

FARMLAND PRESERVATION IN GEORGIA: THREE POSSIBLE ROADS TO SUCCESS

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Abstract

Georgia is the fourth fastest growing state in the United States in terms of population, but also still has an economy tightly linked to agriculture with sixteen percent of all jobs in Georgia related to agriculture. Yet, Georgia has no statewide program to preserve farmland. Three different combinations of program administration and funding sources are considered: a privately-run program funded through voluntary membership dues, a state-run program funded through voluntary purchases of a special license plate for farmland preservation, and a state-run program funded by a mandatory tax levied on all Georgia taxpayers. Over a five year period, the privately-run program is estimated to be capable of permanently preserving approximately **45,000 acres** of Georgia farmland, a state-run program funded voluntarily by special license plates is estimated to be capable of permanently preserving **168,000 acres** of Georgia farmland, and a state-run program funded by new, dedicated tax revenue is estimated to be capable of permanently preserving **203,000 acres** of Georgia farmland. Nationwide, about 1.6 million acres of farmland have been permanently protected, so the potential acreage protected by all three programs is significant. The preservation rates predicted for Georgia, ranging from 9,000 to 40,000 acres per year, appear consistent with the very successful programs in Maryland and Pennsylvania, which have had preservation rates ranging from 10,000 to 30,000 acres per year over their existence. In conclusion, all three styles of farmland preservation program appear to be feasible in Georgia and are likely to be successful if implemented.

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Executive Summary

Georgia is the fourth fastest growing state in the United States in terms of population, but also still has an economy tightly linked to agriculture. Sixteen percent of all jobs in Georgia are tied to agriculture. Yet, Georgia has no statewide program to preserve farmland and protect this segment of the economy from the pressures of development. Other states and numerous counties and cities around the country have established successful farmland preservation programs, most notably programs in Maryland and Pennsylvania. Farmland preservation is an important topic because farmland provides benefits to the Georgia economy by paying local governments more in taxes than it requires in service expenditures, by providing environmental benefits (such as storm water management) as a free byproduct, and by providing vital wildlife habitat. This report details an attempt to assess the possibilities for a successful farmland preservation program in Georgia.

Three different combinations of program administration and funding sources are considered. The first is a privately-run program funded through voluntary membership dues. The second is a state-run program funded through voluntary purchases of a special license plate for farmland preservation, mimicking the non-game wildlife habitat program currently in force in Georgia. The third program considered is a state-run program funded by a mandatory tax levied on all Georgia taxpayers, with the resulting revenue dedicated exclusively to farmland preservation.

The feasibility of each program was assessed through surveys of Georgia farmland owners and Georgia citizens to evaluate the willingness of both to support and participate in these different farmland preservation programs. Approximately 400 farmland owners (all owning a minimum of 300 acres) and 500 randomly selected Georgia residents over 18 participated in the project. Farmland owners were surveyed by mail to determine their willingness to sell the development rights to 100 acre parcels at a variety of possible prices. In such a scenario, the farmland owner receives money now in exchange for agreeing to a permanent deed restriction on the land that prevents the future development of that land. Thus, the land will remain forever in agriculture (which can include timber production). Georgia citizens were surveyed by phone concerning their willingness to pay for the three different programs, focusing on how popular support for the programs is impacted by both the funding mechanism and the amount of money requested.

The results of this research suggest that all three programs would be successful if tried in Georgia. Many farmland owners are willing to sell the development rights to (at least some of) their farmland, providing significant supply of land for farmland preservation at prices that seem in line with reasonable estimates of the development value of the land being preserved. Many citizens are willing to voluntarily contribute to both public and private farmland preservation programs, through membership dues to a private group or by purchasing special license plates

for an additional fee. Further, a majority of citizens say that they would vote in favor of a mandatory tax to provide a dedicated funding source for a public farmland preservation program.

Specific findings and estimates of the rate of farmland preservation that could be achieved under the three programs considered include:

- ❖ The average farmland owner would be willing to sell the state the development rights to 100 acres for a price of \$4,780 per acre.
- ❖ The average farmland owner would be willing to sell a private group the development rights to 100 acres for a price of \$4,988 per acre.
- ❖ For a privately-run program, the average price at which owners were willing to sell development rights is estimated to be \$4,527 per acre in South Georgia, \$4,956 per acre in Central Georgia, and \$5,034 per acre in North Georgia.
- ❖ For a state-run program, the average price at which owners were willing to sell development rights is estimated to be \$4,287 per acre in South Georgia, \$5,030 per acre in Central Georgia, and \$5,904 per acre in North Georgia.
- ❖ Thus, we find that farmers in South Georgia would sell their development rights for less money to a state-run program while North Georgia land owners would sell for less money to a privately-run program.
- ❖ Citizens would vote in favor of a mandatory, state tax for dedicated funding for farmland preservation by a 66 to 34 percent margin if the tax was \$20 per year and by 53 to 47 percent if the tax was \$50 per year.
- ❖ Special license plates used to voluntarily fund a state-run program would be purchased by 40 percent of the population at both additional cost levels of \$20 and \$50.
- ❖ Many citizens said they would join a private group dedicated to farmland preservation and pay membership dues to fund such a group. At \$20 per year, 48 percent would join, at \$50 per year, 32 percent said they would join.
- ❖ The most money would be raised under the tax since, if passed, all taxpayers would have to pay, but all proposed programs enjoy significant public support.
- ❖ The amounts of money raised by all three mechanisms are substantial. At the low end, the private group is predicted to raise almost \$145 million in five years with \$20 annual dues and \$242 million over five years with \$50 annual dues. At the high end, the \$50 per year new tax would raise a little over \$914 million in a five year period, which is about six times an optimistic forecast of funding for the Georgia Community GreenSpace Program over the same period.

- ❖ Over a five year period, the privately-run program is estimated to be capable of permanently preserving approximately **45,000 acres** of Georgia farmland.
- ❖ Over a five year period, a state-run program funded voluntarily by special license plates is estimated to be capable of permanently preserving approximately **168,000 acres** of Georgia farmland.
- ❖ Over a five year period, a state-run program funded by new, dedicated tax revenue is estimated to be capable of permanently preserving approximately **203,000 acres** of Georgia farmland.

To put these numbers in perspective, the federal Farm and Ranch Land Preservation Program has allocated approximately \$87 million across all 50 states for fiscal year 2004 with slightly above \$1.2 million designated for Georgia. In contrast, the privately-run program funded with voluntary membership dues would be able to spend twice that amount *each month* and the tax-funded state program could spend that amount *every 2.5 days*. Nationwide, only 1.6 million acres of farmland have been permanently protected, so the potential acreage protected by all three programs would be significant. The top two states in terms of farmland preserved to date are Pennsylvania and Maryland which have protected approximately 276,000 and 229,000 acres, respectively. Maryland's program is 25 years old, so the preservation rates predicted for Georgia, ranging from 9,000 to 40,000 acres per year, appears consistent with these two very successful programs which have had preservation rates ranging from 10,000 to 30,000 acres per year over their existence.

In conclusion, all three styles of farmland preservation program appear to be feasible in Georgia and are likely to be successful if implemented. Georgia has the public support to fund one of the leading farmland preservation programs in the country and the land owner support to turn that funding into a permanent legacy of protected farmland for future generations of Georgians.

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CHAPTER 1: INTRODUCTION

Why do we need Farmland Preservation Laws?

Suburbanization and urban sprawl are continually invading America's open spaces, particularly farmland. Around 1960, reports of soil degradation and wasteful patterns of urban sprawl shattered American's perceptions of a limitless supply of farmland. Then, from 1982 to 1992, an estimated 5.1 million acres of forest land and 6.2 million acres of agricultural land in the United States were lost to development, including urban sprawl (Geoghegan 2002). As of 1992, 80% of the usable crop land in the U.S. was already under cultivation and with current rates of urban encroachment the remaining 20% of land could be depleted in as little as fourteen years. The latest USDA estimate is that 2 million acres of productive farmland are lost annually to development (Natural Resources Conservation Service 2002). Land in the United States is being consumed at twice the rate of the population growth. Over fifty-five percent of the growth in the housing market has been homes built on a lot size of ten or more acres (Natural Resource Conservation Service 2002).

One of the main concerns with farmland being converted into developed land is the irreversibility of the change in land use. Will farmland consumed today for urban needs be required in the future for basic human subsistence and can it be reclaimed (Macek 1999)? The other fundamental argument for farmland preservation does not deal with the quantity of land lost but the quality of land being converted. Prime farmland is usually level to gently sloping, well drained, and not prone to erosion; these characteristics also make this land ideal for development (Macek 1999). The majority of land lost is located on the urban fringe and has the characteristics mentioned above; in many cases the most productive farmland is developed. A 1993 report from the American Farmland Trust stated that 85% of the United States' fruits and vegetables and 80% of our dairy products are produced in counties subject to urban growth pressures (American Farmland Trust 2003).

Farmland is also needed to help balance community budgets. Ranch, farmland, and forestlands all generate surplus revenues from taxes because they do not use most of the community services that those taxes fund. Losing these lands to development can cause an unbalanced tax base unable to support desired government services (American Farmland Trust 2002b).

Environmental Benefits Derived from Farmland Preservation

There are also some environmental issues associated with farmland protection. Many farmland preservation programs just protect the land from future development but cannot force the landowner to continue farming his land. With this being the case, farmland preservation programs can also be viewed as a form of open space preservation. Farmland preservation programs benefit the environment in a number of ways. Farmland can serve as a water recharge area if the surface is connected to an aquifer and if infiltration rates are high. This is particularly important because most residential and agricultural water used is from ground water sources (Ward 1986). Crops and other vegetation planted on farmlands helps to purify the air. Large

wooded farming areas and tree farms also support a variety of wildlife species (Ward 1986). Large tracts of farmland or any form of open space can serve as a source of storm water management during rainfall events. Storm water management is usually a large, expensive problem in communities where there are many impervious surfaces such as roads, parking lots, and roofs (American Farmland Trust 2003). There are other positive externalities associated with preserving farmland. The first of these are the aesthetic values associated with farmland, which can increase property values. Farmland preservation programs also help stabilize property values on adjacent lands since these programs permanently protect farmland (American Farmland Trust 2003).

If farmland is not protected and urban sprawl does force farmers to be pushed further and further outward, there some negative environmental affects. When prime farmland is lost to development the lower quality, marginal lands are forced into production. This agricultural production on lower quality lands (lands with steeper slopes and not highly fertile or well structured soils) comes at much greater economic and environmental costs. When forced to plant on less fertile soils farmers have to increase fertilization and pesticide applications as well as much more intensive irrigation methods and rates (Macek 1999).

The Effects of Suburbanization on Agricultural Land

As suburban development intensifies, the conflicts between agricultural and nonagricultural land uses become increasingly severe. Increasing suburbanization can cause the political influences of the rural community to decline. When the rural communities lose their political clout there can be a significant increase in local ordinances. These ordinances include the regulation of pesticide use, odor controls, controls on the density of livestock and poultry operations, and increasingly restrictive building codes (Berry 1978). All of these new ordinances force farmers to internalize their negative externalities. Raising taxes to pay for new schools, utilities, roads, or other services simultaneously occurs with suburban encroachment into rural areas. These taxes are often paid based on acreage owned and not on the basis of how parcels of land are used (Berry 1978). Local governments may also impose the principle of eminent domain to take farmland for roads or reservoirs (Berry 1978). Aside from the political aspects of suburbanization, increased air pollution can cause damage to crops. Farmers must also worry and protect against vandalism to their land and crops, along with increased harassment of farm animals primarily carried out by children (Berry 1978).

Suburbanization has direct effects on farmland values, especially parcels of land that lie close to suburban development since land is a financial asset. The first effect of increasing suburban development is the rising opportunity cost felt by the farmland owners (Lopez et. al. 1988). This is a direct result from the increasing development pressures felt by the farmland owners. The rising opportunity cost influences agricultural production decisions. This is best observed by the reluctance farmers feel toward investing in new technologies. Rising opportunity cost creates uncertainty in their planning horizons, due to the increasing possibility of selling their land (Lopez et. al. 1988). Another direct effect of suburbanization is observed when agricultural land is a productive input. When urban sprawl encroaches upon farmland, the land itself can become less responsive to current agricultural market conditions. When this happens, and farmers

become less willing to replace or maintain their current farm infrastructure, it is termed “impermanence syndrome.” A study conducted by Lopez, Adelaja, and Andrews in 1988 discovered that encroaching suburban development near farmland also increases the user cost of the land. This increase in user cost comes in forms like increased property taxes and capital gains (Lopez et al. 1988). This same study also confirmed that suburbanization pressures created both of the above effects on farmland. They concluded that as developmental pressures strengthen, premature idling of farmland and disinvestments in capital grow (Lopez et al. 1988).

The Federal Farmland Preservation Law

Due to increasing public awareness of the mentioned concerns associated with urban sprawl, the Federal government authorized the Farmland Protection Program in Title III, Section 388 of the Federal Agricultural Improvement and Reform Act of 1996 (also known as the 1996 Farm Bill). This legislation offers 50% of the fair market value with the expectation that the local or state government will match the federal funding for farmers who offer their development rights for permanent preservation (Natural Resource Conservation Service 1996). The original funding for the bill was fully expended by the 1998 fiscal year. In 2000 Congress allotted \$10 million for the Farmland Preservation Program. This value was then increased for 2001 to \$30 million (Natural Resource Conservation Service 2003).

In order for states to match the federal funding, they must establish their own farmland preservation programs. There are many ways that local and state governments are preserving farmland; transferable development rights, differential tax assessments, agricultural zoning, urban growth boundaries, agricultural districts, and conservation easements (Geoghegan 2002). Currently, there are forty-eight states that have farmland protection programs using one or more of the above methods.

Various Methods Used to Preserve Farmland

In an effort to reduce the effects of suburbanization on farmers, many local governments have implemented farmland protection programs. Currently there are forty-eight states that have some form of farmland protection law. The overall goals of farmland protection programs are: (1) to protect prime or unique farmland, (2) sustain rural economic stability and development, and (3) preserve valuable farmland for future generations (Natural Resource Conservation Service 1996). The various methods used to preserve farmland can be grouped into three broad categories: development rights, tax incentives and disincentives, and zoning. All of the methods of preserving farmland, directly or indirectly, affect the property tax paid on the land. Escalating property taxes are one of the main reasons that farmers near urban areas are forced to sell part, and sometimes all, of their land. Real property taxes paid by farmers located in urban fringe areas often exceed net farm income (Peddle 1997). In most other instances, real property taxes consume over twenty percent of net farm income (Nelson 1998). Therefore, if these methods can reduce the property value or directly reduce the property taxes paid, then farmers will defer selling land to developers, keeping land in production.

