

Easement Price Variations Under the U.S.D.A. Farmland Protection Program

by

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I: Introduction

This paper seeks to explain variations in the prices offered to farmers for the sale of their development rights in 12 of the states currently participating in the Farmland Protection Program (FPP) under the 1996 Farm Bill. FPP provides matching funds for state purchased agricultural conservation easements and other farmland easements as provided in the law. The price paid for conservation easements is an important incentive for farmers to give priority to farmland conservation among other available land uses. Current literature (e.g. Wang and Libby, 2002; Adelaja, 1999) point out that the process of price determination for the purchase of development rights is motivated by several complex factors which in turn affect the willingness to supply protected land by a farm owner. In this literature, explanations for price variation emphasize the differing appraisal and scoring mechanisms used to establish prices offered to farmers at local and state levels, and the importance of funding sources and parcel sizes in price (Plantinga et al., 2000). This paper attempts to provide a more complete analysis of the process of price determination in the purchase of development rights at the county level in the USA.

II: History and status of farmland preservation policies in USA

Farmland retention policy is of fairly recent vintage. Until the early 1960's, there was little concern about farmland preservation because there was abundant land suitable for development, as well as a surplus of agricultural commodities at relatively low prices (American Farmland Trust, 1997). Interest in farmland preservation emerged first in the northeastern states, focused largely on residential expansion into

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farming areas in a linear or fragmented development pattern. The major cause of farmland conversion was explosive demand for development space after World War II by personnel released from the military (Derr and Dhillon, 1997). Veterans needed new houses and such support services as roads, schools, railroads, retail stores, hospitals, recreation and water supply areas. The demand for development space was further increased in the 1946-64 period by the WW II “baby boomers”, as well as the growth in household purchasing power via a rise in real household incomes and increased employment (Adelaja, 1999). Construction of the interstate highway system, initiated in 1956, increased access to the countryside and to national forest and park systems. Conversion of farmland also reduced availability of the amenity and ecological services of farmland, namely the rural lifestyles, wildlife habitat, water and air recharge capacity, and pastoral scenery. Many people felt a general reduction in the quality of life as a result of these land use changes.

A food crisis emerged in the early 1970s with the wheat failure in Russia and the OPEC oil embargo which caused the U.S. energy crisis of 1973-74. The scarcity of food abroad led to a rapid increase in agricultural exports resulting in the collapse of local granaries. This led to shortage of local food and raised deep concerns in states which were depending on importation of food and petroleum-based fuel. At this juncture, some policy makers felt that the productive agricultural land base was threatened and that permanent measures were needed to stabilize the supply of agricultural land (Derr and Dhillon, 1997).

The conversion of farmland continues into the 21st Century as people continue to migrate from urban centers to rural areas. Heimlich (2001) reports that continuing high fertility rates, high immigration rate, and the longer life expectancy are the leading causes of net population growth in the U.S, at the rate of 1 percent per year. Responding to this increased demand, more new housing units and related support infrastructure are creating urbanizing conditions that reduce the amount of farmland available to supply open space, ecosystem services and other benefits. The decline in farmland has triggered various interventions by all levels of government and various non-governmental organizations to prevent further depletion and destruction of farmland. At the same time, policy makers, researchers and development agencies are continuously searching for new legislative instruments – incentives, regulatory and purchase -- to curb further conversion. The 1981 Farmland Protection Policy Act requires Federal agencies to reduce or eliminate the unintended impact of various Federal programs on farmland conversion. Farmland

protection policies remain one of the most important areas of policy for the US agriculture today, especially in states where the stock of farmland and open space has been reduced to the point that public benefits are heavily compromised (Adelaja, 1999).

Property tax relief programs have been enacted in all states to reduce the cost of farming and encourage farmers to continue working the land. Gardner (1977) was among the first to point out that reduced land taxes do little to alter the basic economics of location and conversion, though may delay the timing of that conversion. Further, to the extent that there is a rollback of avoided taxes or a conversion penalty forced onto the developer buying farmland, there may be a tendency for the developer to convert even more land to cover his cost (Chichilnisky, 1994)

Several states, including Oregon, Florida, Georgia, Maine, Rhode Island, Vermont, Washington, Maryland and New Jersey, are implementing growth management programs to influence the amount, type, location and quality of future development. Growth management programs direct future growth and development away from areas preferred for farming or open space services and toward designated growth centers.

Transfer of Development Rights (TDR) programs are functioning in about 12 states, with local TDR programs in several others. A TDR program implements a concept whereby the right of a land owner to develop land is severed from the property, thus restricting development in perpetuity, and is transferred to another property in a location where greater development densities are permitted (Adelaja and Schilling, 1999). The owner gaining additional development opportunity pays the owner giving up that right.

Another farmland policy option, of particular interest in this paper, is the Purchase of Development Rights (PDR). The PDR has similar conceptual underpinnings as the TDR program in that the development rights associated with farmland are severed, thus permanently preserving the land in its undeveloped condition. With PDR, farmers are directly compensated for appraised value of the right to develop that land. The farmer retains full rights to continue farming and related activities on that protected land. The result is the same under TDR and PDR except that developers gaining additional density rights in receiving areas pay under TDR and taxpayers pick up the bill under PDR. So the distribution of cost is different under the two models. Suffolk County, New York was the first to undertake a development rights purchase program, in 1977. By 1992, several states and county governments had established PDR

programs of some form. By 1995, virtually all states in the Northeast had a farmland preservation program, and the idea spread west to Ohio and Michigan and to California and Colorado (American Farmland Trust, 1997). The very presence of these policy interventions is recognition that farmland markets fail to capture most of the amenity benefits associated with actively farmed land.

