.

Robison, L.J., and S.R. Koening. "Market Value Versus Agricultural Use of Farmland," in M.C. Ahearn and V. Vasavada (editors.). *Costs and Returns for Agricultural Commodities: Advances in Concepts and Measurement.* Boulder, CO: Westview Press, 1992, pp.207-228.

Stam, J.M. "Credit as a Factor Influencing Farmland Values." U.S.D.A., Economic Research Service Staff Paper No. 9504, March 1995.

U.S. Census Bureau. "Database: C90STF3A." Internet site: http://homer.ssd.census.gov/cdrom/lookup/ (Accessed July 14, 2003).

_____. "Metropolitan and Micropolitan Statistical Areas Defined by Office and Management Budget." Internet site: http://www.census.gov/population/estimates/metro-city/03mfips.txt (Accessed July 14, 2003).

_____. "Income." Internet site: http://www.census.gov/hhes/www/income.html (Accessed July 16, 2003).

University of Georgia. *The 2002 Georgia County Guide.* Center for Agribusiness and Economic Development, Athens, GA, 2002.

_____. *The 1991 Georgia County Guide.* Cooperative Extension Service, Athens, GA, 1991.

Table 1. Estimates for Capitalization of Cash Rents of Cropland and Pasture

	-Cropland-			*-Pasture-*		
Variable	Parameter Estimate	Probability > |t|	Standard Error	Parameter Estimate	Probability > |t|	Standard Error
N (Constant)	0.0256**	0.0345	0.0116	0.0531*	0.0089	0.0190
Cash Rent	0.5084*	0.0038	0.1626	0.7935*	0.0098	0.2883
Real Interest Rate	-0.0944***	0.1691	0.0706	0.0345	0.7087	0.0914
AR(1) Coefficient	0.3003	0.0978	0.1759	-0.0524	0.7784	0.1845
R-square	0.32			0.22		
Durbin-Watsom	2.01			1.99		
Degrees of Freedom	31			31		

***One-tailed test significantly different from 0 at 90.0% level.

**One-tailed test significantly different from 0 at 97.5% level.

*One-tailed test significantly different from 0 ay 99.5% level.