In order to better understand how the property tax rate is determined one must know how the fair market value of a parcel of land is determined (Peddle 1997). The market value of land is determined by the value of the net rents or returns the parcel of land is expected to generate over its life (Peddle 1997). There are three important components that factor into the capitalized value attached to the land. The first is the “highest” or “best” use of an attribute of the land. This is the use of the land that will generate the highest price paid to the resource owner. Secondly, the various attributes a parcel of land has which add to the long-term stream of rents. The last component is the interest rate that is used to compare the benefit and cost flows, as well as various time horizons, when comparing potential projects (Peddle 1997). Most of the following methods used to prevent urban encroachment on farming communities rely on adjusting one of these three components, allowing farmland to reflect its agricultural value rather than the land’s developmental value. There is an obvious negative aspect of this reduction in land value: the reduction in property taxes paid to the local governments that depend on them.

Differential tax assessments are one of the tools used to preserve farmland. The goals of this method are to delay the sale of agricultural land for urban uses, to recognize that such land places less of a demand on local governments for the infrastructures that are financed by property taxes, and to reduce the burden of the property taxes on these lands near urban developments (Nelson 1998). Differential tax assessment programs reach these goals by: (1) assessing the land based on its use value rather than its developmental value (2) reducing the assessed value of the agricultural land to a percent of urban land and (3) applying taxes only for certain services, thereby reducing the total tax rate which is applied (Nelson 1998). State Income Tax Credits have also been used in Michigan as a form of a tax incentive program by granting a state income tax rebate to resource landowners when local property taxes exceed seven percent of a farmer’s net income. The farmer is refunded the amount equal to the property taxes paid in excess of the seven percent threshold. The local governments do not lose any revenue generated from these tax rebates; instead the state government bears the burden (Nelson 1998). However this type of program has not had high success rates. Less than five percent of Michigan’s land base is enrolled in the program. Those that are enrolled are usually either retired or are low income, non-farming households (Nelson 1998). Instead this program has encouraged reduced productivity, therefore reducing the net farm income and enabling a farmer to qualify for the rebate (Nelson 1998).

The most common and least costly method used to preserve farmland is agricultural zoning or districting (American Farmland Trust 1998a). An agricultural district is voluntarily created through statutes and voted on by local farmers; therefore the governing body or local governments can also change it. Agricultural zoning is imposed by local ordinances (American Farmland Trust 2001a). The objective of zoning and districting is to prevent any non-farm uses within the district, or designated area. This restricts land uses to agricultural or livestock, any other type of open space activity and to a very limited amount of home building (Nelson 1998). Areas that are zoned for agriculture have very large minimum plot requirements. However, there is a drawback to zoning. The restrictions imposed through zoning opens this technique for political criticisms and legal issues dealing with its’ constitutionality (Luzar 1988). Also, included in this preservation category are urban growth boundaries (UGB). An UGB’s objective is to preserve open spaces and farmland by directing development into cities. An UGB still

allows for small acreage home sites to be located within areas of low resource productivity (Nelson 1998).

The last method is the most efficient and productive way to permanently preserve farmland. This method involves permanently taking the development rights of a parcel of land. This is accomplished through transferable developmental rights (TDR), purchased developmental rights (PDR), and/or conservation easement programs. TDR programs allow landowners to transfer the right to develop one piece of land to another piece of land, shifting development away from agricultural areas toward designated growth zones (American Farmland Trust 2001b). PDR (also referred to as PACE for purchase of agricultural conservation easements) programs restrict the future use of a parcel of land. Both TDR and PDR programs compensate the landowners for restricting the use of their land. The appropriate level of compensation can be determined in various ways. The first, and most widely used, method is through a professional appraisal. Here the appraiser determines the difference between the fair-market value of the land and then the value of the property with the restrictions. The other method is the comparable sales method; which relies on the sale of similar agricultural conservation easements to determine the value of the subject easement (Wang and Libby 2002). There are nineteen states with PDR or TDR programs that are receiving the matching federal funding; Montana, Ohio, and Utah have acquired easements without federal funding. As of December 2001, the average in state easement price ranged from \$667 per acre in Florida to \$6,654 per acre in Rhode Island making the average easement cost approximately \$1,817, including the \$0 in Ohio because all lands are donated (Wang and Libby 2002). Conservation easement programs rely on the land being donated by landowners; however a tax deduction is allowed (American Farmland Trust 2004). All three of these programs are based on a parcel of land having a bundle of attributes (Peddle 1997). Therefore by restricting the use of land, the parcel's market value should only reflect its' agricultural use value (Nickerson & Lynch 2001). By reducing fair market value there is also a reduction in property taxes. In order to overcome these costs the county must have a large non-farm tax base so that property taxes are only increased marginally (Dunford 1981). The reduction in market value also allows a farmer to sell his land for a lower price allowing another farmer to purchase at this lower price; keeping the land in agricultural use (Nickerson & Lynch 2001). Even though these programs sound good, there are some drawbacks to their usage, the first being the high cost of development rights in an urban area. The second drawback is administrative costs. There are studies that must be completed and planning that must be conducted for a number of years before the implementation of these programs (Dunford 1981). Currently eleven states authorize PDR programs and five states allow for the transfer of development rights.

What is Happening in Georgia?

Georgia currently trails only California, Texas, and Florida in population growth, with a 23% increase in population since 1990 (Georgia Department of Natural Resources 2003). Forty-three percent of the nation's farms are located in the Southeastern region and 30% of this region's land is in farming (United States Department of Agriculture 2003). Georgia's average size farm is 220 acres, well below the national average of 436 acres (United States Department of Agriculture 2003). In Georgia some would argue that farmland should be protected because of

the impact the food, fiber, and related industries have on Georgia's economy. A study conducted by Kriesel and Doherty in 2000 found that one in seven Georgians work within the food, fiber, and other related industries sector of Georgia's economy. They also found that these industries contribute \$56.7 billion to the state's \$352.8 billion economic output. The real estate and financial sector was second at \$47.7 billion. Once these output and employment figures are broken down into the groups that are directly affected by farms the totals are: farm inputs and machinery sectors contribute \$2.1 billion towards output and employ 17,816 individuals, farm and forest production sectors contribute \$6.5 billion towards output and employ 87,269 people, food and fiber processing sectors contribute \$36.7 billion and employ 179,840 people, the food wholesale and retail sector contributes \$3.0 billion and generates an estimated 109,672 jobs, and the food service industry contributes \$8.3 billion in output and generates an estimated 240,344 jobs (Kriesel and Doherty 2000).

Therefore, in order to help tackle problems associated with rapid population growth, the Georgia General Assembly created the Georgia Greenspace Program, Senate Bill 399, during the 2000 legislative session. This program establishes a set of guidelines that developed and rapidly developing counties can follow to voluntarily preserve greenspace; there are fifty-nine counties that were eligible during the 2003 fiscal year (Georgia Department of Natural Resources 2003). The Georgia Greenspace Program allows counties to develop and administer their own greenspace program, after the state approves the county's suggested program. Then the eligible counties must adopt policies and rules that would promote the permanent preservation of 20% of their land area for greenspace. Senate Bill 399 defines greenspace as:

“Greenspace means permanently protected land and water, including agricultural and forestry land, that is in its undeveloped, natural state or that has been developed only to the extent consistent with, or is restored to be consistent with, one or more of the following goals:

- (A) Water quality protection for rivers, streams, and lakes;
- (B) Flood protection;
- (C) Wetlands protection;
- (D) Reduction of erosion through protection of steep slopes, areas with erodible soils, and stream banks;
- (E) Protection of riparian buffers and other areas that serve as natural habitat and corridors for native plant and animal species;
- (F) Scenic protection;
- (G) Protection of archaeological and historic resources;
- (H) Provision of recreation in the form of boating, hiking, camping, fishing, hunting, running, jogging, biking, walking, and similar outdoor activities;
- (I) Connection of existing or planned areas contributing to the goals set out in this paragraph.” (Legislative Research 1999)

The General Assembly has appropriated \$30 million for each fiscal year, 2001 – 2003, and \$15 million for 2004, for grants that help pay for the costs of acquiring of conservation easements or real property that will qualify as greenspace (Georgia Department of Natural Resources 2003). The program has now been extended to all Georgia counties. Since each county is responsible

for its own program, deciding what greenspace should be purchased, land prices and results vary significantly from county to county.

Why Private Markets May Manage Farmland Preservation Programs Better Than States

Following September 11, 2001 the economy slowed and state tax revenues have been short of previously forecasted levels, forcing many states to reduce their budgets. One budget area that often gets cut is funds for purchasing conservation easements or development rights for greenspace or farmland preservation programs, as Georgia's Governor Sonny Perdue did when he recommended that the Georgia Legislature cut funding for the Georgia Greenspace Program in half for the 2004 fiscal year (Georgia Department of Natural Resources 2003). Therefore, with decreasing state budgets and the slow economy, an opportunity is created for hundreds of private trusts across the nation to assume responsibility for farmland preservation programs. Despite the slowing economy and budget cuts, government failure is part of the reason that a state organized farmland preservation program does not exist. There is obvious support for these types of programs across the nation, yet one does not exist in Georgia. That is, government priorities do not match taxpayer priorities. Also when the government runs farmland preservation programs there are compromises made due to the political process (Katz 2003). Another consequence of governments remaining in control of farmland preservation programs is that their political and bureaucratic decisions are, generally, less efficient, more wasteful, resulting in them being less environmentally friendly. "Government control means political control" (Katz 2003). Governments just might not have the resources to efficiently run farmland preservation programs where a private organization can devote all of its efforts to organizing and overseeing farmland preservation programs.

Private trusts are better equipped than the majority of state workers to assess environmental values of the properties and to oversee covenant compliance. Another benefit associated with private trusts managing farmland preservation programs is that they are more easily able to customize or individualize covenants to the owners of properties that would help maximize the goals of farmland reservation programs (Katz 2003). These customized covenants could incorporate the relative risk of conversion and the property's environmental value into the eligibility criteria for program enrollment. Private land trusts would be better able to manage and oversee covenant compliance, since land trusts are usually local. This is especially important because farms that are enrolled are usually diffused across the state, increasing travel time for state employees (Katz 2003).

However market failure is occurring as well because there is increasing support across the United States for farmland preservation programs, yet one has not been established in Georgia. The lack of profit generated from a private farmland preservation program could be the reason why one has not been established. There is also a major downside to private land trusts or organizations running farmland preservation programs: there is no guarantee that the organization will be successful and exist forever whereas the government will always exist. Also, market failure is much more likely to happen if a private organization runs a farmland preservation program. This is because farmland can be considered a public good, potentially causing private markets to

underestimate the value of farmland due to the externalities associated with farmland and preserve too little.

Problem Statement and Objectives

Private organizations may be better equipped to manage farmland preservation programs. A number of land trusts across the United States currently manage preserved farmland. Currently, Georgia does not have a specific farmland preservation program. Georgia is one of the fastest growing states in the nation with statewide growth of 23 percent between 1990 and 1999 (United States Census Bureau 2004). These high population increases create high development pressures on Georgia's farmland. A farmland preservation program would reduce these pressures and help Georgia farmers retain their farmland and aid Georgia's agricultural economy. Therefore, the goal of this study is to determine whether there is a demand and/or a supply for a state or privately run Georgia farmland preservation program.

Data will be collected using a farmer willingness to accept mail survey and a willingness to pay phone survey of Georgia citizens. The data from landowners will be used to estimate the price per acre that would need to be paid for development rights depending on the number of acres that are to be acquired. This will allow a supply curve for the farmland available for a preservation program to be estimated. The citizen data will be used to estimate the public demand for a farmland preservation program and to estimate how much revenue could be generated to fund the various farmland preservation programs studied here. The results will show whether private and/or state-run farmland preservation programs are feasible in Georgia and will provide estimates of how much land could be preserved in these different cases.

CHAPTER 2: LITERATURE REVIEW

It is particularly difficult to analyze farmland protection programs because of the externalities that are not accounted for in market transactions. Since there are public good aspects associated with the benefits of these programs, market allocations tend to deviate substantially from the social optimum (Bowker & Didychuk 1994). This also means that agricultural landowners are not able to obtain any of the rents associated with these amenities; instead they are accrued to third parties (Beasley et. al 1986). The externalities associated with these programs such as the increase in ground water recharge rates, wildlife habitats, and flood plain protection are very difficult to quantify without using methods such as contingent valuation surveys/methods (CVM). Therefore many of the studies done to determine willingness to pay, willingness to accept, participation, or valuing the affects of farmland preservation use CVM. Little research has been conducted to determine the willingness of farmers and farmland owners to participate in a farmland preservation program and to determine an acceptable value for the development rights. However there have been studies done on what the public expects and desires a farmland preservation program to accomplish. This chapter reviews farmland preservation studies conducted to estimate the public value of farmland and its' amenities, household willingness to pay to preserve farmland, which characteristics of land affect the price of development rights, and what will help increase public support for farmland preservation programs.

Work on the Value of Preserving Farmland

Bowker and Didychuk (1994) conducted a land owner contingent valuation survey in a predominantly agricultural area of Eastern Canada that is currently under strong urban pressures. When public good aspects of land are involved, market good allocations may deviate substantially from the social optimum. This study uses the CVM approach to estimate the Hicksian welfare function that may then be represented a number of ways with utility maximization in microeconomics. Also employed is a form of payment card to elicit household willingness to pay to preserve units of the farmland base in Moncton, Canada. The survey had a cover letter explaining the loss of the external benefits and other aspects of farmland retention. The model included these variables: log of the amount of farmland to be preserved, household income, affiliation with conservation organizations, distance to nearest parcel of farmland, farm background, number of people in household, and whether or not they visit farmland. Income and background were the only two variables that were not highly significant; however income was kept in the model for theoretical importance. The surprise was the significance of the number within household variable; each additional household member added eleven dollar to annual household WTP most likely due to increased option and family bequest considerations. They found that regional total extra-market amenity values generated by farmland were approximately \$1.7, \$2.3, \$2.7, and \$3.0 million if 23,750; 47,500; 71,250; or 95,000 acres of farmland were preserved. This would indicate that the regional extra-market benefits of farmland retention in Eastern Canada are \$97 per acre at the margin, which is equivalent to 6 to 16 percent of the typical agricultural land value for this region (Bowker & Didychuk 1994).

Bergstrom, Dillman, and Stoll (1985) also conducted a study using contingent valuation methods to estimate the total value curve for prime farmland amenities in Greenville County, South Carolina during 1981 and 1982. This survey was intended to measure household willingness to pay for the external benefits generated from prime land amenities. The model included these variables: amount of prime land to be preserved, payment vehicle type, whether background information was included in the survey, family income level, farm background, age, highest level of education, involvement in commercial development, involvement in commercial agriculture, and area of residence (urban or rural). It was found that payment vehicle, farm background, involvement in commercial agriculture and commercial development, and area of residence were not significant. They found that the amenities per household associated with farmland preservation were \$5.70 for 18,000 acres; \$6.78 for 36,000 acres; \$7.86 for 54,000 acres; and \$8.94 for 72,000 acres. The total annual aggregate value is then equal to \$967,400, which is approximately \$13.00 per acre for the environmental amenities farmland provides in Greenville County, South Carolina, which is lower than average; however considering that Greenville County is a predominantly rural area, agricultural land amenities are not scarce (Bergstrom et al 1985).