III: Conceptual Framework

All PDR programs operate with specific pricing procedures to be followed in the process of purchasing development rights from farmland owners. These procedures define allocation rules governing the exchange of development rights between land owners and authorized state or local governments and land trusts. Pricing procedures also reflect the cost of monitoring and enforcement arising from the preservation programs. All PDR programs define the price of an easement as the difference between the current full market value of a parcel of land and its current value if the same parcel is preserved for agricultural use (American Farmland Trust, 1997). Appraisals of market values are based on comparable sales information while agricultural value assessments are generally obtained by calculating the present value of an estimated income stream or by use of a point-based formula based on soil quality, location, and other factors. The price paid for farmland easements is heavily influenced by differences in land productivity and other soil properties, as well as the development potential of the land parcel. Although a final price is computed based on standard values about productivity and land market characteristics described above, the actual price paid for a conservation easement varies widely across different farmland locations. It is likely that conservation easements on two parcels of farmland that have similar soil productivity and market properties but differ in location will be priced differently. Price variation among easement purchase programs continues to be of interest to researchers (e.g Wang and Libby, 2002; Adelaja, 1999), and may partially explain behavior of communities towards farmland preservation strategies.

The easement value calculated by the funding agency or land trust may simply serve as the starting point for negotiation for development rights (Buist, Fischer, Michos and Tegene, 1995). A successful negotiation leads to an actual price at which development rights can be exchanged, and is usually a result of many influences associated with the social, demographic, political and economic factors surrounding the community's environment. However, it is argued in this paper that the final price reached is influenced by

the demand for agricultural land to provide open space, rural scenery, environmental amenities, cultural heritage and the maintenance of agricultural values. This demand is created by the degree to which farmland base is diminished by urbanization or other forces and characteristics of the remaining farmland..

Farmland conservation agencies act on behalf of society to establish a price for conservation easements and so this price reflects a cost to society of buying development rights. Communities whose farmland loss threatens the local economic base have an incentive to allocate a significant amount of revenue toward preservation activities, exhibited as the willingness to pay to acquire farmland development rights. Perhaps there is a threshold proportion of protected farmland in a region beyond which additions will come only at a lower price per acre. In essence, as more and more easements are obtained, scarcity of these farmland services is reduced and there is diminishing marginal utility arising from the benefits of preserving farmland. Since PDR programs are very costly to local and state governments, priority to secure conservation easements is focused either on land under the greatest threat from future development (where fewer acres of farmland can be secured at a high price) or on land with less development pressure where more or larger parcels can be acquired at a relatively lower cost. On the other hand, farmland owners have two land allocation choices. The possibility of future development has a present value for land owners. Perhaps the owner prefers to take a chance with future development patterns, and hold the land or sell it to a development speculator who will bear the risk of future value. The other option is to sell their development rights to public and private authorities seeking to protect open space and the various benefits of working lands, thus capitalizing that development potential. The decision depends on the relative returns per acre from allocating land under the two alternatives. If the farmer is inclined to sell development rights for the various monetary and social benefits he derives, the higher the price of a conservation easement, the more protected land the owners are willing to supply.

Thus, the mechanism of price determination can be modeled as a supply-demand function. The supply function of protected farmland corresponds to the marginal cost incurred to preserve farmland in form of easements and can be represented by the upward sloping function as shown in Fig.1.

