Getting the Most for Our Money in Farmland Preservation

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I. Introduction

Across the U.S., citizens continue to be concerned about the pace and pattern of urban sprawl and the loss of open space. In response, more than 110 state and county governments have instituted programs to preserve land as farmland. These programs include zoning rules and direct purchase of land, but by far the most important tool is the use of "conservation easements," which are permanent restrictions on land use, explained below. In designing these easement programs, each of the state and county programs takes a slightly different approach to such questions as who is eligible, how much the landowners will be paid (if such payments are part of the program), and what kinds of development will be allowed even when land is in "preserved" status, plus various administrative details. Because of the large number of choices for program design and the large amount of resources at stake, it is important to examine the performance of these program features.

This paper looks at the design and operation of the main program in Maryland, the Maryland Agricultural Land Preservation Fund (MALPF). We examine the features of the program in comparison to possible alternative designs. Our broader purpose is to examine the nature of farmland preservation and the implications for how to best design farmland preservation programs. This paper does not examine the question of whether, or to what extent, farmland preservation is a desirable social goal.

The MALPF pays agricultural landowners to put *conservation easements* on their land. An easement is a restriction to the property deed that proscribes almost all forms of development for the current and future owners of the parcel. A conservation easement is

the opposite of a *development right*, the right to develop the land: A farmer who accepts a conservation easement simultaneously relinquishes his development rights.

Farmers who want to participate – that is, want to have an easement placed on their property – and who meet the eligibility criteria submit bids to enroll their land. The bids are scaled (using a procedure described below) and the farms with the lowest bids, based on this scale, are accepted. The farmers are then paid the amount of their bids. The number of farmers accepted in any given round depends on the amount of funds available and the size of the bids. This type of competitive bidding is shared by other agricultural programs, notably the Conservation Reserve Program in its early years.

Bidding programs may be contrasted with "menu-based" programs in which a fixed payment is available, based on a parcel's specific characteristics; for example, $1500/acre for an easement on a 100 acre parcel near a major road with medium-quality agricultural land. In Maryland, most of the county-level programs are menu-based. (A third type of program might be called a "bargaining program," in which a likely parcel is identified and the landowner and conservator come to an agreement on the easement price. Most land conservancies operate this way but this approach is also used at times by state and county governments.)

Bidding programs induce competition among landowners to enter the program and this feature should then lead them to submit lower bids, which would then allow the state to preserve more farmland with a given amount of money than under either a menu-based or bargaining approach. During 1996-2000, MALPF had sufficient funds to purchase easements for 35 percent of the submitted bids. Program administrators have

claimed that competitive bidding has saved the program $91 million (MDA 2001), which could, in turn, be used to purchase easements on 51,896 additional acres.

In this paper, we analyze this program, with special attention to this competitive-bidding feature. Our main focus is empirical. Because there are many county-level characteristics (zoning rules and competing land preservation programs, among others) that are difficult to control for, we focus on a single Maryland county, Carroll. Our analysis is based on a comprehensive data set of bids (both accepted and rejected) and assessed land values; a landowner survey that includes both bidders and farmers who have never submitted a bid; and land parcel data for these observations.

We use an auction-theory model to guide the analysis. We also investigate two features that depart from standard models but which are nonetheless common in real-world programs: multiple enrolment rounds and the provision of information to farmers to help them prepare their bids. In the MALPF, bids are evaluated either yearly or every six months, and rejected bidders can reapply at later dates.

Questions Addressed

We address a series of questions that range from questions about specific administrative details to larger questions about farmland preservation programs.

Perhaps the most important issue is to determine the competitiveness of the program; that is, its success in using landowner competition to induce lower bids and, from the state's standpoint, to enroll a larger amount of land for a given availability of funds. We define this objective more rigorously below. As a practical matter, this goal entails addressing such questions as: Is there any evidence of collusion? (This is a

standard question asked of auctions.) Are there design changes that could make the bidding rounds more competitive? We identify program features that appear to be enhancing competition and, in those cases where the program appears to be falling short of its design goals, we suggest alternative designs.

MALPF and its supporters are also interested in whether the program is sufficiently focused on acquiring the "right" parcels. In this context, "right" means parcels that are large and/or contiguous, traits believed to be important for long-run viability of local agriculture. One answer to this question is obvious without any analysis: Of course the program is not adequately focused on these parcels, because it has no provisions aimed toward them. It is *not designed* to target these parcels. We examine the question of how the program, absent such targeting, is performing and also how such targeting might be introduced. We examine the types of properties that this program should attract. This is both a theoretical question, in terms of the design of the auction, and an empirical question, in terms of observed characteristics of accepted and rejected parcels. Such information is important because it allows state administrators to consider alternative designs that might attract different kinds of farms.