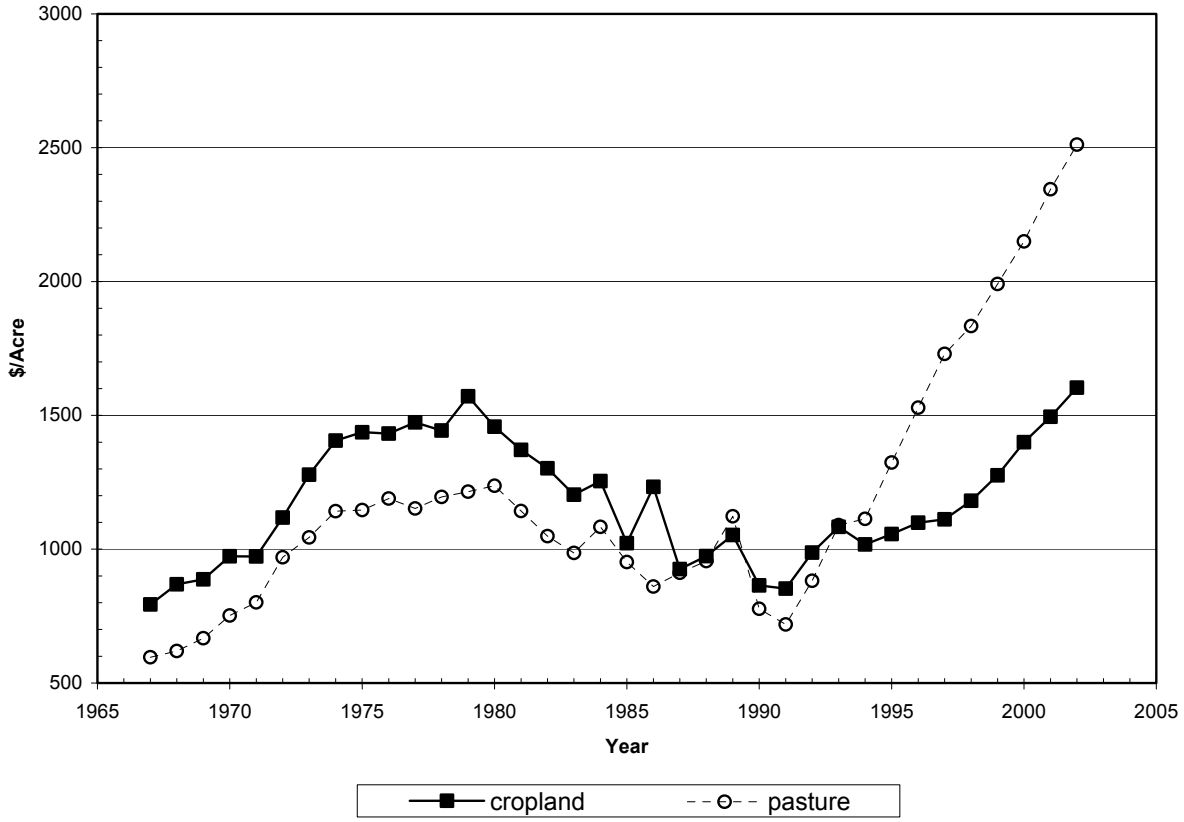

Chart 1. Real Values (2000=100) for Georgia Cropland and Pasture, 1967-2002

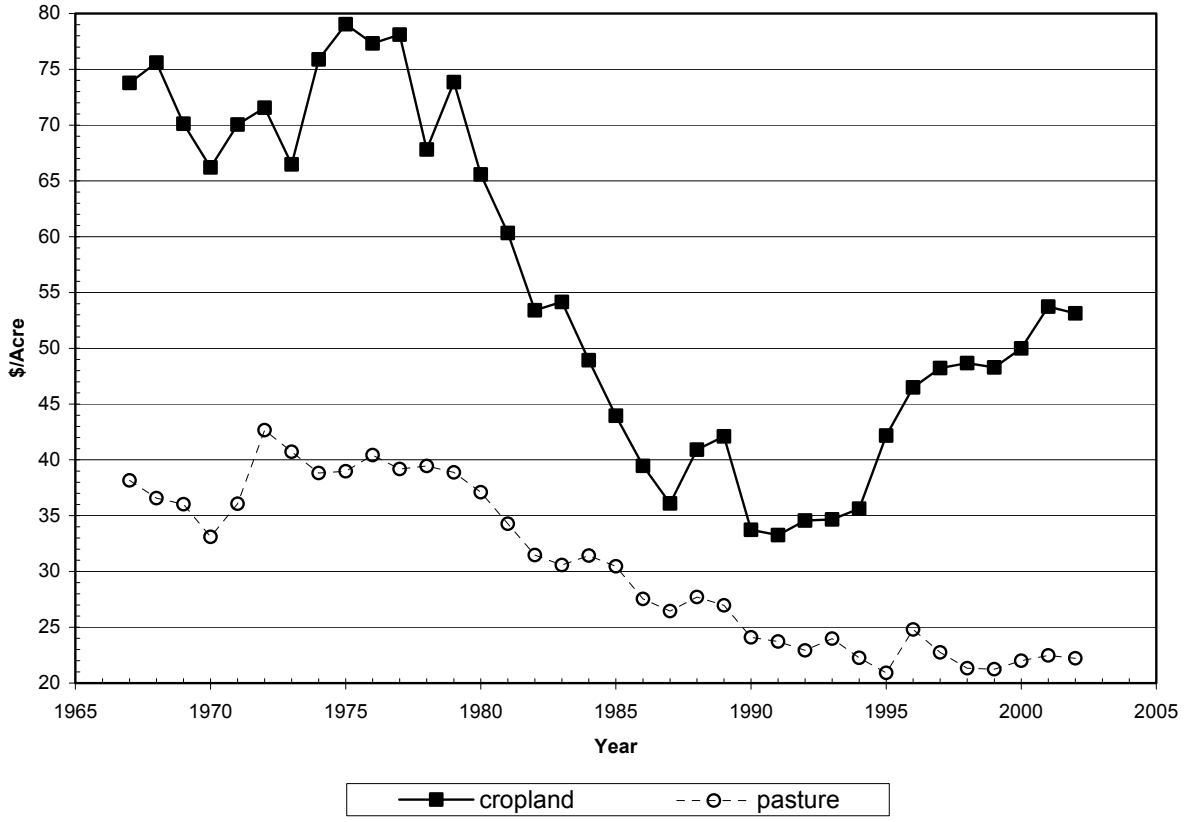