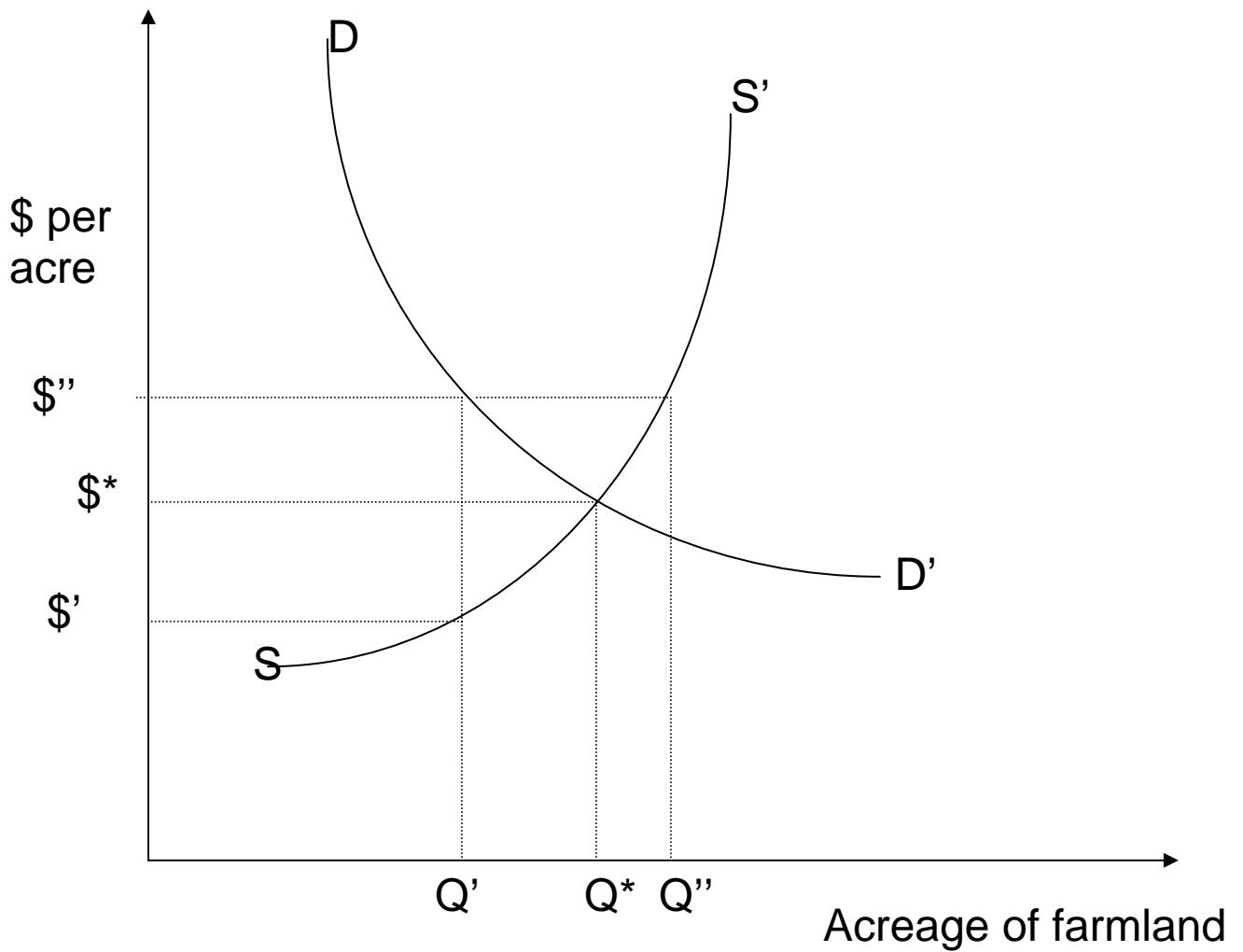


Fig.1: Equilibrium in farmland market

The marginal costs basically include program costs to cover operations, labor, and other direct costs incurred by authorized land trust agencies to secure easements on farmland. Since the biggest program cost is payments to farmland owners to acquire easements (American Farmland Trust, 2000), the marginal cost function corresponds to the farmland supply function, or the willingness of farmland owners as suppliers of farmland amenity services to sell farmland easements at a range of prices. The demand curve is downward sloping and reflects how much land trusts and farmland agencies are willing to pay to

acquire development rights on an additional acre of farmland. The demand function demonstrates that the greater the amount of farmland preserved into the PDR program, the less land trusts are willing to pay to secure easements on additional acres of farmland. This function reflects the marginal value or marginal benefit society obtains from farmland preservation. At equilibrium, marginal cost = marginal willingness to pay = marginal value of farmland = Q^* . Purchase of farmland rights beyond Q^* implies that willingness to pay is less than reservation price for farmers to sell; marginal cost to society of purchasing more easements is greater than marginal benefits of conserving more farmland. On the other hand, at quantities less than Q^* , increasing acreage increases benefits by more than it increases costs (marginal benefit is greater than marginal cost), so total net benefits will increase. It is only at Q^* that marginal costs and marginal benefits are equal, and it is impossible to increase net benefits by changing acreage. This discussion suggests that a community can maximize the net social benefits from farmland, and achieve the optimal supply, by allocating funds to preserving farmland. Efficiency is achieved when the market can equate marginal costs with marginal benefits (Kahn, 1998). The optimal quantity and price are not known ahead of time, but emerge in the process of policy change. At some point, citizens will feel that gains from saving additional farmland are less than the opportunity cost, or the returns to those dollars in some other use. Residents of a particular community may place a very high value on protecting specific farmland acres that have “unique qualities” or are essential to the integrity of a greenbelt area. In reality, of course, there is never full agreement about how much farmland is enough or what price is too high, but the notion of optimality is comforting to economists and has useful conceptual qualities.

This study focuses on the demand and supply factors affecting farmland markets. We argue that the mechanism of price determination in the PDR programs significantly responds to the economic, social, demographic and political factors that drive the changes in consumption of farmland, that alter the proportion of farming and non-farm communities, and that replace farming activities with development activities.

IV: Factors influencing the price per acre of conservation easements

The land valuation literature provides guidance for the identification of factors that influence the demand and supply of farmland and its associated amenity values, and affect variations in price per acre of

easements secured in urbanizing communities. The price paid for conservation easements varies widely from place to place depending on development pressure. Greater competition for developable open land leads to relative scarcity of working farmland and the related agricultural services. It can be argued that farmland scarcity triggers intervention in land use patterns, and if a significant amount of farmland base is lost, authorities place high priority on protecting farmland and exhibit a higher willingness to pay for farmland easements. Gardener (1977) highlighted the driving forces causing farmland loss and encouraging land use policies to preserve the farmland base. Some of the factors highlighted by Gardener were specifically tested by Adelaja (1999) and include population density, relative changes in income, changes in the population of the farming community, political dynamics of urbanizing communities, and municipal or county concerns about growth and environmental degradation.

