ESTIMATING THE VALUE OF IRRIGATION WATER IN GEORGIA

Kyle C. Spurgeon[1] and Jeffrey D. Mullen[2]

AUTHORS: 1. Undergraduate Student, Department of Agricultural and Applied Economics, University of Georgia, 314 Conner Hall, Athens, GA 30602-7509; 2. Assistant Professor, Department of Agricultural and Applied Economics, University of Georgia, 314 Conner Hall, Athens, GA 30602-7509.

REFERENCE: *Proceedings of the 2005 Georgia Water Resources Conference*, held April 25-27, 2005, at the Unversity of Georgia. Katheryn J. Hatcher, editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. In 1999, the state of Georgia imposed a moratorium on the issuance of new irrigation permits in the Flint River Basin, creating scarcity with respect to both access to irrigation water and the amount of water available. A hedonic model was developed to examine the extent to which both sources of scarcity have been capitalized. Agricultural land sales from 1977-2002 in Sumter County were used to estimate the model. GIS was used to merge diverse data sets related to land sales and irrigation permits, and to generate spatial variables for analysis. Preliminary results suggest that the moratorium has induced a premium for holding a permit after the moratorium, and permit capacity is valued at $7.26 for each acre-inch/acre per day.

INTRODUCTION

Water resources in Georgia are under pressure from a growing population, increasing industrial and agricultural use, and greater demand for in-stream flows to support ecological systems. In addition to these pressures, from 1998 through 2002 Georgia experienced a prolonged drought. One of the responses to the water problem has been the implementation of a moratorium on the issuance of new water withdrawal permits within the Flint River Basin, the heart of the state's irrigated agriculture.

Water rights in Georgia, like most states in the southeast, are governed by riparian doctrine in which water rights are tied to the land. As a result, a permit to withdraw water cannot be transferred without transferring the property to which it is ascribed. The moratorium has, in effect, created two types of scarcity within the Flint River Basin: scarcity of access to irrigation water, and scarcity with respect to the quantity of water available for irrigation. The objective of this paper is to examine whether each of these types of scarcity have been capitalized in agricultural land sales.

BACKGROUND

From 1960 to 1995, the number of irrigated acres in Georgia increased more than 7-fold, from around 300,000 acres to 2.2 million acres (Georgia Department of Natural Resources). After decades of sporadic droughts, Georgia implemented its first agricultural water use permitting system in 1988. This law required users withdrawing 100,000 gallons per day or more, on a monthly average, to apply for a permit from the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources. Permits were free and generally issued to anyone who applied. There are currently over 20,000 permitted agricultural water withdrawals.

Within the Flint River Basin, 655,000 acres, 50% of harvested farmland, is currently under irrigation. Groundwater from the Floridan aquifer in southwest Georgia supplies about 70% of the water used for irrigation. A combination of groundwater and surface water from the Flint River is used to irrigate the other 30% of farmland (www.dnr.state.ga).

After years of heavy demands on its water resources, the Flint River reached record low-flow levels in 1999 prompting the implementation of the Flint River Drought Protection Act in 2001. The Act allocated $10 million dollars to "buy-out" permitted surface water withdrawals from local farmers for a single year. In addition, a moratorium was placed on the issuance of any further permits for groundwater withdrawals from the Floridan aquifer. New surface water permits from the Flint River had been prohibited since 1998.

The buy-out was administered over the 2001 and 2002 summer cropping season. The Georgia Environmental Protection Division (EPD) held sealed bid auctions in which farmers offered to sell their right to withdraw irrigation water for the season. In effect, the farmers were leasing their water rights to the state. The average prices paid by the EPD for the water permits were $131.85 in 2001 (208 permits purchased over 33,101 acres), and $126.05 in 2002 (272 permits purchased over 40,386 acres). Cummings estimated that as many as 1/3 of the permits sold to the EPD in 2001 were not actually going to be exercised that year. In other words, some farmers leased the state water that they had no intention of withdrawing. This suggests that the true per acre value for irrigation permits may be higher than the average offers in the auctions.

Prior to the moratorium, groundwater permits in southwest Georgia were easily obtained. Withdrawals associated with a permit were defined as a flow (gallons/minute) and limited by pump capacity. That is, a permit applicant could request withdrawals up to the amount of water their pump could withdraw.

No market currently exists in Georgia to openly trade water use permits. Instead, Georgia's riparian water rights doctrine stipulates that water use permits are to be considered part of the land they are issued to, and therefore cannot be sold separate from the land. According to farm real estate agents in southwest Georgia, casual observation of the farm land market implies a difference of $800 to $1,000 more per acre for permitted land over non-permitted land (Cummings, 2002). The purpose of this paper is to move beyond casual observation. Instead we develop a hedonic model to estimate the value of holding an irrigation permit after the moratorium took effect, and the marginal value of increases in the amount of water permitted for withdrawal.

METHODS

A hedonic model of agricultural land sales was developed to estimate the value of holding an irrigation permit after the moratorium, and to estimate the marginal value of water permitted for withdrawal. The model, based on Faux and Perry (200 is represented by equation 1.