Beasley, Workman, and Williams conducted a contingent valuation study in 1986 to estimate the amenity values associated with urban fringe farmland. This study focuses on estimating the accrued amenity values felt by the individuals living in close proximity to existing agricultural land. This survey forecasted two levels of development and asked people their willingness to pay to avoid such changes. This survey was conducted using personal interviews giving background information and maps showing quantity, location, and other various characteristics of local farmland. There were 119 usable survey responses. It was found that annually a household would be willing to pay \$70.75 more dollars to prevent the high development scenario than they would pay to prevent the moderate development scenario. Individual households were willing to pay \$76 annually to prevent the moderate development scenario. Thus, the average bid to prevent the high development scenario was \$144 annually. The individual bids in the sample were aggregated and these results were extrapolated over the area population. Therefore the annual amenity benefits that local residents accrue from preserving farmland are \$626,000 relative to the low development scenario and \$1,284,000 relative to the high development scenario.

Wichelns and Kline (1993) conducted a study to evaluate how parcel characteristics affected the cost of that parcel's development rights. The goal of their paper was to examine the marginal cost implications of farmland characteristics hopefully enabling a reduction in public expenditures required to obtain a selected mix of farmland characteristics. They used a model based on the theoretical relationship between value and urban proximity. This model of farmland values and land values uses land characteristics as key independent variables, therefore describing the value of the development rights in terms of parcel characteristics. These key variables include the size of the parcel (in acres), the distance in miles from the town in which the farmland is located to the states capital of Rhode Island, the ratio of linear road frontage in feet to the size if the parcel, the number of miles the parcel of land is from the nearest town or beach, and the month in which the real estate appraisal was conducted for that parcel of land. They found that the per acre development cost of a farm participating in the Rhode Island program decreases as the distance from Providence increases, where farm activities are less

likely to conflict with residential land uses. A similar result was also found in relation to parcels close to local beaches and town centers. This study also found that a parcel with a panoramic view increases the cost by 53 percent over a parcel of land without a view of the water. However since the public usually does not gain access to the preserved farmland the cost of preserving these lands may exceed the marginal social benefit. It was also found that the average per-acre development right decreases as parcel size increases. Therefore purchasing larger parcels at lower per-acre costs will be more cost efficient. These large contiguous tracts of farmland are often preferred by states because they enhance the long run agricultural viability. The final result of this study was that the average per-acre cost of development rights only increased gradually as linear road frontage increased; therefore if scenic farmland views are socially desirable then parcels with road frontage may be purchased with little additional costs, increasing net social benefits. In conclusion, it was found that marginal cost impacts of several parcel characteristics: proximity to urban centers, water views, size, and road frontage are significant.

Work on Purchase of Development Rights Programs

PDR programs are continuing to be approved by state legislatures and public referenda. The legislative objectives of PDR programs include the preservation of farming activities and agricultural resources and the ability to produce farm products locally. These programs cost millions of dollars, which is transferred from the general public to farmland owners. The goal of a study conducted by Kline and Wichelns (1994) was to determine what motivates the public to spend millions on these programs. This information could also be used to determine if the PDR programs are achieving the objectives that the public has in mind. Kline and Wichelns (1994) use a combination of referenda data and other secondary census data to help analyze the public's motivation. The relative importance of the public's goals for farmland preservation programs should be reflected in the voting data that show the support or rejection of referenda that provide the funds for the PDR programs. The dependent variable for the regression analysis was obtained by dividing the percent of voters approving the referendum by the percent of voters rejecting the referendum. Then the census data was used to construct relevant socioeconomic and land use variables. The importance of agriculture within each county is represented by the percent of land in farms. Municipal growth rates are represented by the percent change in land and house values and the percent change in population. Income and education levels were also obtained from the census data but dropped because they were only significant at the 25 and 64 percent levels of significance. Dummy variables were also used to delineate between geographic regions and metropolitan areas (Southeast, Northeast, Capital, Central, and Metro). Results show that PDR funding is most likely to be approved in areas where there are high increases in land and house values in addition to increases in population. It is also shown that areas with resource sensitive lands, areas that include at least four of the resource sensitive characteristics as defined by the Division of State Planning, have high levels of support for farmland preservation programs. These results suggest that growth related and environmental factors play significant roles in motivating public support for PDR programs.

Kline and Wichelns (1998) analyzed the public's preferences for preserving farmland and open space. This study combined factor analysis and a discrete choice model to examine and describe the heterogeneous preferences transcended from the socioeconomic categories for preserving

farmland and open space. Several small focus groups were set up in Rhode Island to gather perceptions on why it is important to preserve these lands and to identify lands and land traits that are most valued by the public. Using this information an intercept survey was created and data were collected from several motor vehicle registration sites. They found that respondents that were born after 1945 have a higher marginal utility for preserved land than those born prior to 1945. They also found a positive relationship between parcel size and the utility measure. When converted to a per-acre basis, results were consistent with diminishing marginal utility as the parcel's acreage increased. Results also showed that the least preferred land type to be preserved is turf farmland followed closely by wetland and woodland land types. Respondents did not think that wetlands should be preserved under open space programs because it was illegal to build on them, already. The most valued types of land to preserve are beaches, fruit and vegetable farms, followed by crop and pasture farmland. Their model also found negative preferences for allowing public access to crop and pasture farmland. Survey respondents had strong preferences for lands that contained endangered species habitat and important groundwater resources. When the types of land are given ordinal ranking the top three choices are fruit and vegetable farms with public access, woodland without public access, and fruit and vegetable farming without public access. Respondents that favored preserving land for aesthetic reasons gave priority to crop and pasture farmland without public access and woodland without public access. Respondents that favored preserving land for agrarian purposes preferred fruit and vegetable farms with public access, crop and pasture farmlands without public access, and fruit and vegetable farmlands without public access.

McLeod, Woirhaye, and Menkhaus (1999) studied what factors influenced citizen support for rural land use controls, such as PDR programs, in Western Wyoming. This study was conducted in an effort to update Sublette County's Master Land Use Plan in order to address the issue of increasing rural residential development and the loss of agricultural land. The primary focus was to determine the characteristics of people who favor the various forms of land use control; zoning, cluster development, and purchase of development rights. Surveys were sent to landowners, regardless of their residence, and non-landowning residents or renters. The three land use controls were defined without using the actual name as to avoid bias associated with the names. It was found that zoning was favored the most (61.3%), followed by cluster development (58.2%), and the purchase of development rights (43.3%). Three separate models were estimated that corresponded to the three various land use controls and then a dichotomous choice logit model was used for the analysis. They found that the private land management, planning to live in the county, and increased age, income, and education all created a negative effect for zoning. Two of the three land types were favored by the public for using a form of a purchase of development rights program; the last land type was located near public land and therefore needed for public access. Since it would be used in two of the three scenarios, the outlook for purchase of developmental rights programs is far better than its previously mentioned approval of 43.3%. Residents who believe that an increase in population will increase their quality of life also favored PDR programs. However respondents who said that an increase in population would decrease their quality of life and those that have resided in the county for longer periods of time did not favor cluster development.

Work on the Conservation Reserve Program

Even though similar studies have not been completed estimating willingness to participate or accept a farmland preservation program; there have been some studies done to estimate willingness to participate in the Conservation Reserve Program. The CRP is similar to farmland preservation and allows farmers to bid into the program. Under the CRP there are 10-year contracts between the USDA and the owners of “highly erodible cropland” who will agree to convert their erodible land from cropland to another type of vegetative cover for 10 years. In return the USDA provides financial and technical assistance in establishing the cover crops and pays a fixed per acre rental rate (Esseks & Kraft 1986).

Konyar and Osborn (1990) did a study to develop and estimate a model to determine regional CRP participation, using national data. The dependent variable's value is equal to the proportion of enrolled acres out of the total eligible CRP acres. Each explanatory variable's value equals the mean for the group of farms or farmers in that cell. The model was then estimated using the “minimum logit chi-square” method, which involves applying a weighted OLS. The estimated coefficients that were significant at the 1% level are: land value, tenure, farm size, age, and the average net returns for nonparticipants in a major land resource area minus the average major land resource area net returns under CRP participation (CNR-PNR). It was found that farmers are less likely to enroll acres as the price of land increases. Konyar and Osborn also discovered that farmers are less likely to enroll in the CRP if their land has a high market value. The tenure variable had a positive sign suggesting that non-operating landowners are more likely to enroll acres in the CRP than owner-operators. Farmers that own and operate their land are less likely to enroll because they have labor and capital invested whereas a non-operating owner does not have labor invested and may not have capital invested either. The farm size variable had a negative sign suggesting that smaller farms are more likely to enroll than the larger farms. Larger farms are less likely to enroll due to large capital investments that cannot be put to alternative uses if land is retired from production. It was also found that as farmer age increases, participation in the CRP decreases. The elasticity of the probability of participation with respect to net returns was also calculated and broken down into two separate elasticities: one associated with the net returns from CRP participation (PNR) and the other with the returns from continued crop production (CNR). The results suggest that farmers are less responsive to the changes in the returns from the CRP participation than the changes in the returns from continued crop production. This is largely due to the price floors placed on commodities by the USDA and the income ceiling that the CRP creates due to constant rental rates over the 10-year contract period.

Kalaitzandonakes and Monson (1994) did an analysis to estimate the potential conservation effort of CRP participants using a sample within Missouri. This study used a mail survey that provided the necessary demographic, economic, and attitudinal information that is later used to estimate the influence of these factors on CRP participation using a sample of contract holders in Missouri. A number of independent variables were drawn from the survey: Income level, debt level of each landowner, age, level of education, level of current participation in the CRP, risk preferences, inferred future discount rates, whether profit was the main objective of their operation, technical capabilities of their chemical technologies, and attitudes towards conservation, farming as a way of life, and farming externalities. These variables were used in a latent variable model estimated using maximum likelihood procedures to determine conservation

effort for the CRP. Half of the parameters were found to be significant at the 0.05 level. Farming, as a way of life was the only attitudinal variable that was significant, meaning that there was no positive relationship between attitudes toward conservation and conservation effort. However, most of the economic variables were significant and consistent with theory. The model suggests that as risk aversion increases and the discount rate decreases, there is a positive effect on conservation effort. Also, as education levels increase so does potential conservation effort. Age and increasing debt were found to have a negative effect on potential conservation efforts, while income was not found significant but still included in the model. They concluded by saying that the most significant discovery of this study was the importance of the economic factors in considering the future use and participation in the CRP.

McLean-Meynsse, Hui, and Joesph Jr. conducted a study in 1993 to examine why Louisiana's small farmers with highly erodible land were not participating in the CRP. They did this using a multinomial-logit model to determine the influence of the socioeconomic characteristics on small farm participation. There were two main reasons that farmers gave for not participating: low CRP payments and lack of resources. The results suggest that farmers do not participate due to low payments as age increase, farm size increases, average returns per acre increase, land-owned ratios increase, if they only farm part time, lower income, less education, and if they are African-American. The results also suggest that the participants that gave lack of resources as a reason for not participating may be tenant farmers because they generally have a higher income, higher education level, greater returns per acre, are full time farmers, have smaller farms, lower land-owned ratio, and are African American. The model also suggests that education, income, race, and average return per acre significantly influence whether people are aware of the program. The study authors conclude that the more educated, older, full-time farmers or landowners are more willing to participate in the CRP.

Esseks and Kraft (1986) analyzed the data from an American Farmland Trust commissioned phone survey concerning the reasons that farmers were not participating in the CRP. Using a multivariate analysis they found that the most significant reason for not bidding was the farmer's perception of the erosion on their land. If a farmer believes that the majority of his land has erosion problems then he is more likely to enroll, or bid, in the CRP than farmers who believe that their land has no erosion problems. The second most significant variable was age. The older a person is the less likely they are to enroll, or bid, into the CRP. Whether or not a farmer owned and operated his land was the third most significant variable. Owner-operators were more likely to place bids in the CRP than non-operators. Esseks and Kraft concluded by stating the three major obstacles that prevent farmers from bidding: people believe that their land is not "highly eroded" even though it is classified in this category, people did not know about the farm bill's conservation compliance provision, and lastly people felt that the rental payment offered by the USDA was too low and would not cover costs or that they could farm and generate more income.

The first stage of the CRP is when the landowner submits an irrevocable bid to enroll a specific amount of acres along with an annual per acre rent value. If the USDA accepts the bid then the landowner assumes responsibility for the set forth land use conditions, including the cover crop planting. Esseks and Kraft (1988) focused a similar study on what makes eligible landowners offer a bid and what makes others not. The main reason that landowners identified for not

bidding was that the land they owned was not eligible. However after extensive use with soil maps Esseks and Kraft believed that due to the slopes these lands were qualified for the CRP. They also asked some indirect questions to determine why landowners did or did not participate. They found that the most significant variable was perceived erosion; the more erosion a landowner thought they had on their land the more likely they were to enroll some acreage in the CRP. Another significant variable was whether the landowner had been a recent client of a conservation agency; they found a positive correlation. The percentage of the previous year's income that was generated from annual crops was also significant; there was a positive correlation due to an expected income benefit. Lastly, education was suggested by the model to have a positive effect on participation in the bidding stage.

Napier and Camboni (1988) conducted a study of Ohio farmers, in the erosion prone regions of the state, to determine their attitudes towards a proposed soil conservation program similar to the CRP. Their diffusion model showed that the most significant variables were those associated with attitudes and farmers' perception of erosion on their land and the lands within their county of residence. Napier and Camboni also discovered that farm magazines and conservation newsletters are the best print media to use when attempting to effect attitudes towards a proposed program. The model also suggested that as the number of acres affected by severe erosion increases then so will the landowner's attitude toward this type of program.

Implications for this Study

This review suggests several variables to include in the farmers' willingness to accept model are age, income, education, farming as a way of life, farm size, risk preferences, whether they are a recent client of a conservation agency, and residency. A person's age, household income, and highest education level are socioeconomic variables that are generally included in willingness to accept models (see Table 2.1). Farming as a way of life and farm size are critical variables because they differentiate individual farmers and landowners from each other. A risk preference variable would be critical because it potentially could demonstrate if a farm preservation program attracts risk seekers or risk adverse individual farmers. Whether participants are a recent client of a conservation agency could show that they already have prior knowledge of farmland preservation policies and conservation efforts to prevent the loss of farmland. Residency has the potential to have a large effect on participants' decisions. This effect is due to how tied people feel to the place they live. If participants have lived in an area for most of their life they could take pride in the local community and feel loyalty towards preserving its land and heritage.