i) Population pressure

As expected, increased population in an area is associated with reduced amenity services from farmland as land is diverted for construction of residential facilities, supporting services and commercial centers meant to support the increasing population. Rapidly growing areas experience the greatest loss of farmland amenity and often receive priority in selection of land on which to secure easements. Gardener (1977) concluded that an increase in population density leads to loss of farmland and related amenity values and so the resultant high demand for farmland raises the price of conservation easements. However, Kline and Wichelns (1994) found no relationship between easement price per acre and farmland loss. Furuseth (1985) also found that the prices of conservation easements do not necessarily rise as farmland becomes more scarce. Both studies found that strongest demand for preservation policies and the highest prices for farmland exist in communities that are agriculturally oriented, with the greatest amount of farmland acreage, with the largest number of farms, with the most stable farmland base, and where the community of farmers is still larger than the non-farm community. Frieden (1979) and Fischel (1982) found that the high price per acre of conservation easements in more populated areas reflects not only a significant loss in farmland but also municipal government's concerns about the strain that a growing population puts on budgets to finance services and infrastructure. The last scenario implies that municipal authorities involved in PDR programs may deliberately set a high price for conservation easements to attract more farmers to supply the open land services and frustrate residential development that is expensive

to serve with needed infrastructure. Since population pressure leads to loss of farmland, this study hypothesizes that in highly urbanizing communities, price elasticity of demand for farmland services is greater than 1 as the rate of quantity demanded increases more than percent change in price.

ii) Changes in income and economic conditions

There is evidence that changes in personal income affect the rate of farmland loss in the American countryside and the demand to control that loss. Heimlich, et al. (2001) point out that changes in income and economic status of American communities have been a key driver for both expansive growth, involving urban development at the edges of cities and rural areas, and a low-density, automobile-dependent pattern of housing, commercial centers and other structures. A change in personal income may create an enabling environment for creation and expansion of single-family detached homes in rural areas. On the other hand, personal income has been documented to affect the preferences and bargaining power of communities regarding the decision to preserve more land for agricultural uses (Adelaja, 1999). The strength of preferences for benefits provided by farmland is determined by citizens' willingness to pay for the provision of these services, given the budget and other resource constraints of the community's households. In an urbanizing community, the cost to provide the services from open space and rural amenities is relatively high. Willingness and ability to pay are conditioned by income of the community residents. Therefore, it is likely that in high-status communities, citizens have a high willingness to pay for a large quantity of farmland to provide open space benefits, leading to the deduction that the income elasticity of demand for conservation easements is greater than unity. Logan (1976) found that high-status communities undergoing rapid urban expansion are capable of generating a high bargaining power through mobilizing the community's financial and social resources to press for farmland preservation programs. Further, high income communities have capacity to spend for public services that they prefer, including farmland protection, and are less dependent on outside funds. He concludes that the high-status communities undergoing rapid urban growth and loss of farmland have the necessary social and financial resources to mobilize their citizens to press for land use regulation and other policies. A similar observation is made by Libby (2002) that higher-income communities tend to enact their own land use zoning to maintain an environment of economic and social exclusivity. Because of their desire for open space and a

more rural environment, high-income communities may contribute financially to programs that acquire more farmland easements, creating increased demand that leads to an increase in farmland prices. The alternative argument is that a high per-acre price of conservation easements secured in high-income areas is a motivation for farmland owners to allocate more land for conservation, and less to development. Based on the above arguments, it can be hypothesized that changes in prices per acre of conservation easements are positively influenced by personal income of communities located in urbanizing areas. Thus, changes in income motivate changes in the supply of protected farmland to the extent that communities can offer a per acre price for conservation easements high enough to induce a higher supply of farmland by land owners.

iii) Education levels

Education is a social factor which may be associated with personal income, and can influence the pattern of development and demand for farmland amenities. Unlike personal income, however, education levels will not always determine the strength of preferences or ability to pay for services provided by farmland. Education may lead the person in other directions entirely. Rather, preferences for greater farmland retention are driven by the stock of knowledge and human capital available among urbanizing communities. Logan (1976) found out that a high proportion of highly educated people generate a community that possesses the human capital skills to develop more efficient preservation and growth control strategies. Logan further argues that highly educated communities provide important inputs in the design and evaluation of farmland policies that alter existing rules to suit their preferences. The basis of this argument was that highly educated people are more likely to belong to grass roots organizations and thus are able to expand their communication channels and political influence leading to farmland preservation. Further, the highly educated individuals are inclined to prefer homes in areas where a significant acreage of farmland is preserved. Prices for parcels of land in the neighborhood of preserved farmland are spatially and positively influenced by the farmland values associated with farmland protection (Heimlich, et al., 2001). Based on the above arguments, it can be hypothesized that price per acre of a conservation easement is likely to move in the same direction as the proportion of educated people found in the jurisdiction

iv) Political Structure

Sustainable success of PDR programs seems to rely on the existence of a substantial political pressure within the farming communities to protect quality agricultural land. Thus the politics of an urbanizing community are likely to influence the demand for farmland retention and the ultimate changes in price offered for conservation easements. The influence of political dynamics was studied by Dye (1966) and his results were interpreted and reported by Adelaja (1999). This research led to a conclusion that legislative patterns associated with farmland retention are influenced by the political structure of the urbanizing communities. It was found that the demand for farmland conservation (and ultimately the price) increased as an inter-party competition strategy, probably during the election time, to motivate the support from rural communities as the majority party vied for votes. Further, the proportion of the population that supported the majority political party (either Republican or Democratic Party) influenced the legislative demand for farmland preservation. Generally there appear to be differing interests among Republican and Democrat populations regarding the legislative decisions concerning farmland preservation. Rural areas tend to be more Republican, and place major emphasis on property rights of the land owner. This position would favor voluntary sale of agricultural conservation easements over more regulatory approaches like rural zoning. Further, Democrats will be more attuned to growth management from the city outward, arguing for improving urban conditions to stem the flow of out-migration, while Republicans are more inclined toward voluntary and compensatory approaches to securing the amenity and production services of working farmland. Overall support for action to protect farmland and reduce costs of urban sprawl, however, comes from both major political parties. Therefore, the bargaining power to press for farmland preservation in a rapidly urbanizing community appears to be influenced by the proportion of the population that is registered in the majority political party. Consequently, it can be hypothesized that variation in the price of conservation easements associated with the demand for farmland conservation, is also influenced by the proportion in that majority party.