Chart 2. Real Cash Rents (2000=100) for Georgia Cropland and Pasture, 1967-2002

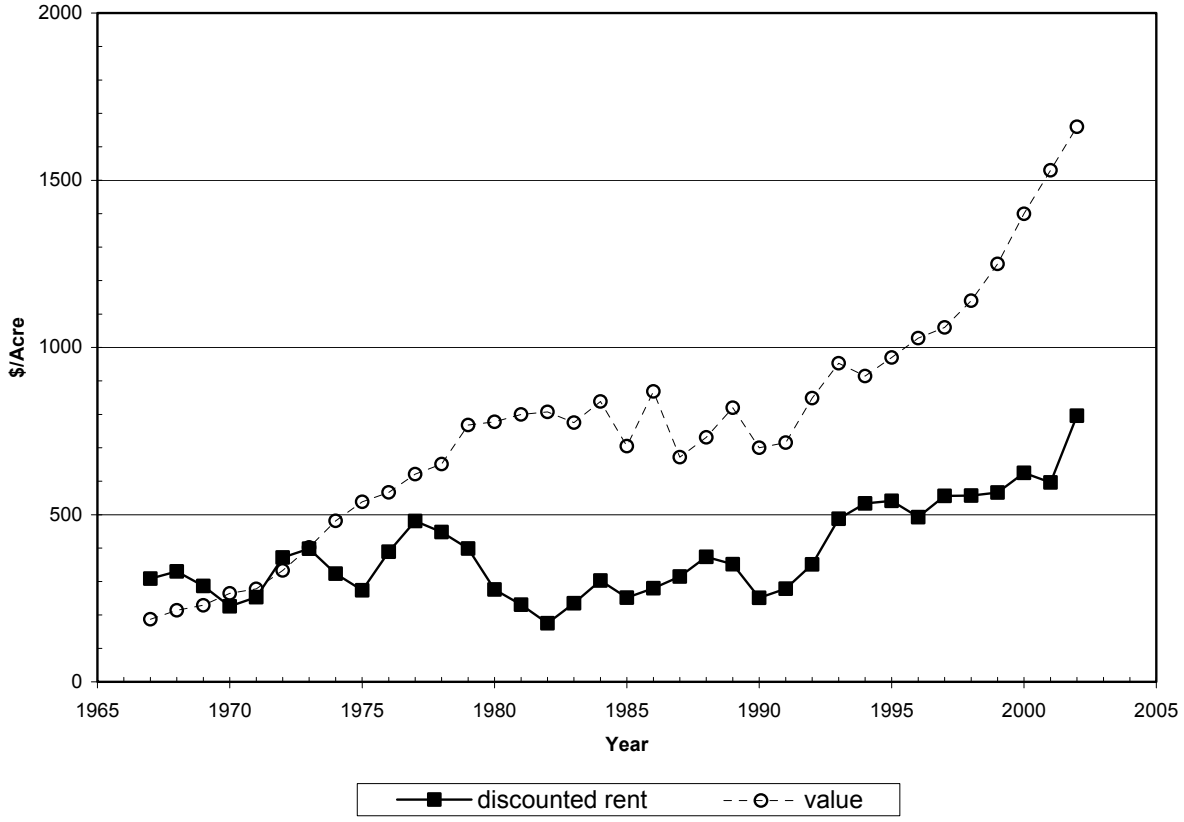