Table 2.1 Potential Variables for a Farmers' Willingness to Accept Survey

Independent Variables	Authors				
	K & M (1994)	E & K (1988)	E & K (1986)	K & O (1990)	M, H, & J (1994)
Income	Y				X
Age	X		X	X	X
Education	X	X			X
Debt Levels	X				
Future Discounting Rates	X				
Farming as a way of life	X	X	X	X	X
Risk Preferences	X				
Recent client of a conservation agency	X	X			
Farm size				X	O
Land Value				X	
Race					X
Ownership (acres owned/operated acres)					O

Note:

X = a significant variable

Y = an non significant variables that was included in the model

O = a non significant variable that was not included in the model

K & M (1994) is Kalaitzandonakes and Monson (1994)

E & K (1988) is Esseks and Kraft (1986)

E & K (1988) is Esseks and Kraft (1988)

K & O (1990) is Konyar and Osborn (1990)

M, H, & J (1994) is McLean-Meyinsse, Hui, and Joesph Jr. (1994)

CHAPTER 3: THEORETICAL FRAMEWORK

The analysis in this study is based on random utility theory, which allows modeling of discrete choices within a utility maximizing framework. The basic hypothesis is that any rational household will always choose the most preferred option, or bundle of goods, from a set of feasible alternatives. This most preferred bundle would maximize the household's utility. This is the back-bone of our farmers' willingness to accept analysis. The base indirect utility function for each farmer is

$$U(x_i, DR_i, M_i) \quad (3.1)$$

where x_i is a vector of measurable personal and farm characteristics, DR is the value of the development rights if the farmer chose not to sell the development right ($DR = 0$ if he chooses to sell his development rights for the given dollar amount), M is the household income, and i denotes the farmer.

Farmers want to maximize their utility and in order to do this they must compare their utility when their land has development rights and when they have sold the development rights. A farmer's indirect utility function after he has sold the development rights is

$$U[x_i, 0, P + M_i] \quad (3.2)$$

where P is the payment amount received for the development rights.

From this relationship, utility maximization implies that a land owner will choose not to sell the land's development rights in cases when it does not increase his indirect utility, if $U[x_i, DR_i, M_i] > U[x_i, 0, P + M_i]$. However if the farm land owner chooses to sell the land's development rights then his indirect utility is increased, implying $U[x_i, DR_i, M_i] < U[x_i, 0, P + M_i]$.

Therefore, a farmer's willingness to accept (WTA) can be defined as the value that makes both of the indirect utility functions equal

$$U[x_i, DR_i, M_i] = U[x_i, 0, WTA_i + M_i]. \quad (3.3)$$

The minimum willingness to accept, $WTA_i = C_i(x_i, M_i)$, is treated as a random variable in random utility framework (where i denotes the individual farmer). The actual values of WTA are unobservable or observable only with error and the actual minimum willingness to accept value is revealed only through elicited preferences or observed choices. Therefore $C_i(x_i, M_i)$ cannot be stated with certainty. However the minimum willingness to accept value, C, would make the two utility functions equal (Maddala 1983).

In order to estimate the willingness to accept value for a commodity we could ask if the participant would be willing to sell the commodity for a specified dollar amount, q. If the individual is willing to sell the commodity for q, then $q \geq C$ where C is the minimum willingness

to accept value. Once all the data have been collected and aggregated, one can determine if $q \geq C$ or if $q < C$.

However if only one value, q , is suggested then there is a wide range of possible values that could be greater than or less than q . Therefore we used three dollar values in an attempt to narrow the intervals, reduce the uncertainty, and thereby increase the statistical precision of our estimation.

The survey questions took the following form; there were six different versions using three various initial offer amounts (\$1500, \$3000, \$5000) and two different purchasing agencies (the State of Georgia and a private agency):

“The State of Georgia is purchasing development rights to farmland in order to permanently protect farmland from development. The State would like to buy the development rights to 100 acres of your farm. You could farm exactly as you do now, and could still sell the land to another farmer, just not to someone who wants to develop it (for houses or businesses). In exchange for the development rights to 100 acres of your farm, the state is offering \$1500 (\$3,000, \$5,000) per acre.

- Would you agree to this transaction?
- If yes, would you have sold the development rights for \$1,000 (\$2,000, \$4,000) per acre?
- If no, would you have sold the development rights for \$2,000 (\$4,000, \$7,000) per acre?”

“A private organization in your county is purchasing development rights to farmland in order to permanently protect farmland from development. This group would like to buy the development rights to 100 acres of your farm. You could farm exactly as you do now, and could still sell the land to another farmer, just not to someone who wants to develop it (for houses or businesses). In exchange for the development rights to 100 acres of your farm, the group is offering \$1,500 (\$3,000, \$5,000) per acre.

- Would you agree to this transaction?
- If yes, would you have sold the development rights for \$1,000 (\$2,000, \$4,000) per acre?
- If no, would you have sold the development rights for \$2,000 (\$4,000, \$7,000) per acre?”

The answers to these questions help determine the farmers' WTA for development rights by allowing inference about whether $U[x_i, 0, P + M_i]$ or $U[x_i, DR_i, M_i]$ is greater. By varying the payment values in the questions, we can estimate the parameters of the function $U[x_i, DR_i, P + M_i]$.

To simplify, for the moment, consider the following questions with the same basic set up.

- A. For \$w, will you sell your development rights to permanently preserve your land?
- B. If Yes, for \$v would you sell?
- C. If No, for \$z would you sell?

Therefore question A establishes

$$U(x_i, DR_i, M_i) >> U(x_i, 0, M_i + w) \quad (3.4)$$

If the farmer decides to sell the development rights for w then

$$U(x_i, DR_i, M_i) < U(x_i, 0, M_i + w) \quad (3.5)$$

therefore the offered amount, w, is greater than the minimum payment that farmer would accept for the land's development rights.

If the farmer answered "yes" to the first question then he was asked if he would accept a lower per acre value for the development rights to his land ($v < w$), question B. If the answer was "yes" then

$$U(x_i, 0, M_i + v) > U(x_i, DR_i, M_i) \quad (3.6)$$

therefore the payment amount is greater than the minimum payment amount that a farmer would be willing to accept in order for him to sell the development rights. This also means that the initial payment amount, w, is greater than the second offered amount, v, which are both greater than the minimum payment a farmer would be willing to accept in order to sell his land's development rights, $w > v > C$.

If the farmer answered "no" then

$$U(x_i, 0, M_i + v) < U(x_i, DR_i, M_i) \quad (3.7)$$

and the second offered payment is less than the minimum willingness to accept in order to sell the land's development rights. This also means that the initial offered payment is greater than the minimum willingness to accept for the land's development rights, therefore the minimum willingness to accept payment is between w and ($w > C > v$).

If the farmer answered "no" to the first question (A) then they were asked if they would sell the development rights for a higher value ($z > w$), question C. If they answered "yes"

$$U(x_i, 0, M_i + z) > U(x_i, DR_i, M_i) \quad (3.8)$$

and z is greater than the minimum payment the farmer would accept for his land's development rights, however the initial offered amount is lower than the minimum, $z > C > w$.

If the farmer answered "no"

$$U(x_i, 0, M_i + z) < U(x_i, DR_i, M_i) \quad (3.9)$$

then both the initial payment offer, w , and the higher payment offer, z , are less than the minimum the land owner would be willing to accept in order to sell the land's development rights ($C > z > w$).

An ordered response model will be used for our analysis due to the ordered categories established in the survey design. Probit models are used when there is an assumption of an underlying response variable, $y_i^* = WTA_i = C_i$, defined by this regression

$$y_i^* = \beta x_i + u_i \text{ or } f(u_i) = f(y_i - x_i \beta) \quad (3.10)$$

where $f(u_i)$ is the probability density function of a standard normal random variable, y_i^* is the underlying response variable, x_i is the set of explanatory variables (now including income, M_i) and u_i is the residual (Maddala 1983). Because y_i^* is unobservable we will use the normalization rule

$$\text{Var}(u) = 1 \text{ therefore } u_i \sim IN(0,1).$$

This normalization is necessary in order to statistically identify the estimates of β (Maddala 1983).

The response variable, in practice, is unobservable and what we really observe is a categorical variable, which is defined by

$$\begin{aligned} y_i &= 1 \text{ if } y_i^* < v \\ y_i &= 2 \text{ if } w > y_i^* > v \\ y_i &= 3 \text{ if } z > y_i^* > w \\ y_i &= 4 \text{ if } y_i^* > z . \end{aligned}$$

Therefore, from the previous relationships we can derive the probabilities, which vary from observation to observation depending on x_i , of the observed values of y .

If a yes, yes answer is given then:

$$\text{prob}(YY) = \text{prob}(y_i = 1) = f(u_i) = F(v) \quad (3.12)$$

If a yes, no answer is given then:

$$\text{prob}(YN) = \text{prob}(y_i = 2) = f(u_i) = F(w) - F(v) \quad (3.13)$$

If a no, yes answer is give then:

$$\text{prob}(NY) = \text{prob}(y_i = 3) = f(u_i) = F(z) - F(w) \quad (3.14)$$

If a no, no answer is given then:

$$\text{prob}(NN) = \text{prob}(y_i = 4) = f(u_i) = 1 - F(z) \quad (3.15)$$

where Y = yes, N = no, F() is the cumulative distribution function, and

$$F(v) + [F(w) - F(v)] + [F(z) - F(w)] + [1 - F(z)] = 1.$$

See Figure 3.1.

From these we generate the likelihood function $L(u) = f(u_1) f(u_2) \dots\dots\dots f(u_n)$ where $u = (u_1, u_2, \dots\dots\dots u_n)$.

Maximizing this likelihood function with respect to β allows one to find the coefficient values that maximize the probability of finding the sample data that we actually observed. Maximum likelihood estimators also have several attractive features: they are unbiased, asymptotically consistent, and efficient. Therefore, among all the other consistent estimators, the MLE has the smallest asymptotic variance (Kalaitzandonakes and Monson 1994).

Then, using an ordered probit model, we will compute maximum likelihood estimators for the $\hat{\beta}$'s and then compute various estimates of WTA. To estimate a farmland owner's WTA we will use

$$WTA_i = \hat{\beta} x_i \quad (3.16)$$

where WTA_i is the willingness to accept value for farmer i and x_i is the vector of characteristics modeled for farmer i.

Having estimated WTA_i for all farmers in our data sample we can compute a median by

$$WTA = \hat{\beta} x_m \quad (3.17)$$

where x_m is the x vector composed of median values of each independent variable.

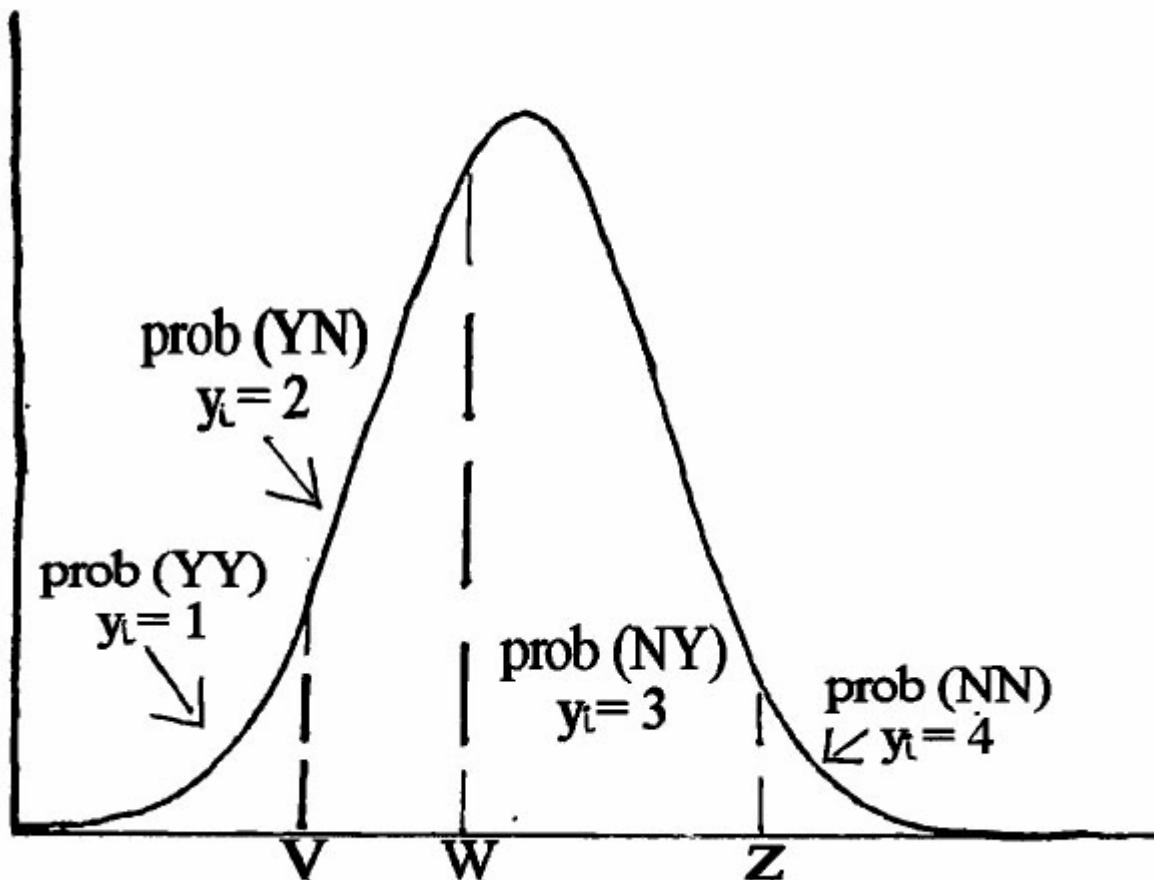


Figure 3.1 Probabilities in the Ordered Probit Model

The estimated farmer WTA values will then be used to construct a supply curve for the potential acres of farmland that could be preserved. The supply curve is constructed using the lowest WTA value and the 100 acres of their farmland that would be preserved. Then, the second lowest WTA value and the 200 acres of farmland; the 100 acres of the farmer's land with the lower WTA and the 100 acres from the new farmer's WTA value. This continues so that each farmer's WTA is plotted with their 100 acres of farmland to be preserved and all of the farmers' 100 acres who had a lower WTA values.

The citizen data will be used to construct budget constraints. These will be constructed for each of the three questions: private voluntary, public voluntary, and public mandatory as well as for the two dollar amounts asked for each question yielding a total of six budget constraints. The private voluntary budget constraints will be generated by multiplying the percent of participants that said they would join by the number of households in Georgia and then multiplied by the two membership fees asked, \$20 and \$50. The public voluntary budget constraints will be generated by multiplying the percent of people who said they would purchase the farmland preservation

license plate by the total number of registered vehicles in Georgia and then multiplied again by the two plate fees, \$20 and \$50. Lastly, the proposed public mandatory question must have at least 50 percent support from the participants, implying that the tax referendum would have passed. If passed, the two dollar amounts (\$20, \$50) would be multiplied by the number of Georgia income tax returns filed to construct the two public mandatory budget constraints.