A third question is whether the state (or county) should conduct a costly land appraisal for landowners wishing to make bids. In the past, Carroll County (the main county we study) paid for an appraisal for all landowners submitting a bid.

II. Problems in Designing Farmland Preservation Programs

Farms and farm-owners can be characterized by two characteristics. These two characteristics are essential for understanding the land development decision.

Development value is the value of the right to develop land that is currently not developed. Suppose a given property that could be developed (under existing zoning laws) would sell for x per acre. Suppose that if the property were instead ineligible to be developed, now or ever (that is, as if it had an easement on it), and therefore must remain either in agriculture or general open space, would sell for y per acre. The difference $d = x - y$ is the parcel's development value, usually expressed on a per-acre basis. Thus, d is the market value of a development right; also, the market value of a conservation easement. Note that x must be greater than or equal to y because a landowner who had the option to develop his land could always choose not to exercise that option and continue farming.

Both x and y are subject to change over time. Since x and y represent "market" values, they are also subject to (i) uncertainty from the point of view of a landowner who perhaps is unfamiliar with the market; and (ii) a general (but not particularly interesting) randomness, since even in very thick markets a given parcel's value is not fixed but subject to bargaining and other real estate market variability.

The second characteristic is the farm-owner's desire to retain the land in an undeveloped state; that is, his *desire to keep farming*. We define this characteristic separately from the market value of the land in agriculture. That is, while a landowner will be more likely to keep the land in farming if the income from farming is higher (the parcel is high quality farmland), this second characteristic is meant to measure something different: the farmer's willingness to accept a development offer.

Denote this characteristic by θ. Let a higher value of θ represent a lower "desire" to keep farming and, conversely, a higher likelihood to sell the land to a developer.

A landowner's reservation value for a conservation easement is thus:

$$v(\theta, d, y) = \max[\theta x - y, 0]$$

Under this formulation, the higher is either x or θ, the higher is the required price to sell one's development rights; the higher is y, the lower will be the reservation price. This functional form is general enough to capture all of the important elements that affect the land preservation program. (We could define this value either as a function of $\{\theta, x, y\}$ or $\{\theta, d, y\}$. We chose the latter for the sake of exposition.)

When $\theta = 1$, we have $v(\theta, d, y) = x - y$; the farmer is willing to sell his development rights for exactly their market value. When $\theta < 1$, then the farmer is willing to sell his development rights for less than their market value. This farmer is "inclined" toward farming and values agriculture above its market value; therefore, he is more willing to relinquish the right to develop the property.

Note that $\theta > 1$ is possible; indeed, required by the model. If x represents the market value of a develop-able property, that market value must reflect the mix of landowners' willingness to allow their land to be developed. Thus, we must scale θ such that $\bar{\theta} = 1$, where $\bar{\theta}$ is the mean θ of landowners in the local market. This assumption requires some simplifying assumptions; for example, θ must be distributed independently of y. This assumption does not substantially affect the model's versatility.

The problem of preserving land with cheap development rights

In most competitive-bidding situations in which sellers compete to sell items to a buyer, the buyer wants to select the lowest bid. In land preservation this means

purchasing development rights from those landowners who offer them for the lowest amount. This strategy leads to an obvious problem, however: The cheapest development rights are for those parcels that are least likely to be developed. These are not necessarily the parcels that MALPF wants to enroll.

Alternatively, if MALPF were to select the parcels with the highest development rights (this strategy would require something other than soliciting of bids), it would overcome the problem of buying low-priority land, but its budget would be quickly exhausted. Parcels with high reservation values for their development rights are imminently likely to be developed, so acreage would truly be snatched from out of the jaws of development. But only one or two such expensive parcels could be purchased.

A successful land preservation program must be to balance these two forces.

MALPF and Bid-scaling

MALPF has introduced a clever innovation as a way of overcoming this problem. It conducts a bid-selection procedure that attempts to get the "biggest bang for the buck."

For each submitted bid, MALPF conducts an appraisal of the market value of the land, absent an easement. It also estimates what the value of the land would be if it were restricted to agricultural use. The difference between these two is the predicted easement value. Such a value, calculated in this way, implicitly includes both the value of the land for development and the likelihood that that parcel would actually be developed if no easement were in place. The second component is important because the state should be less willing to pay for a parcel that is less likely to be developed because these are parcels that would likely remain in agricultural use even without the program.

Under MALPF, each farmer's bid is divided by the parcel's predicted easement value. The ratios are then ranked for all bidders in a county in a given year. MALPF buys easements starting at the farm with the lowest ratio, then from the farm with the next lowest ratio, and continues until the year's funds are exhausted. This procedure enables the state to buy easements that are, presumably, the greatest bargains. This is a more elaborate scheme than a simple decision about whether a given parcel is "eligible."