Chart 3. Cropland Values and Discounted Cash Rent, 1967-2002

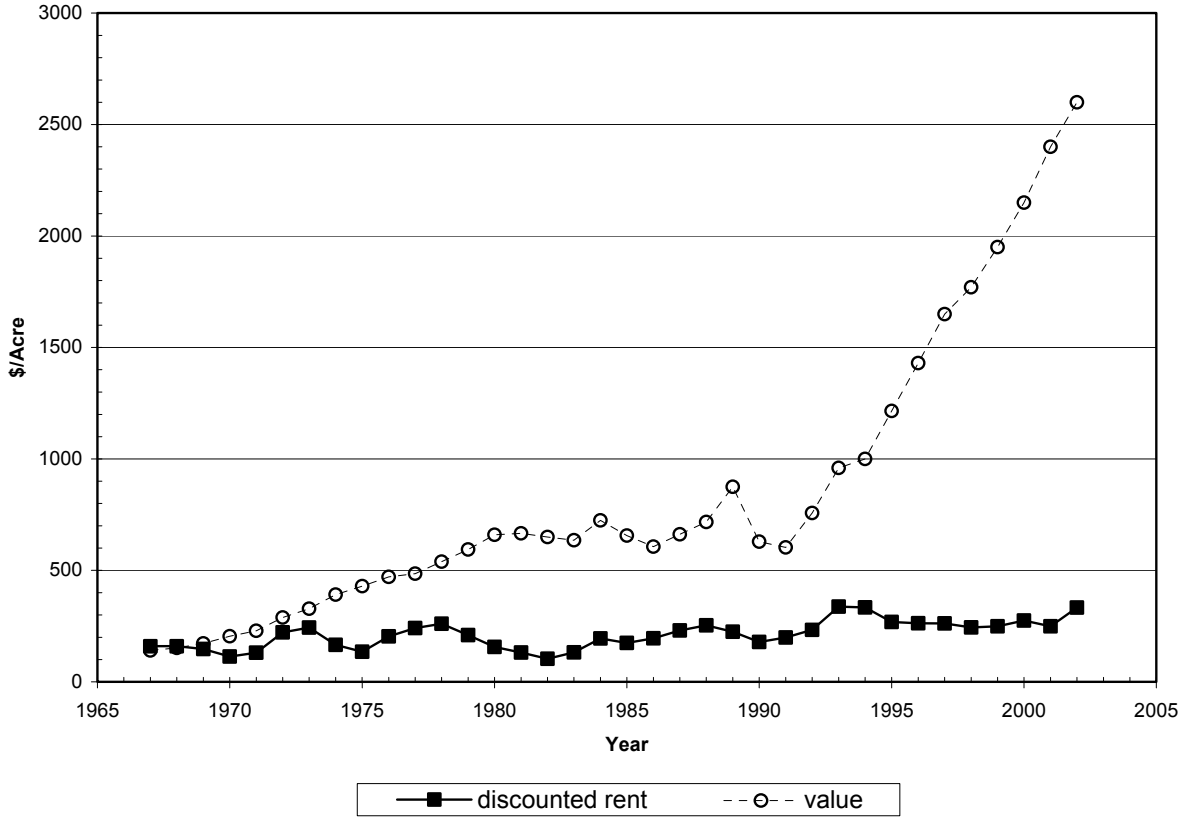

Chart 4. Pasture Values and Discounted Cash Rent, 1967-2002