Finally the private market potential farmland supply curve will be graphed with the private voluntary budget constraints to determine if there is a demand for a privately organized farmland preservation program in Georgia, and if so how many acres could be preserved. The state market potential farmland supply curve will be graphed with the two public voluntary and the two public mandatory budget constraints to determine if there is a market for a state run farmland preservation program, and if so how many acres could be preserved.

CHAPTER 4: DATA COLLECTION

The issue of the relative influence of economic, physical, and other personal factors on the potential farmland preservation efforts was addressed in this study with a sample of Georgia farms. Specifically, Georgia farmers who farmed or owned at least 300 acres, including forestry, were targeted. We decided to survey large landowners due to Wichelns and Kline's (1993) results of increased cost efficiency when purchasing development rights in larger tracts. Producer data, from farmers, were collected using a mail survey. The National Agricultural Statistical Service (NASS) was unable to make public any names and addresses, due to confidentiality requirements; therefore they compiled the list using their database and addressed the stamped envelopes. Data on the general public were also gathered to estimate citizen willingness to pay (WTP) for a farmland preservation program in Georgia. Consumer data were gathered using a telephone survey conducted by the University of Georgia Research Institute. Both surveys collected the necessary demographic, economical, and attitudinal information needed to estimate the relative influences of these factors on the potential farmland preservation efforts of the surveyed groups.

Farmers' Willingness to Accept Pretest

The farmer willingness to accept surveys was pre-tested in February 2003. We mailed 250 surveys to Georgia farmers who owned or operated 300 or more acres who lived above the Fall Line, a common dividing point between North and Central Georgia. The intent of this was to test the farmland preservation questions and to make sure that participants were understanding and properly answering the questions. There was a general cover letter on the front of each survey informing the reader of what would happen if development rights were sold to permanently protect farmland. The cover letter also explained that the interest of this survey was to determine if there was a public demand for a private market farmland preservation program.

The actual document that was mailed included a one page cover letter followed by the survey on the front of the second page and a consent form, required by the University of Georgia, on the back of the survey page. The survey began with basic demographic questions and concluded with a single farmland preservation question. The surveys were given to the Athens, Georgia NASS office in stamped envelopes so that they could place the address on the front and then mail them.

There were 250 color-coded surveys mailed. Fifteen of these surveys were undeliverable and returned, meaning that 235 surveys actually reached mailboxes. Of these 235 remaining surveys, eighty-two were completed and returned, giving a response rate of 34.89%. Since all of the returned surveys were completely answered and we only received two telephone calls by people with questions; we felt that the questions were understood. Therefore we could finalize the design and content of the larger mail survey.

Table 4.1: Farmers' WTA Returned Pretest Surveys

Payment Agency	Initial Amount Offered for the Development Rights			
	\$1500 per acre	\$3000 per acre	\$5000 per acre	Total
Private	16	23	8	47
State	9	13	13	35
Total	25	36	21	82

Consumers' Willingness to Pay Pretest

The willingness to pay survey began with the basic demographic questions. These questions were then followed with questions about the individual's connection to the environment and/ or agriculture; these questions were designed to "warm up" the participant and help focus attention on the environment and agriculture protection. These questions were then followed by questions designed to gather information about the participant's county of residence and work commute distance. The last question was the farmland preservation question, which varied. This question was designed with three different payment vehicles and two monetary values.

The three various payment vehicle influences were designed to test for preference between voluntary private, voluntary public, and mandatory public programs to preserve 100 acres of farmland per year. The voluntary private question asked participant's if they would pay dues to a private organization whose goal was to protect 100 acres of farmland per year in their county of residence. The voluntary public question asked if people would be willing to purchase a specialized farmland preservation license plate, which would include an extra fee, with the extra money going towards protecting 100 acres of farmland per year in their county of residence. After the first intercept survey site this question was changed due to comments made by participants. Participants were upset because they would rather have another type of license plate but would still like to contribute in some other way to this proposed program. Therefore for the final two intercept survey sites this question was asked in the form of an additional line on state tax forms for a donation to a farmland preserve program whose goal was to preserve 100 acres of farmland per year in their county of residence. The mandatory public question asked if there were a county referendum held which would dedicate funding to a farmland preservation program, and every property owner would pay an additional amount in property taxes, would you vote to pass this referendum. The two dollar amounts that were used were \$20 and \$50 for each type of question.

The pretest for the consumer intercept survey was conducted in three locations. The first site was the Georgia Square Mall in Athens, Georgia in February 2003. A total of fifty-one surveys were completed in a four hour period, 4pm through 8pm. The second site for the consumer intercept survey was the historic district in downtown Conyers, on March 27, 2003. This survey was conducted during the lunch hours in order to catch people while they were on their lunch breaks. From this second location, fifty surveys were completed and only forty-six were usable. The third time the intercept survey was conducted was in downtown Athens, Georgia. This area was also surveyed during the busy lunch hours since there are many popular lunch restaurants. There were forty-one completed and usable surveys gathered from this third intercept survey

attempt. Merging all the intercept surveys together there were 148 completed, usable pretest surveys.

Table 4.2 Pretest Intercept Survey Categorical Results

WTP Amounts	Payment Vehicle			Total
	Private Voluntary	Public Voluntary	Public Mandatory	
\$20	25	27	23	75
\$50	21	23	21	65
Total	46	50	44	140

Final Farmer Mail Survey

The front of the first sheet of paper was the cover letter. This explained that the data gathered were strictly confidential and to be used in a Master’s thesis. The cover letter also contained brief information on what would happen if farmland development rights were sold. The survey began, on the back of the cover letter, with the same demographic questions as the pretest. These questions were then followed by specific information gathering questions on the type of farming operation and farm size. Included in these questions was a question asking to state the county(s) in which the farmland was located. These questions were then followed by questions directed at the future of e-commerce in agriculture. Hedging questions followed and then the final question was about farmland preservation (The hedging and e-commerce questions are for use in later, separate research). The required consent statement was located on the back of the survey. This survey was directed to the head of households and therefore it was expected that respondents would bid in terms of their household willingness to accept. However the actual farmland preservation willingness to accept question was asked in the individual form.

There were several question responses that were coded differently than the actual participant’s response. The highest level of education response was changed into number variables.

Highest Level of Education Completed	Coded Response
Some high school	1
High school graduate	2
Some college	3
Bachelor's degree	4
Masters' degree	5
Ph.D. degree	6

The family income level answers were entered as the mean value of each income level, as shown below.

Income Level	Amount Entered
under \$15,000	\$10,000
\$15,000 - \$30,000	\$22,500
\$30,001 - \$45,000	\$37,500
\$45,001 - \$60,000	\$52,500
\$60,001 - \$75,000	\$67,500
\$75,001 - \$90,000	\$82,500
\$90,001 - \$120,000	\$105,000
over \$120,000	\$150,000

The responses to the percent of income generated from farming were also given numerical values: 1 for under 25%, 2 for 25% - 50%, 3 for 51% - 75%, and 4 for 76% - 100%.

The last conversion-related question asked which county the farmland was located in, which was answered using county names. The county in which farmland is located was changed into two regional dummy variables. The counties were divided into North, Central, and South Georgia regions and converted into north and central dummy variables (see Figure 4.1 Georgia Regions). All of the other variables used from the survey were entered and used as participants' responded.

The data for estimating the median willingness to accept for the development rights to farmland was collected using this finalized survey. This final survey was mailed in May 2003. Surveys were sent to 1250 households that owned or operated 300 or more acres of farmland in Georgia (this sample included some forestland owners). There are approximately 8,000 Georgia farms that consist of 300 or more acres; ideally we were sampling 16% of the farms of this size in Georgia. A total of twenty-two surveys were undeliverable and returned. Therefore, 1228 surveys actually reached households. Of these 1228, 273 were returned. However, of these 273 returned, thirteen came with letters stating that they no longer farmed, had sold the farm, or that the person who used to farm had since passed away. There were 260 usable surveys that were returned, yielding a response rate of 21 percent.

Since this response rate was lower than the pretest response rate, we decided to re-mail the survey. An additional cover letter was constructed according to the methods discussed by Dillman (2000) and added as a sheet in front of the original survey document. This cover letter explained not to answer and return this survey if they had responded to the original survey. This second cover letter also stressed the importance of this survey and its possible future implications. The re-mail was given to NASS in stamped envelopes; therefore they just had to address them. They were mailed in early September 2003. There were eight surveys from this re-mail that were returned as undeliverable. There were 237 answered and returned. When this number was added to the returned surveys from the first mailing there were a total of 497 surveys that were returned, yielding a total response rate of 40.74 percent. Of these 497 surveys that were returned, only 390 are completely answered and usable. These usable surveys are divided between the three various farmland preservation questions and the three initial payment amounts as shown in Table 4.3.

Table 4.3 Farmers' WTA Usable Surveys

Payment Agency	Initial Amount Offered for the Development Rights			Total
	\$1500 per acre	\$3000 per acre	\$5000 per acre	
Private	58	56	63	177
Initial Mailing	32	33	28	93
Remail	26	23	35	84
State	63	69	81	213
Initial Mailing	34	37	44	115
Remail	29	32	37	98
Totals	121	125	144	390

It is important to mention that there is one possible bias associated with our contingent valuation survey due to the various dollar amounts offered in the questions. It is referred to as strategic behavior, which is when people answer no to the first question because they saw the higher dollar value asked in the second part of the farmland preservation question. There were twelve surveys that were returned where the participant had crossed through their answer to the first question due to the higher dollar value asked later. However, since there were only twelve (out of 390 useable surveys) of these and not everyone answered no to the initial part of the question, we feel that this strategic behavior did not have a significant affect on our results.

Final Consumer Willingness to Pay Survey

This section of the project was contracted out to the Survey Research Center of The University of Georgia. The Survey Research Center conducts a large telephone interview in each spring and fall semester. The telephone interview method that the Survey Research Center used was the random digit dialing method. Also when conducting these telephone interviews the selection of whom to contact in each household was done based on the 'Youngest male, Oldest female' technique. This technique tends to generate more male respondents, which are typically under represented in sample surveys (Survey Research Center 2003). The Survey and Research Center conducted the telephone survey between February 17th and February 23th 2004 using a random digit dialed sample of 577 telephone interviews, 515 were usable giving a survey response rate of 89.25%.

We added five questions to their general demographic questions, which encompass gender, age, ethnicity, education level, and income. The five questions that we added were on the intercept pretest surveys. The first two questions were intended to gather information about whether or not the participant was affiliated or connected to the environment or agriculture through their career or community involvements. The following three questions were identical to the final question on the pretest, including the payment vehicle influence as discussed previously. Of the 515 usable surveys; 104 interviews were asked this first question using \$20 as the annual dues and 90 using \$50 as the annual dues amount:

“A group of people in your county are considering forming a private farmland preservation organization. Each member will pay annual dues of \$20 (\$50) for the next

five years. All your dues will go toward permanently protecting farmland in your county from being developed. Would you join this group and make a contribution?"

80 interviewers were asked this second question using \$20 annual dues and 91 using the \$50 annual dues amount:

"The State of Georgia is considering selling a new license plate to fund a farmland preservation program. The license plate will have a small picture of a pasture and barn. The cost will cost an annual amount of \$20 (\$50) in addition to the standard car tag fees for the next five years. Your extra payment will be committed to farmland preservation programs, with a goal of preserving at least 100 acres of farmland per year in each county. Would you buy one of these license plates?"

73 interviewers were asked this final question using \$20 annual dues and 77 using \$50 annual dues:

"The State of Georgia is considering holding a referendum next June to begin a dedicated-funding farmland preservation program. If the referendum passes, every taxpayer would pay an additional annual payment of \$20 (\$50) on their state income taxes for the next five years (whether they voted for the program or not). All the money would go toward farmland preservation with a goal of preserving at least 100 acres of farmland per year in each county. Would you vote in favor of this program?"

CHAPTER 5: RESULTS & POLICY IMPLICATIONS

Model Specification

As discussed in equation 3.1, the base indirect utility function that each farmer is maximizing is

$$U(x_i, DR_i, M_i) \quad (5.1)$$

where x_i is a vector of measurable personal and farm characteristics. Therefore we are trying to estimate which personal and farm characteristics should be included in the x_i vector so that we can estimate a farmers' willingness to accept (WTA) which was defined in equation 3.3

$$U[x_i, DR_i, M_i] = U[x_i, 0, WTA_i + M_i] \quad (5.2)$$

One of the main objectives of this study is to determine the potential supply of farmland that could be preserved. Conceptually the expected relation is that supply increases at a decreasing rate. Therefore as the per acre offered amounts for the development rights increase, the number of farmers willing to accept these amounts will increase.

As discussed in the last section of the literature review chapter there were several variables that had been found significant in similar studies and would be good to include our farmers' x_i vector: age, education, farming as a way of life, farm size, risk preferences, whether they are a recent client of a conservation agency, and residency. Therefore the x_i vector should be a function of socioeconomic and farm characteristics.

The socioeconomic variables are potential indicators of differences among farmers' that could cause our supply curve and their willingness to accept values to shift. The socioeconomic variables expected to have a significant influence on farmers' willingness to accept are: age, gender, income, and highest completed education level. It is expected that as age increases their willingness to accept will increase. Younger farmers may not be as willing to sell their development rights at a specified price because they foresee increasing land values since they have longer to live. As the level of education increases, WTA is expected to decline largely due to the participant's awareness of the farmland preservation issue and their support for such a program. However as income increases, WTA is expected to decrease because households with higher incomes do not need the payments as much as the lower income households.

The specific farm characteristic variables that are expected to influence a farmer's willingness to accept are: percent of household income generated from farming, total years of farming experience, total acres of farmland owned, total acres of land that you farm, and the county in which the farmland is located. We are unsure of the effect that each one of these variables will have on a farmers' willingness to accept.

Therefore, the functional relationship for the willingness to accept curve is expressed as:

$$\begin{aligned} WTA_i = & \beta_0 + \beta_1 AGE + \beta_2 SEX + \beta_3 EDUC + \beta_4 INC + \beta_5 PINC + \\ & \beta_6 EXP + \beta_7 ACRO + \beta_8 ACRF + \beta_9 NORTH + \\ & \beta_{10} CENTRAL + \mu \end{aligned} \quad (5.3)$$

where:

- WTA = farmers willingness to accept (in 1000's of dollars)
- AGE = participant's age
- SEX = gender of the participant
- EDUC = participant's highest education level
- INC = family income level (in 1000's of dollars)
- PINC = percent of family income generated from farming
(1 = under 25%, 2 = 25% - 50%, 3 = 51% - 75%, 4 = 75% - 100%)
- EXP = years of farming experience
- ACRO = acres of farmland owned (in 100's of acres)
- ACRF = acres of farmland operated (in 100's of acres)
- NORTH = indicator for whether or not the county in which the farmland is located is in the northern region of Georgia
(1 = North Georgia location, 0 = otherwise)
- CENTRAL = indicator for whether or not the county in which the farmland is located is in the central region of Georgia
(1 = Central Georgia location, 0 = otherwise)

Farmers' WTA Survey Results

There are 12,874 farms in Georgia with 180 acres or more and there are 4,941 farms with 500 or more acres. The average Georgia farm size is 220 acres and the average age of Georgia farmers is 56.5 years. Females operate twenty-five percent of the farms in Georgia and fifty-one percent of the operators say that farming is their primary occupation. Over sixty-five percent of Georgia farmers have spent at least ten years of experience on their present farm (National Agricultural Statistical Service 2004). Compared to these statistics, the mean age of the survey respondents were 57.94 years with 34.75 years of farming experience. 94 percent of the participants were male with some college education. The mean annual household income was \$85,270 of which 50 to 75 percent of that income was generated from farming. The mean acres that farmers owned was 1,161 while the mean acres farmed were 953. By design the study will have larger farms since only farmland owners of 300 or more acres were surveyed.