v) Regional Effects

This factor deals with the effect of spatial proximity to a similar PDR program in a nearby state or locality on the sale price of conservation easements. Insights on this point follow from arguments raised by Adelaja (1999) in his study of the motivations for the adoption of right-to-farm laws by governments. This and similar literature (e.g. Irwin, 2001) point out that land use programs in neighboring jurisdictions affect

the pattern of land use activities and policies in a given locality. Because of similar land use problems across jurisdictional boundaries, authorities often find it necessary to combine efforts in land-use policy planning and implementation to reduce the cost. There is also an inclination by community leaders to learn from their neighbors and even compete with them by enacting similar laws.. Consequently, policies may have the same effect across jurisdictions and /or neighboring communities. Land-use policies and legislation influence land use decisions by farm owners, and are reflected in the sale prices of conservation easements. Thus it appears that the willingness to supply land for sale of development rights by farm owners is influenced by the existence of PDR programs in the neighboring localities. Consequently, the price per acre of a conservation easement may be influenced by easement prices in the neighboring parcels of land.

In some cases, however, negative experience with a farmland preservation program, particularly complaints about property rights or a low easement price or perceived losses associated with reduced development may be a wake-up call for the neighboring communities to oppose them. For the PDR programs, it is obvious that there are diverging interests among sections of a community in farmland preservation programs to the extent that supporters of development may oppose legislative actions to implement farmland preservation programs in heavily urbanizing communities.

vi) Land Use

The type of land use determines the stock of ecological resources and services available in a particular environment. Land use change at one scale or another is the single greatest factor affecting these ecological resources. Land use change, whether ecological or human-induced, is recognized as the key driver of farmland loss (Bocksteal, 1996). Policy intervention to preserve farmland is largely motivated by the rate at which the stock of natural resources is altered due to human activities. Human activities responsible for land use change are in turn influenced by the social, economic, demographic and economic characteristics of urbanizing communities. Any program to preserve farmland and the associated benefits contributes to the stock of natural resources needed for agricultural activities. Further, the dominant land use activities in an urbanizing community serve as incentives influencing the legislative decision to preserve more land for agricultural uses. For example communities whose dominant economic activity and

income base are threatened by farmland loss have big incentives to press for legislative action to conserve more farmland.

In addition, the forces of demand and supply of agricultural products play a big role in the determination of changes in land values (Gardener, 1977). Food and fiber are some of the direct products that arise from agricultural activities. The more productive the land, the higher the price expected for an acre of cropland and the more competitive crop farming is compared to other land uses. When the forces of demand and supply dictate that food and fiber are competitive in land markets, then farming communities would favor agriculture over other uses. If this situation is coupled with fewer restrictions to international trade in food and fiber, comparative advantage of farming would increase leading to increased profitability of the enterprise. Consequently, the farming sector would face a significant amount of demand to the extent that profitability and competitiveness would increase. On the other hand, if the food/fiber industry is less competitive, then the demand for more and larger parcels of cropland would decrease, the price of agricultural land would decrease and farmland owners would be willing to supply land for other uses. Development may be an attractive alternative under those conditions, but complicated by the existence of zoning and other growth management policies which designate specific areas to remain in agriculture and others for development (Heimlich, 2001). In such a case, the sale of development rights would be an easier choice to make especially if the PDR program is accompanied by differential tax incentives supporting protection of farmland. This pattern of activity would lead to greater availability of land for preservation purposes and would bring the price per acre of conservation easements down.

vii) Population directly employed in agricultural industry

The percentage of county population engaged in the agricultural industry plays a role among the factors influencing the demand and supply of agricultural land. The individuals engaged in agriculture have obvious stakes in the land market and will influence various policy choices that affect the future of agriculture. Other stakeholders who would be affected indirectly would be processors, transporters, farm suppliers and professionals involved in the agriculture field. The population involved in agriculture would raise enough pressure on the legislative machine in favor of maintaining the economic viability of the local agriculture. The legislative decisions will in turn influence the demand and supply of land available for farmland retention and the price of conservation easements.

V: Empirical Framework

Land use policies such as the purchase of development rights to farmland directly influence the per acre price of conservation easements acquired for farmland retention (Heimlich, 2001). When land use policies change the rules governing use of land, they directly influence development potential for land. Obviously, the PDR programs are meant to decrease the developmental potential of land and increase the benefits accruing to the existence of farmland. The question is: What social, economic, political and demographic factors help explain variation in easement purchase price under the national Farmland Preservation Program? Our attempt to answer this question relies on an analysis of the demand function incorporating the theoretical framework outlined above. Beginning with the demand function stated as follows:-

$$P_i = f (A_i, C_{ji}, R_i, Y_i, I_i, D_i, E_{ji}, p_{ji}) \dots\dots\dots (1)$$

Where

- P_i = price per acre of the i th conservation easement,
- A_i = acreage of i th easement devoted to conservation program,
- C_{ji} = Vector of categories of land use practices,
- R_i = County demographic characteristics: population density,
- Y_i = County per capita median income,
- I_i = Proportion of people employed in the agriculture industry in the county,
- D_i = Dummy variable characterizing spatial/ regional factors,
- E_{ji} = Vector describing education levels in the county, and
- p_{ji} = Vector describing various political affiliations of people in the county,

To examine the changes in the per acre easement prices with respect to changes in the various factors outlined in section (iv) above, a comparative static analysis is carried out by taking the first order conditions of equation (1) with respect to each of the independent variables included on the right-hand side.