(1) Y = *f*(MORATORIUM, DIST, WATER, ACRES, WOOD, LAND1, LAND2, LAND3, LAND4, LAND5, t)

Where: Y is the state sale price/acre expressed in real 2000 dollars; MORATORIUM is a dummy variable, equal to 1 if the sale occurred after the imposition of the moratorium, and 0 otherwise; DIST is the distance from the centroid of the parcel to the nearest urban center, measured in meters; WATER is the quantity of water permitted for withdrawal, measured as a flow in acre-inches/acre/day; ACRES is the total area of the parcel; WOOD is the proportion of the parcel that was wooded at the time of the sale; LAND1, LAND2, LAND3, LAND4, LAND5 are all dummy variables equal to 1 if the soil quality of the parcel is listed as Land Class I, II, III, IV, or V, respectively, for each of the top five land classes designated by the Natural Resources Conservation Service, 0 otherwise; and t is a time trend to account for general appreciation (or depreciation) of farm land in the basin.

DATA

Three types of data were needed for to estimate the model: sale price and parcel characteristics (Y, ACRES, WOOD, LAND); spatial data relatinf the parcel to urban centers (DIST); and data related to the irrigation permits (WATER). The initial intention of the study was to estimate the model in equation 1 for the entire Flint River Basin. Data constraints, however, prevented this.

The sale price and parcel characteristic data were collected on land sales from 1977 through 2003 from the Georgia Department of Audits. The irrigation permit data were collected from the Georgia Environmental Protection Division, and the distance variable was constructed using an electronic geographic information system. These data sets were to be merged using spatial information pertaining to the parcel and the irrigation permit. Unfortunately, only one county in the Flint River Basin, Sumter County, had a digitized parcel map that allowed for the data sets to be merged.

To accommodate the limited data available for estimation, equation 1 had to be modified. As Sumter County, located in the center of the Flint River Basin, has fairly homogenous soil conditions, the LAND dummy variables were dropped from the model. The distance variable was measured in terms of distance to the centroid of Americus, the county seat, largest city in the county, and closest urban area to any parcel within the county. There were 42 sales of agricultural parcels between 1977 and 2003 that had irrigation permits.

RESULTS

The model was estimated by ordinary least squares with the 42 Sumter County observations using a linear functional form. Parameter estimates and t-statistic values are presented in Table 1. A *, **, and *** indicate estimates that are significantly different than zero for alpha equal to 0.10, 0.05, and 0.01, respectively. The adjusted R^2 for the model is 0.56.

Table 1: Sumter County model results

Variable	Parameter Estimate	t-statistic
Intercept**	1618.74	2.59
MORATORIUM**	913.62	-1.96
DIST*	-0.016	-1.82
WATER**	7.26	4.73
ACRES	0.63	1.52
WOOD	-889.43	-1.29
t**	-69.25	-1.96

DISCUSSION

While the parameter estimates are preliminary at this stage, examining the sign and magnitude of the estimates suggests the model is performing fairly well. All of the parameters, with the exception of the time trend, have their anticipated sign. The negative price effect for the distance variable is consistent with observed patterns of land values emanating from urban centers. Wooded acreage, which is generally not irrigated, also leads to considerable reduction in the priceo f the parcel. The negative effect of the time trend is unexpected. However, considering Sumter County's agricultural economy over the time period covered by the data, it is apparent why the time trend is negative.

Most of the transactions in the data set took place in the late 1970s and early 1980s. In real dollar terms, Sumter County farm income fell nearly 50% in 1979 and then fell by another 50% in 1980 (www.georgiastats.uga.edu). It was not until 1994 that real farm income surpassed 1978 levels. Once the recovery began, farmers stopped selling their land. From 1993 to 2003, there were very few sales of agricultural land holding an irrigation permit in Sumter County.

The moratorium dummy variable suggests the value of holding a permit after the moratorium is around $913/acre. While this is not an excessively high figure, it is likely higher than the true value. Only three of the 42 observations in the data set occurred after the moratorium had taken effect. With the data disproportionately distributed in the early years, some of the general appreciation in land values after 1994 is likely to have been attributed to the moratorium dummy variable.

The model also suggests the per acre price increases as the acreage sold increases. In other words, larger parcels sell for more, per acre, than smaller parcels.

The WATER variable is also positive, and highly significant. The estimate can be interpreted as the marginal value of permitted pumping capacity. Because Georgia irrigation permits are written in terms of flow, rather than static volume, the parameter estimate in also expressed as a flow value at $7.26/acre-inch/acre/day.

CONCLUSIONS

The results of this study provide preliminary evidence that the scarcity created by the permit moratorium has, in fact, been capitalized into agricultural land sales. There is, however, need for further investigation. Sumter County is only 1 of 41 Georgia counties within the Flint River Basin. In addition to those 41 counties, the Basin's water issues also affect numerous surrounding counties. Application of the hedonic pricing model to the entire Flint River Basin would provide a more accurate value for irrigation water, which could improve future water policy decisions in the region.

While attempting to gather and synthesize the relevant data for this study it became apparent that Georgia's lack of a uniform data management system imposes considerable research costs. Lowering these costs through the establishment of a uniform record-keeping system for parcel data could provide substantial long-term benefits by facilitating research in the public interest.

LITEREATURE CITED

Cummings, R. G. 2002. Water use permits in Southwest Georgia preliminary, speculative notes on their value. Georgia Water Policy Working Paper #2002-006.

Faux, J., and G. M. Perry, 1999. Estimating irrigation water value using hedonic price analysis: A case study in Malheur County, Oregon. *Land Economics* 75(3): 440-52.

Georgia Department of Natural Resources website www.dnr.state.ga

www.georgiastats.uga.edu Georgia Statistics System website.