The estimated coefficients for the private and state farmer willingness to accept models are shown in Tables 5.1 and 5.2.

In the private farmer's willingness to accept model (Table 5.2) all variables except age, years of experience, acres owned, and acres farmed are significant at the ten percent level. In the state farmer's willingness to accept model (Table 5.1) all of the variables excluding education level, acres owned, and acres farmed are also significant at the ten percent level. Even though

Table 5.1 State Model Output

Variable	Coefficient	Standard Error	T - Value	P - Value
CONSTANT	3.3375	0.773	4.3175	< 0.0001
AGE	-0.0231	0.0095	-2.4246	0.0162
SEX	1.5466	0.4756	3.2516	0.0013
EDUC	0.021	0.0979	0.2149	0.8301
INC	-0.0067	0.0021	-3.2483	0.0014
PER_INC	-0.1035	0.0748	-1.3836	0.168
EXP	0.0356	0.0086	4.137	0.0001
ACRO	0.0003	0.0097	0.031	0.9753
ACRF	0.0117	0.0101	1.153	0.2503
NORTH	1.6173	0.231	7.0009	< 0.0001
CENTRAL	0.7439	0.1856	4.0074	0.0001
Log - Likelihood function value			-501.8885	
n = 213				

Table 5.2 Private Model Output

Variable	Coefficient	Standard Error	T - Value	P - Value
CONSTANT	3.4908	0.8085	4.3178	<0.0001
AGE	0.0162	0.0115	1.403	0.1625
SEX	-0.6292	0.347	-1.8133	0.0716
EDUC	-0.2121	0.0811	-2.6143	0.0098
INC	0.0053	0.0022	2.4697	0.0145
PER_INC	0.3842	0.0844	4.5548	< 0.0001
EXP	0.0091	0.008	1.1403	0.2558
ACRO	0.0037	0.0029	1.2738	0.2045
ACRF	-0.115	0.0078	-1.471	0.1432
NORTH	0.507	0.2466	2.0558	0.0414
CENTRAL	0.4294	0.2163	1.9847	0.0488
Log - Likelihood function value			-504.0616	
n = 177				

these variables were not found to be significant we still felt that they should be included in our model due to their economic importance. Therefore, the private market willingness to accept model is defined as

$$\begin{aligned} WTA_i = & 3.4908 + 0.0162(AGE) - 0.6292(SEX) - 0.2121(EDUC) + 0.0053(INC) + \\ & 0.3842(PER_INC) + 0.0091(EXP) + 0.0037(ACRO) - 0.115(ACRF) + \\ & 0.507(NORTH) + 0.4294(CENTRAL) + u \end{aligned} \quad (5.4)$$

and the state market farmer's willingness to accept model is defined as

$$\begin{aligned} WTA_i = & 3.3375 - 0.0231(AGE) + 1.5466(SEX) + 0.021(EDUC) - 0.0067(INC) - \\ & 0.1035(PER_INC) + 0.0356(EXP) + 0.0003(ACRO) + 0.0117(ACRF) + \\ & 1.6173(NORTH) + 0.7439(ACRO) + u. \end{aligned} \quad (5.5)$$

The private and the state models predicted a decent percent of the actual survey responses; since there were four probability categories any prediction under twenty-five percent would not have been good. The model predictions are shown in Table 5.3. Both data sets were then merged and run in one model, which generated a log-likelihood value equal to -1038.4554 . This was then used to conduct a likelihood ratio test of the null hypothesis that all coefficients were equal, meaning that both data sets could be pooled and run in one model instead of two. The critical value for this test is $0.05\chi^2(11) = 19.675$ and our computed likelihood ratio statistic is

$$2 * [1038.46 - (504.06 + 501.89)] = 65.02 \sim \chi^2(11)$$

Since the critical value is less than the calculated value we reject the null hypothesis, at the 0.05 level of significance. This supports our decision to run two separate models, private and state, instead of estimating farmer's WTA in one model.

There are several interesting effects that the variables had on farmer willingness to accept. The first interesting result for both the private and the state model is the impact gender has on a farmer's willingness to accept. Given these results it is interesting that men will sell the development rights to a private organization running a farmland preservation program for \$629.20 per acre less than women. However, men will sell their farm's development rights to a state run farmland preservation program for \$1546.60 per acre more than women. This creates an estimated \$2174.80 difference in male farmers' WTA between a private and a state farmland preservation program. In other words men favor privately run farmland preservation programs over state run farmland preservation programs.

The second interesting variable is education. In the private model results as education level increases, WTA decreases. This is consistent with previous research and economic behavior because the more educated a person is the more likely he is to know about the benefits a farmland preservation program could offer. The percent of income generated from farming is also significant and positive in the private model. This result is also consistent with economic theory because the more household income that is generated from farming the more the farmer depends on his annual returns, therefore holding out for a higher price for the development rights to his farmland. However the education and the percent of income generated from farming

Table 5.3 Model Predictions – Classification Success

State Model Results – Classification Success

Survey Response	Actual Responses	Number of Predicted Responses	Percent Actually Predicted Correctly
Yes, Yes	40	44	40
Yes, No	51	23	19.6
No, Yes	36	83	50
No, No	86	63	39.5
Percent Predicted Correctly with the Model			36.6

Private Model Results – Classification Success

Survey Response	Actual Responses	Number of Predicted Responses	Percent Actually Predicted Correctly
Yes, Yes	28	20	17.9
Yes, No	37	14	16.2
No, Yes	24	84	41.7
No, No	87	58	34.5
Percent Predicted Correctly with the Model			29

variables in the state model are not significant, meaning that education levels and the percent of income generated from farming have no effect on farmers' WTA in a state run farmland preservation program.

The last interesting variables are the two regional dummy variables, the north region and the central region. It is very interesting that these variables have a much greater effect on a public/state run farmland preservation program. For a privately run preservation program, development rights in the northern region of Georgia would cost an estimated \$507 per acre more than in the southern region and an estimated \$429 per acre more in the central region of Georgia than in the southern region. However, the state model estimates that development rights in the northern and central regions of Georgia would cost \$1617 and \$744 per acre more than development rights in the southern region of the state. This shows that Georgia farmers would expect more money from a state operated farmland preservation program particularly in the northern region of Georgia. Table 5.4 shows the estimated WTA values at the median for all of the regions of the state.

Table 5.4 Estimated Regional WTA Values

Private WTA Results	WTA Estimate	Std. Error
WTA at the median x (south)	\$4,527	\$718
North WTA at the median x	\$5,034	
Central WTA at the median x	\$4,956	
Median WTA	\$4,988	

State WTA Results	WTA Estimate	Std. Error
WTA at the median x (south)	\$4,287	\$858
North WTA at the median x	\$5,904	
Central WTA at the median x	\$5,030	
Median WTA	\$4,780	

Farmer's willingness to accept values were then estimated using these equations and are reported as a percent of farmers with 300 or more acres in the state who would sell development rights for 100 acres of their land for x dollars in Table 5.5.

Table 5.5 Farmers' Estimated Willingness to Accept

Percentile	State WTA	Private WTA
10%	\$3,838	\$4,198
20%	\$4,046	\$4,432
30%	\$4,262	\$4,688
40%	\$4,547	\$4,861
50%	\$4,780	\$4,988
60%	\$5,034	\$5,179
70%	\$5,226	\$5,343
80%	\$5,613	\$5,489
90%	\$6,048	\$5,910
100%	\$6,843	\$9,285

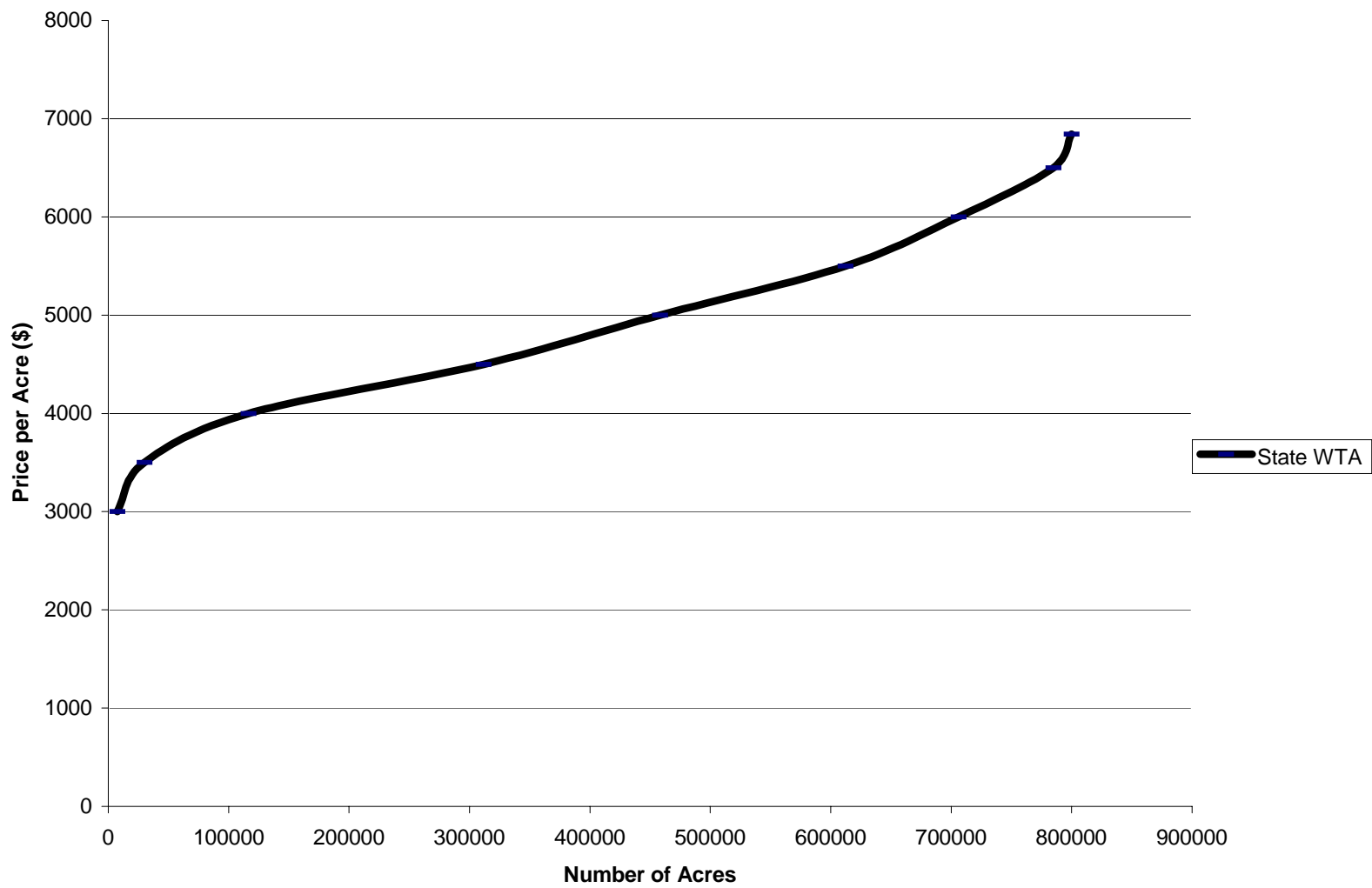
Farmland supply curves were then estimated for the private and the state models. The supply curves were derived using the base of 8,000 Georgia farmers who own 300 acres or more of farmland creating the base of 800,000 acres of Georgia farmland that potentially could be preserved. Next, the estimated WTA values were broken down into \$500 per acre increments starting at \$3000 per acre for the development rights and ending at \$7000 per acre; however there was one value, \$9285, which was outside this interval in the private model and therefore

used as the last value in the private supply curve. Once all the estimated WTA values were divided by these increments they were made into a percent of farmers whose willingness to accept was equal to or below the chosen increments. This percentage was then multiplied by the base acreage of 800,000 to determine the amount of farmland (in acres) that potentially could be preserved under a private and a state organized farmland preservation program. Lastly, these values were plotted using excel, generating the estimated potential acres of farmland that could be preserved by a private and a state run program. Table 5.6 shows the plotted points for the private and state model supply curves and Graphs 5.1, 5.2, and 5.3 show the supply curves.