Variables and Measurement:

Following the conceptual framework and hypotheses developed in the last section, variables representing the characterization of farmland preservation practices are selected for analysis, as follows:-

I: Dependent variable: Price (in dollars) paid to individuals for agricultural conservation easements purchased under the PDR programs in those states participating in the FPP program.

II: Independent variables: Eight variables are defined as follows:

i) **Acres:** Amount of protected farmland (acres) where development rights are purchased from individual farm owners under the PDR programs in a specific county.

ii) **Land use category:** This variable is measured by the percentage of land devoted to various agricultural purposes in a specific county namely (a) Range (b) Pasture (c) Forests (d) Crops.

iii) **Spatial proximity:** This is a dummy variable describing the extent to which farmland rights are defined in the counties participating in the FPP program. There are counties in states where the PDR program is fully active, and these can be defined as those with strong and well-defined farmland rights. Other counties are in states where only scattered independent, partial, local programs exist and can be regarded as those with weak and less defined farmland rights. Therefore one dummy variable characterizing the spatial proximity is defined as follows:

$D = 1$ if a specific county belongs to a state that has strong farmland rights.

$D = 0$ if otherwise.

iv) **Education:** This variable is measured by three categories of formal education namely the percentage of population in a specific county that attained (a) high school education, (b) Bachelor's degree, and (c) Graduate degree.

v) **Income:** This variable is measured as the median income per capita in a specific county

vi) **Industry:** This variable defines the percentage of county population that is directly employed in the agricultural sector/industry. This proportion is largely composed of farm operators, processors, farm suppliers, transporters, financial firms, university professors in agricultural fields, and government personnel dealing with agricultural-related subjects and/or programs.

vii) **Political structure:** This variable is measured as voter count under each of the 2 dominating political parties in the country. Data obtained for this variable measure the percentage of population registered as (a) Republican (b) Democrat (c) Independent

viii) **Population density:** This variable is measured as the number of people residing in one square mile in a specific county participating in the FPP program.

Data, Measurement and Sources

In accordance with Wiebe, Tegene, and Kuhn,(1996), empirical work on farmland preservation needs to take into account the interrelations of the land with the owner, adjoining land uses, and the allied agribusiness services. Therefore to understand the mechanism of farmland preservation under the FPP program, appropriate data were used to study these mentioned interrelationships. Data used in this research are 1997 county-level data assembled by the American Farmland Trust and are composed of 353 observations about prices paid to farm owners for the acquisition of conservation easements by the local, State and Federal Land Trusts in 12 of the states currently participating in the FPP program. The following states were included: California, Colorado, Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, and Rhode Island. The data are also composed of the acreage dedicated or sold to land trust authorities by farm owners for the farmland preservation program; and land use practices. Data on the economic, social, political and demographic characteristics were assembled from Census Reports for the 2000 U.S Census of Housing and Population.

The intensity of county level programs encouraging farm owners to sell development rights to private and public land trusts varies widely from county to county as it does from state to state across the U.S. While some counties have actively responded to a statewide PDR program, others only operate independent local PDR programs with minimal or no state intervention. Reasons for the reluctance of some state and local authorities to undertake farmland retention programs are not clearly documented but scanty literature points to the fact that over-dependence of state and local authorities on property tax for services is a possible candidate (Libby, 2002). Statewide programs operate in Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Vermont and California although some California counties also operate independent programs. The rest of the counties in other states are only partially operating the program. These county data for states with state level programs have also been included in the analysis.

VI: Results and Interpretation

A: Correlation Analysis

The conservation easement price is influenced by the number of acres already protected by PDR programs and by various economic, social, demographic and political factors. Table 1 shows the degree of relationship among these variables as indicated by the correlation coefficients.

Table1: Correlation Coefficients with respect to price, acreage and the inter-linking factors in land markets

	P_i	A_i	C_{1i}	C_{2i}	C_{3i}	Y_i	I_i	R_i	E_{1i}	E_{2i}	E_{3i}	p_{1i}	p_{2i}	p_{3i}
P_i	1.00	-0.10	-0.16	0.20	0.0005	0.06	0.03	0.12	-0.34	0.03	-0.08	0.07	-0.04	-0.01
A_i	-0.1	1.00	0.02	0.06	-0.07	-0.05	0.06	-0.07	-0.04	0.02	-0.13	0.08	-0.03	-0.02

C_{1i} = proportion of land under forests

C_{2i} = proportion of land under range

C_{3i} = proportion of land under crops

E_{1i} = percentage of population with high school as highest educational attainment

E_{2i} = percentage of population with Bachelor's Degree as highest education level

E_{3i} = percentage of population that have attained more than Bachelor's Degree education level

p_{1i} = percentage of county population that is registered as Republican

p_{2i} = percentage of county population that is registered as Democrat

p_{3i} = percentage of county population that is registered as independent

Other variables are as described above.