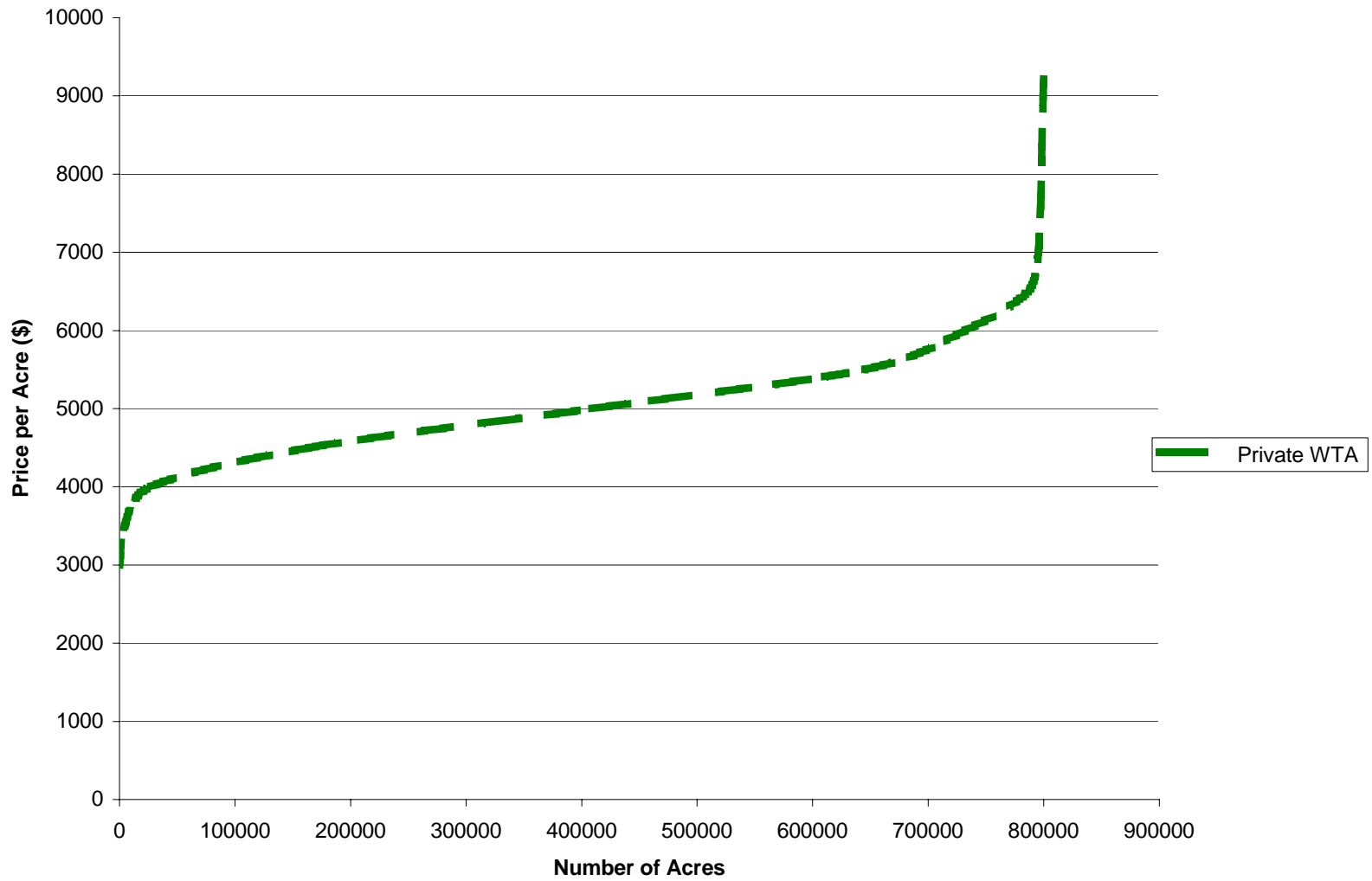
Table 5.6 Farmland Supply Curve Points

\$ Per Acre	Acres Preserved under the State Model	Acres Preserved under the Private Model
3000	7,512	0
3500	30,047	4,545
4000	116,432	27,273
4500	311,737	163,636
5000	458,216	409,091
5500	612,207	645,455
6000	706,103	731,818
6500	784,977	786,364
7000	800,000	795,455
9285		800,000

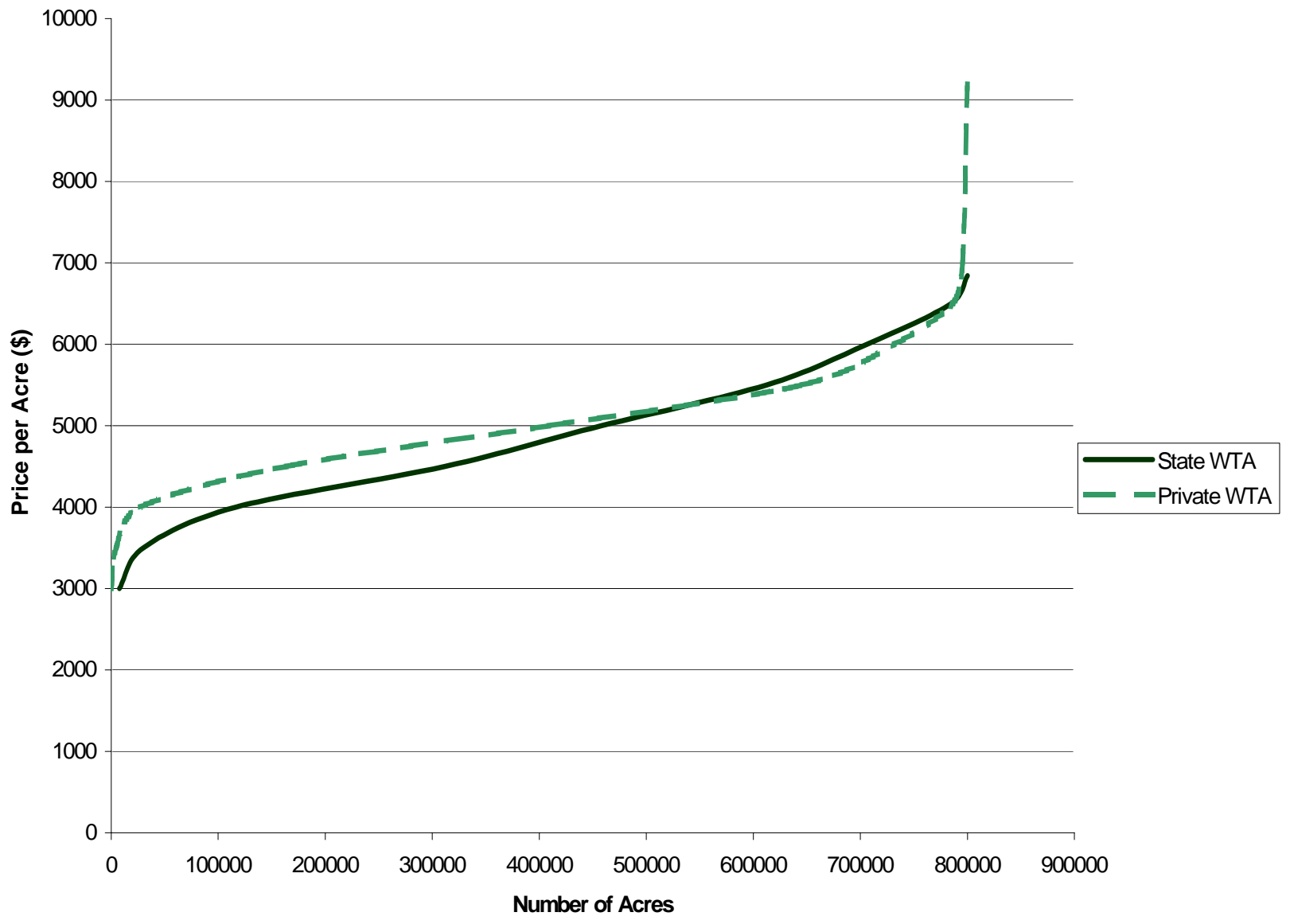
As shown in Table 5.6 and in the supply curve graphs 5.1, 5.2, and 5.3 there is a large difference in potential acres to be preserved with both the state and privately run programs at the lower dollar per acre values. Under a state organized farmland preservation program from \$4000 to \$4500 dollars per acre increment the largest difference in acreage, 195,305 acres, is captured. Therefore the state supply curve is increasing at an increasing rate up to \$4500 per acre and then afterwards the supply curve is increasing at a decreasing rate. However after the \$4500 per acre value less and less acreage is added. This is the same for the privately organized farmland preservation program except it happens between \$4500 and \$5000 per acre and captures 245,455 acres of farmland. Therefore the private supply curve is increasing at an increasing rate up to \$5000 per acre and then begins to increase at a decreasing rate. This might suggest that farmers who support this type program are going to reasonably sell their development rights and that as the dollar per acre value increase, farmers who may not support the goals of a farmland preservation program might be “bought out”. It is also important to notice that the private farmland preservation program has much better support at the lower per acre prices in the Northern region of Georgia (see Table 5.4). This is critical because it is this area of the state that is experiences the highest growth pressures.



Graph 5.1: Potential State Market Farmland Supply



Graph 5.2: Potential Private Market Farmland Supply



Graph 5.3 State & Private Potential Farmland Supply

Table 5.7 Consumer WTP Survey Results

	\$20 Annual Cost		\$50 Annual Cost	
	Percent Supporting	Total Responses	Percent Supporting	Total Responses
Private, voluntary program	48.08%	104	32.22%	90
Public, voluntary program	40.00%	80	39.56%	91
Public, mandatory program	65.75%	73	53.25%	77

Consumer WTP Survey Results

The willingness to pay phone survey data was broken down into the percent of participants that would join the private farmland preservation organization (private voluntary), purchase the specialty license plate (public voluntary), and vote for a tax referendum (public mandatory) to raise taxes to preserve farmland. The results are shown in Table 5.7.

The percent of participants that said yes was then multiplied by the number of Georgia households (United States Census Bureau 2004) for the private voluntary program, the number of registered vehicles in Georgia (Georgia Department of Motor Vehicles 2004) for the public voluntary program, and the number of tax returns filed by Georgians (Internal Revenue Service 2004) for the public mandatory program. This gives the number of people, or vehicles, in Georgia that would be paying the annual dues towards a farmland preservation program. However since the tax referendum, public mandatory, question received more than 50 percent support; the referendum would have passed forcing all Georgia households to pay the annual increase. That is why the public mandatory question is not multiplied by a percent of Georgian's but by all Georgian's who filed a tax return. These numbers, calculated above, were then multiplied by the annual dues amount (\$20 or \$50) times the five years that they would contribute to this program (\$100, \$250). The results are an estimate of the revenue that each of these programs would generate that would be used to purchase the development rights of farmland in order to permanently protect this land, Table 5.8. Budget constraints were then created by dividing the estimated revenue of each of the programs by the price of the development rights beginning with \$3000 per acre through \$9500 per acre in \$500 per acre intervals. These points were then connected to form the budget constraints shown in Graph 5.4.

Table 5.8 Estimated Revenues over the Five-Year Program

	Revenue Generated (\$20 Annual Dues)	Revenue Generated (\$50 Annual Dues)
Private, voluntary program	\$144,546,221	\$242,163,023
Public, voluntary program	\$305,685,320	\$755,806,953
Public, mandatory program	\$365,683,500	\$914,208,750

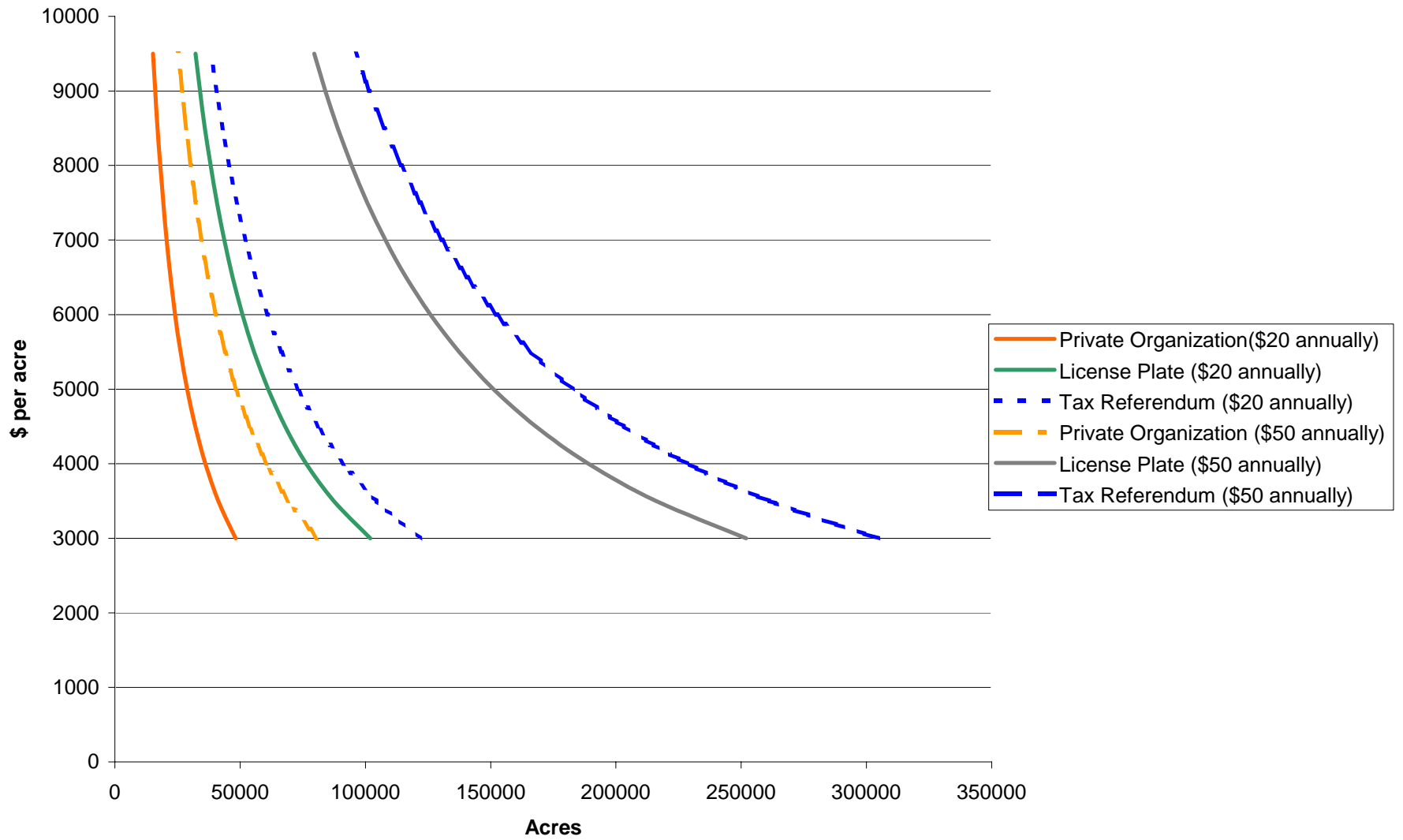
Policy Implications

In order to determine if there is a public or a private market in Georgia for farmland preservation the budget constraints were graphed with the State and Private WTA farmland supply curves. Graph 5.5 shows the public mandatory (tax referendum budget constraints with the state farmland supply curve) and voluntary (license plate budget constraints with the state farmland supply curve) markets for farmland preservation. Graph 5.6 shows the private market for farmland preservation. However, these results assume that the programs pay all landowners the same price per acre. With price discrimination (that is, paying less to farmers with lower WTA values), which the CRP uses, even more acres could be preserved.