Results in table 1 indicate that as expected, easement price/acre (P_i) is negatively related to the amount of land (A_i) protected under the PDR program. This result implies that easement prices are significantly higher as the supply of land for preservation purposes decreases (Bocksteal, 1996). That is, the willingness to pay to preserve land is higher when there is little land available and /or already protected. Similarly, the correlation coefficient between easement price and the amount of forestland is negative implying that the farmland easement price is lower in areas where there is forested land that can provide some of those

desired amenity services. However, the correlation coefficients between easement price and the amount of cropland and rangeland are positive perhaps reflecting the fact that the presence of these open lands creates demand for its protection. This may seem inconsistent with the “scarcity effect” on easement price, but may suggest that the presence of cropland and rangeland in significant blocks indicates the benefits available from protecting that land and against its development. The preferences for farmland preservation can be investigated by considering the correlation coefficients between the various levels of education and the easement price, as well as the acreage of farmland preserved. The effect of education and easement prices is reflected in the correlation coefficients on E_{1i} , E_{2i} , and E_{3i} which suggests that the proportion of high school graduates and post-graduate professionals are negatively correlated with price paid for a conservation easement, as well as the acreage purchased under the FPP program. Further, the acreage preserved as conservation easements is lower for the communities with increasingly high school graduates, and also with post-graduate degrees. As far as the demand for services provided by farmland is concerned, these results indicate that there may be abundant supply of farmland in the communities with high proportions of high school graduates and professionals. Consequently, the abundant supply of farmland already protected depresses the price offered for conservation easements. However, the correlation coefficient on the E_{3i} is weak and insignificant. Further, the correlation coefficients between the percentage of population that holds bachelor’s degrees and the easement prices, as well as acreage, are positive.

B: Regression Analysis

Using the multiple regression technique, an econometric analysis was also performed on the specified model to generate regression coefficients and to determine the overall level of significance of the observed variation in the dependent variable. The critical test of the hypotheses hinged on the signs and significance of coefficients that determine the relationship between the conservation easement prices and the social, political, economic and demographic variables. Model fit is estimated to be significant at 1% if the outcome of the probability values is 0.001 or less ($p \leq 0.001$). Model fit is estimated to be 5% significant when probability values fall in the range 0.001 and 0.005 ($0.001 > p \leq 0.005$) and 10% significant when probability values fall in the range 0.005 and 0.01 ($0.005 > p \leq 0.01$). Variable coefficients which are

significant at 1% or less, 5% and 10% are presented with 3 (***), 2 (**) and 1 (*) asterisks respectively in table 2. Table 2 shows the regression results of the model of determinants of price variation in PDR programs.

Table 2: Regression Coefficients for a model of price determination in purchase of conservation easements in selected states

Variable name	Coefficient (beta)	t-value
1. Constant	66987.6***	2.497
2. Acreage	-0.89*	1.355
3. Crop (%)	-1.66	-0.517
4. Forests (%)	-0.391	-0.771
5. Range (%)	-0.205	-0.469
6. Pasture (%)	-0.257*	-1.291
7. Spatial	0.286**	1.753
8. Income	0.209*	1.440
9. Industry	0.110	0.572
10. Population density	0.191***	2.496
11. High Education (%)	-0.484***	-4.003
12. Bachelors (%)	-0.467***	-2.389
13. Graduate (%)	0.087	0.532
14. Republican (%)	0.218***	2.088
15. Democrat (%)	-0.110	-0.605
R2 = 16%		

As expected, results in table 2 indicate that on average, when the available acreage of preserved farmland increases by 1%, this depresses the easement price by 0.89%. This result implies that the presence of land-use controls influence the values of conservation easements to the extent that easement prices significantly increase as the supply of preserved land decreases (Guidry, Shilling and Sirmans, 1999). Further, the regression results show that when the percentage of land devoted to crop production increases by 1%, price paid for conservation easements decreases by 1.66%. Similarly, when the proportions of land devoted to forests, range and pasture increase by 1%, the price per acre of conservation easement decreases by 0.39%, 0.21% and 0.26% respectively. The regression coefficient for the pasture variable is significant at 10% confidence interval. Although the other results of regression coefficients on land use categories are not significant, the sign on the coefficients support the theoretical framework outlined in this study.

The spatial proximity variable (“Spatial”) represents the spill-over effect that may flow from neighboring counties that are already participating in the PDR program. Because of the existence of similar conservation practices in the neighborhood, political leaders and local governments at the county may consider adoption of these legislative innovations to solve a similar problem (Libby and Irwin, 2002). There is empirical evidence that the stock of protected land in one area can increase the willingness to pay for farmland conservation in the neighboring counties (Monk and Whitehead, 1999). This willingness to pay may further be enhanced by similar attitudes about the laws being enacted in the nearby governments, and/or when nearby communities have similar political beliefs and can often come into contact with each other. In support of current literature and contrary to Adelaja’s (1999) findings, this research found out that the existence of PDR programs in neighboring counties positively influences the demand for farmland for preservation purposes, which raises the price of conservation easements. This result is significant at 10%. This finding further emphasizes the importance of spill-over effects in the dissemination of land-use control programs. Additionally, the finding demonstrates the potential of state and local authorities to cut cost significantly by coordinating activities involved in land-use programs.

Income is the variable given the greatest credit in the literature for influencing the preferences for farmland preservation, creating demand for farmland protection. It is widely documented that growth in personal income responding to the overall growth in economic status, influences changes in preferences for housing and lifestyles. Empirical evidence indicates that preferences are biased towards smaller household sizes with a need for new housing units as income increases. Increased income is also associated with increased demand for roads serving more automobiles, and greater road congestion (Heimlich, 2001). Results in this study indicate that on average, when the proportion of high-income people in the population increases by 1%, the easement price increases by 0.21%. As expected, this result reflects a reduced supply and availability of farmland for preservation programs in urbanizing communities with a large percentage of high-income population. The result further reflects an income-elastic demand for farmland amenities in urbanizing communities. This result is also consistent with literature about the nature of sprawl in the American countryside. The pattern of sprawl is characterized by construction of scattered detached single-family units on relatively large lots, leading to a large amount of development on previously farmed land without a matched increase in population. The scattered development pattern may be accompanied by an

agglomeration of zones isolating the higher-income from low-income communities as well as commercial centers (Heimlich, 2001). As expected, new non-farm residences in rural areas are followed by retail centers, sewage facilities, schools and other services. The rate at which farmland is converted to developmental use will be higher than the rate at which farmland is retained, leading to greater demand for protection and the subsequent increase in farmland easement price.