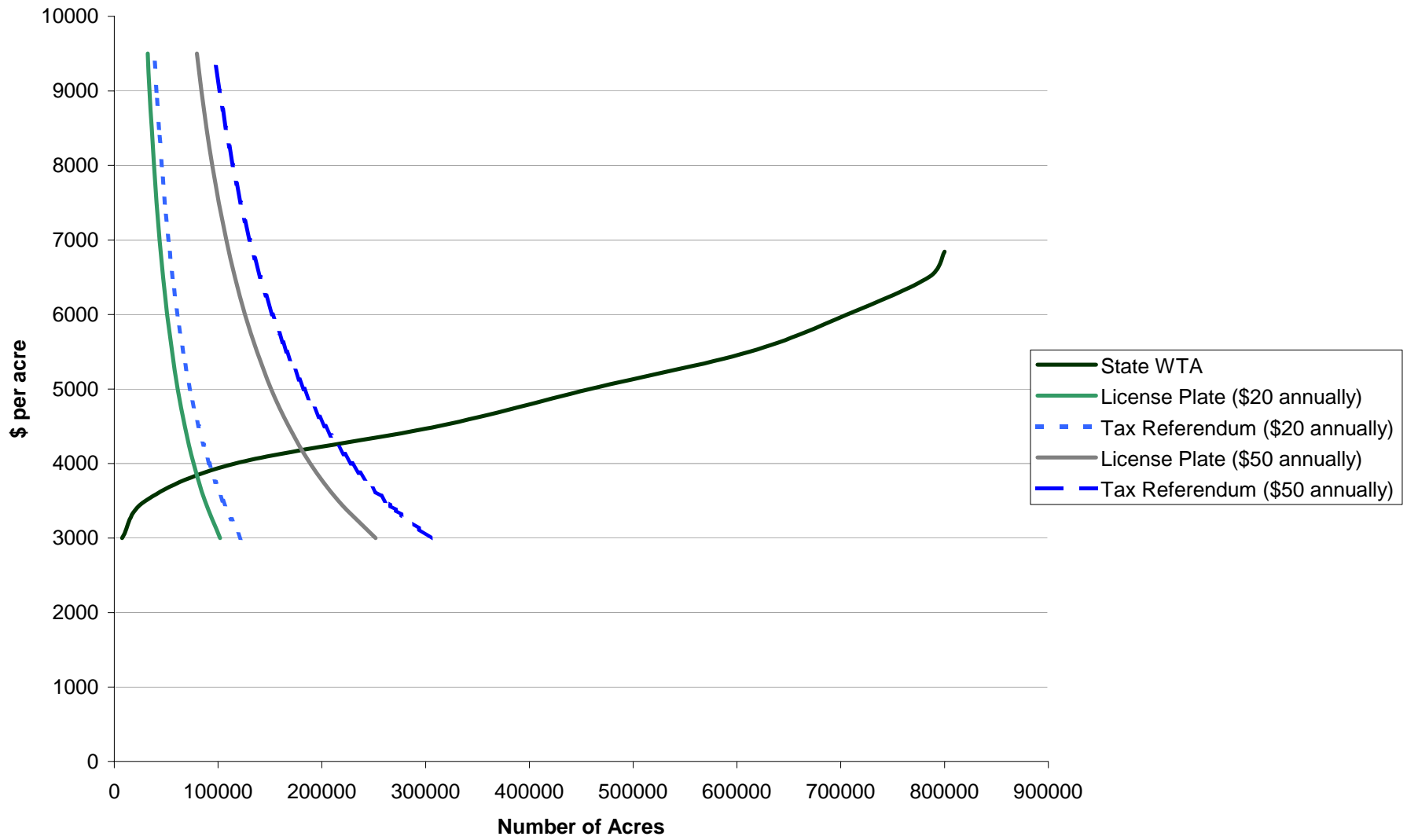
As shown in the public market (Graph 5.5) the tax referendum, causing an increase of \$50 annually, has the potential to preserve approximately 203,000 acres over the five-year period for just over \$4000 per acre to purchase the development rights. Also shown in Graph 5.5 is the ability of the license plate option costing \$50 annually in dues (public voluntary) to preserve approximately 168,000 acres of farmland over the five-year funding period and pay a little less per acre for the development rights than the tax referendum at \$50 annually. The estimated private market for farmland preservation (Graph 5.6) shows that a private organization charging \$50 annual dues would have the ability to preserve approximately 45,000 acres over the five-year period for just over \$4000 per acre for the development rights, for approximately the same price per acre as the public mandatory program at \$50 annually.

The estimated willingness to accept values appear very plausible considering the conservation value of farmland and its selling price. Our estimated WTA values for the various regions of Georgia are very close to the actual value of the land's development rights. Ideally the price of development rights would be calculated by subtracting the agricultural use value of the land from the appraised selling price of the land. The average agricultural conservation use value for an acre of moderately productive land in the Northern region of Georgia is \$628.67, in Central Georgia it is \$375.33 and in Southern Georgia it is \$415.67 per acre (Coleman et. al. 2002). If these values were to be subtracted from the selling price per acre of agricultural land in each of the regions, the value would be very close to our estimated WTA values. This has significant policy implications. This result means that farmers know the value of their land and if a Georgia farmland preservation policy is ever created then the funding organization can expect to pay the selling price of the land minus the agricultural use value for farmland development rights.

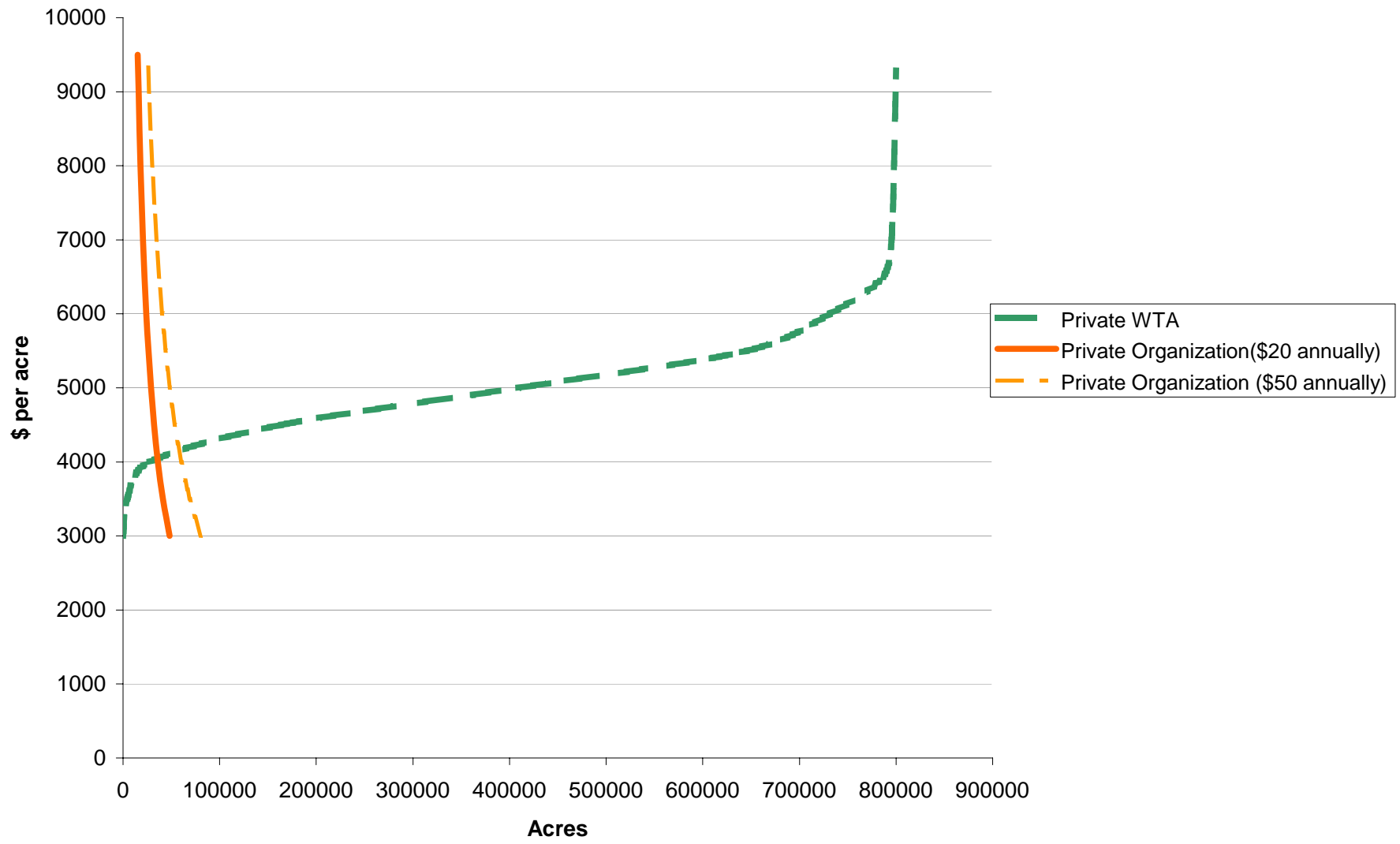
The private market results were not as good as we would have hoped. However there is a market for a farmland preservation program in Georgia, public or privately run, because the graphs do show the budget constraints crossing the potential farmland supply curves. Both programs have the potential to preserve a large amount of land, especially when there is only 1.6 million acres of farmland preserved nationwide and only 170,000 of those acres are preserved using federal funding. Since Georgia is experiencing statewide budget cuts the farmland preservation program may have to be initiated through a private organization and if marketed correctly could surpass our expectations. Also, the private program might be more effective in North Georgia than a state run program (see Table 5.4).



Graph 5.4: Consumer Budget Constraints



Graph 5.5 Estimated Public Farmland Preservation Market



Graph 5.6 Estimated Private Farmland Preservation Market

CHAPTER 6: CONCLUSIONS

Georgia is the fourth fastest growing state in the United States and is located in a region that is heavily dependent on farming. Several states have established successful farmland preservation programs to protect farmers from the population and growth pressures. The most successful method used in farmland preservation programs is when the development rights of the farmland are purchased, permanently preserving the farmland. In order to determine if this would be a feasible idea for a private organization in Georgia to undertake, a farmer willingness to accept survey was mailed to 1250 farmers who owned at least 300 acres of land. The mail survey was also used to examine the difference in farmers' WTA values if it was a state or private organization running the farmland preservation program. However for an organization to purchase the development rights they must have a funding source. Therefore, a citizen willingness to pay phone survey was conducted. This survey tested three payment vehicles at two WTP amounts (\$20 and \$50 annually over a five year period): purchasing a farmland preservation license plate (private voluntary), voting for a tax referendum which would increase your taxes to purchase farmland development rights (public mandatory), or joining a private farmland preservation organization with annual dues which go towards the purchase of farmland development rights (private voluntary).

Using the results from the farmer willingness to accept survey two models were estimated; a state model and private model. From these models the median WTA values were estimated; under a state organized farmland preservation program the median WTA is \$4,780 per acre to purchase the development rights, while for a privately run farmland preservation program the median WTA is \$4,988 per acre for the purchase of development rights. These results have interesting implications because they are almost what could be calculated by subtracting the conservation use value of agricultural land from the fair market value of the land; which is what one would expect to pay for the development rights of a piece of land. The results from the farmers' WTA survey were also used to generate potential farmland supply curves for the state run farmland preservation program and the privately run farmland preservation program.

The citizen data were used to generate six different budget constraints representing the revenue that each funding source could generate over the five-year period. It was discovered that the \$50 tax referendum would pass, with 53% support, and therefore generate the most revenue for a farmland preservation program; \$914,208,750 over the five-year funding period. Further, 39% of participants said they would purchase the farmland preservation license plate with an extra \$50 annual tag payment for five years; which generated the second largest five-year revenue equal to \$755,806,953. Finally, 32% of participants said they would join a private farmland protection organization with annual dues of \$50 and 48% of participants said they would join if the annual dues were \$20 generating the two lowest five year revenues equal to \$242,163,023 and \$144,546,221.

The potential state farmland supply curve was graphed with the two budget constraints for the public mandatory (tax referendum) and the two budget constraints generated from the public voluntary (license plate) funding sources, all of which crossed meaning that there is a public market for a farmland preservation program in Georgia. The public mandatory program at \$50

would preserve approximately 203,000 acre for just over \$4000 per acre for the purchase of the development rights, over the five-year funding period. The public voluntary program at \$50 has the potential to preserve approximately 168,000 acres at a little less per acre for the development rights than the public mandatory program at \$50 annually. A private organization with \$50 annual dues could preserve approximately 45,000 acres for a little more than \$4000 per acre (almost the same price as the public mandatory program at \$50 annually) for the farmland development rights, over the five-year period.

The private market for a farmland preservation program is estimated to be slower in protecting farmland than the state-run programs. However there is a viable market for a privately-run farmland preservation program and, if marketed correctly, it could surpass our expectations. Our results do show that a privately organized farmland preservation program might do much better in North Georgia, especially at the lower per acre values, than a state organized program. This is a very relevant finding because North Georgia is experiencing very high population growth rates. Also consider that through 2002 only 1.6 million acres of farmland had been preserved nation wide, and only 170,000 acres of this have been preserved under the Federal Farmland Protection Program. Therefore any contribution that Georgia could make towards farmland preservation would be significant.

These results and conclusions show that farmers would be receptive to a farmland preservation program and that if offered a fair price for their lands' development rights they would sell, creating a supply of farmland that would be preserved. The citizens of Georgia also show that they would support funding this type of program. Hopefully "the voice of the people" will be heard and the state or a private organization or even an individual with the financial support could look at these results and establish a farmland preservation program for Georgia.

Limitations

Obviously from the results of the citizen survey the two public programs were much more popular programs. However, the license plate results may not be realistic. Currently Georgia offers numerous specialty plates; the most popular is the plate that supports the protection of wildlife. This plate is purchased and displayed on less than ten percent of the registered vehicles in Georgia (Shelton 2004). On the other hand, Georgia recently changed the image on this license plate to a Bald Eagle with the United States flag in the background, which has tripled sales. The Georgia Department of Motor Vehicles does not push the sale of these specialty plates. Therefore our results could represent the true demand for this type of plate; however, they may overstate support. If this is the case, and only ten percent of registered vehicles purchase the plate, the license plate revenue would fall below the support for a private farmland preservation organization.

There is also the possibility that the private, voluntary program funding could be under estimated, especially when it was estimated to have strong support (48% at the \$20 annual dues amount). In order to create the two budget constraints associated with amount of revenue that the private organization could generate the percent of people that said they would join was multiplied by the number of households in Georgia. The underlying assumption was that only

one member in each household would join the private organization. However, there are approximately 600,000 more Georgia income tax returns filed than there are households in Georgia. This means there are people living together and filing separate tax returns, which means that we could have underestimated our budget constraint for the private organization because we assumed that only one member in each household would join. Bowker and Didychuk (1994) also found that as the number of people in a household increases so does the household willingness to pay. This would increase the revenue generated from the private organization and ultimately increase the amount of acres that a private organization could preserve over the five-year funding period. A second reason that the private, voluntary budget constraint could be under estimated is because it neglects potential large donors. People who are in favor of this type of organization and its goals could contribute more than the annual dues amount which our budget constraint does not take into account.

There is also a possibility that both the potential farmland supply curves are under-estimated. The farmer willingness to accept survey was directed at farmers who owned at least 300 acres and would preserve 100 of those acres. There are surely farmers who own less than 300 acres and would still preserve 100 acres. Also, farmers could want to preserve less than or more than the 100 acre chunk that was asked in the question. Therefore, there is the potential that much more farmland in Georgia could be preserved. Further, we have assumed a single, market clearing price is offered to farmland owners. Using a single price is simple, but causes all but the last person on the supply curve to get paid more than the minimum amount they are willing to accept to part with their development rights. Some land owners are willing to sell at much lower prices. Using differentiated prices (say, by taking bids as in the federal Conservation Reserve Program,) would save the programs considerable money and/or allow more acres to be protected for the same amount of money. Thus, our research presents a conservative estimate of the likely success of farmland preservation programs in Georgia by using a conservative estimate of farmland supply, under-estimating the revenue that could be generated using the private voluntary funding source, and possibly over-estimating the support for the public voluntary funding source.

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