The regression coefficients on the variables “crops”, “forests”, “range” and “pasture” (see table 2) are all negative, and imply that on average, when the proportions of land devoted to crops, forests, range and pasture increase by 1 percent, the price at which an acre of conservation easements is purchased decreases by 1.7%, 0.4%, 0.2% and 0.3% respectively. In addition, the coefficient on the “pasture” variable is significant at 1%.

A further result is that when the proportion of the population that is directly employed by the agricultural sector increases by 1%, the price per acre of conservation easements decreases by 0.11%. Although this result is not significant, the sign on the coefficient supports the notion that the population involved in agriculture would support programs to purchase their development rights for its own economic benefit. The coefficient on population density is positive and highly significant implying that the supply of farmland in highly populated areas is extremely low. On average, when population density increases by 1%, farmland easement prices increase by 0.2%. This result confirms that population density is one of the market phenomena that reduces the amount of farmland available to provide open space, rural scenery and recreation services.

The coefficients on education variables indicate that when the proportion of population with high school and bachelor’s degree education as their highest education levels increases by 1%, the price per acre of conservation easements decreases by almost 0.5%. These results are significant at 1%. However, the coefficient on the variable representing the proportion of county population that has achieved more specialized education at the post-graduate level is positive. Although the three education variables test for the same social attribute, which is the amount of education acquired in the county, the analytical outcome is different as far as the elasticity of demand for farmland conservation is concerned. These results imply that individuals who have attained specialized professional training at post-graduate level are likely to be employed outside of agriculture, probably in the services and/or government sectors, and so are not

directly concerned with farmland preservation issues. It is highly likely that the communities where the highly educated individuals reside have experienced urbanizing conditions growing at a rate faster than farmland preservation rate. Consequently, the demand for farmland in these communities is high and likely to bid up the per acre easement price. This argument is also supported by the relatively large negative coefficient of acreage (A_i) and the proportion of county population with post-graduate education ($E3_i$) in Table 1. The negative correlation coefficient in table 1 indicates that there is relative scarcity of preserved land (as conservation easements) in communities with a high proportion of professionals. The alternative explanation is that the rest of the educated communities especially those who have attained high school and bachelor's education, have a high preference for farmland preservation probably because they are directly employed by the agricultural sector. It is also likely that these individuals are settled in rural areas and create communities that are highly attracted to the rural amenities provided by open space. Consequently, these communities have already responded to farmland protection programs, leading to an abundant supply of land protected for agricultural purposes. Ultimately the abundant supply of protected farmland leads to a fall in the price per acre of conservation easements. It can also be argued that the preference for farmland preservation by the educated individuals is influenced by some social, political, or economic factors beyond those that are investigated in the study. However, the differences in these results suggest the need for additional work to understand preferences for farmland preservation particularly related to education levels.

Regarding the political structure of the population, the results show that when there is an increase in the percentage of the population that is registered as Republican by 1%, farmland easement prices increase by 0.2%. This result suggests a significantly high demand for preserved farmland associated with the Republican land occupants. This result further suggests that the communities in which Republicans live support agricultural activities more than do other communities. On the contrary, the coefficient on the variable defining the proportion of registered Democrats is negative. Perhaps Democrats are disproportionately located in the more urban parts of the county and have priorities other than farmland protection. They may support farmland protection in general, but prefer to spend public dollars on other social needs. On average, when the proportion of Democrats living in urbanizing communities increases by 1%, the price per acre of conservation easements decreases by 0.11%.

VII: Conclusions and policy implication

This study has attempted to understand variations in the price per acre of farmland rights acquired for preservation under the PDR program by studying trends in economic, social, demographic and political factors associated with urbanizing communities at the county level. Data used in this study help explain the differences in price per acre of protected farmland. Price is an important economic factor known to influence the decision by farmland owners to either sell their land for development or to sell the development rights to a community or eligible land trust, so that farmland can continue to provide its open-space benefits to the broader society.

This study found out that the most significant factors influencing the variation of per-acre prices of conservation easements in the PDR programs are acreage of already preserved farmland, amount of farm and other open land in the jurisdiction, proportion of the population in farming, population density, income, education levels, political structure, and spatial proximity to similar PDR programs. The significance of these factors was determined from the individual elasticity coefficients generated by the multiple regression analysis. Various land use policies, including PDR programs, are already in place to capture some of the amenity benefits of agricultural land that are not reflected in market price. Thus, the major policy recommendation in this paper concerns possible changes to reduce costs of easement purchase programs. Such programs could be conducted on a regional basis rather than county to reduce coordination cost and take advantage of spatial spillovers from protected land across county boundaries. Land selected for easement purchase should be in an area where farmland amenities can survive over time, and where the surrounding landscape is compatible with agricultural activities. In addition, the scattered and isolated parcels of land on which conservation easements are acquired could create huge monitoring costs for the enforcement process, and so efforts to consolidate conservation easements would be appropriate to reduce costs and ensure the success of the FPP program.

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