In the context of the model, note that both x and y are observable by all interested parties, to a reasonable degree, because they are market values. They can be assessed; the amount of observable information pertaining to them is, almost by definition, the right amount of information. After a landowner submits a bid, his land is assessed for both x and y. Let d_a represent the assessed value. Let b represent a submitted bid for a parcel. Under MALPF, each bid is then scaled:

$$r = \frac{b}{d_a}$$

The scaled bids, r, are ranked from lowest to highest. The lowest bids are accepted into the program. A low scaled-bid represents land that is a "bargain" relative to its development potential. The ability to identify these bargains is precisely what bidding programs are designed to produce.

It is important to recognize, however, that bid-scaling is not perfect. It does not enable MALPF to prevent development as cheaply as if θ itself was observable. To understand the limitations of bid-scaling, we turn next to a more formal model.

Probability of Development

This section presents a more rigorous model of the land preservation problem. The model captures the intuition and ideas presented above; thus, it can be skipped by readers uninterested in the modeling problem. A contribution of this section is a more rigorous, explicit statement of what we think the MALPF's objectives are or should be.

Because x represents the value of land that can potentially be developed, it is itself a function of the probability that the land will become desirable for development. Thus, define x as:

$$x = y + \pi w$$

where w is the value of (marginal) developed land and π is the probability that the development fringe reaches this parcel. Note that π is parcel-specific, but w is not. This version of the model is static, but in general we would expect w and π to change over time. We return to this problem later.

III. Data

Further MALPF Design Details

MALPF also uses a pricing rule that is slightly different from a standard competitive-bid auction. Farmers who are accepted into the program are paid the amount of their bid (as in a first-price auction) so long as that bid is less than the calculated easement value. For any parcel whose bid exceeds the development value and that still has a low enough ratio to be funded that year, the farmer is paid the calculated development value.

Data

Carroll County has preserved 24,069 acres through MALPF, roughly one-quarter of its goal of 100,000 permanently preserved acres, which are believed to be needed to retain a viable agricultural sector. The average acreage per preserved parcel is 131 acres and the average price paid is $1,261/acre.

Data were collected from MALPF on parcel location, number of acres, submitted bids, easement prices paid, and year for transactions from 1978 to 1997. We matched observations with Maryland's Tax Assessment database. We also extracted a random sample of agricultural landowners from the tax data and conducted a survey.

Geographic coordinates of the parcel enabled us to access the Maryland Office of Planning's land-use and parcel characteristic maps. Through GIS we were able to determine the characteristics of each parcel. Parcel characteristics include soil type, current land-use, and the distances to Washington and Baltimore. Land-use was created from satellite images.

IV. Preliminary Analysis

Bid ratios ranged from 0.37 to 3.3 with an average of 1.076. Over 30 percent of bids fell between 0.90 and 1.10. Our main analysis will look at the relationship between the number of bidders, average bids, and parcel characteristics of accepted, rejected, and non-bidding parcels.

There are two likely scenarios that might occur when there are successive bidding rounds. (i) The state may buy the lowest ratio easements in the early years, then higher

ratio easements in later years. That is, the state may obtain the "best" bargains first (based on its stated criteria) and then get successively more expensive land over time. (ii) Farmer participation may be random; for example, the decision to enroll in the program fluctuates over time, even for a given farmer. In this case, there will be no trend in the ratios over time. The implications of these behaviors for program design have not been studied to our knowledge.

Analysis must also account for the result that a large proportion of bid ratios are close to 1. There are two alternative explanations for this outcome: (i) Insufficient competition allowed farmers to submit bids above their reservation values. Because there s no value to submitting a bid higher than the predicted easement value, bids in low-competition years would then cluster around 1. (ii) For many farms, predicted easement values were close to actual reservation easement values, yielding a bid ratio of 1 even when the enrolment auction is highly competitive. Our analysis focuses on distinguishing between these two hypotheses.

In the tables below, we present summary statistics from Lynch and Horowitz. These provide a preliminary basis for understanding MALPF.

Table 1. Summary Statistics for MALPF in Howard County

Purchase price per acre ($1987)	$1770
Total acreage purchased per farm	146
Ln(total acreage purchased per farm)	4.83
Proportion of farms with prime soil	0.63
Proportion of acres with prime soil	0.63

Proportion of farms with moderate soil	0.21
Proportion of acres with moderate soil	0.24
Proportion of farms with land in crops	0.79
Proportion of acres in crops	0.76
Proportion of farms with land in pasture	0.13
Proportion of acres in pasture	0.18
Proportion of farms that are forested	0.08
Proportion of acres in forest	0.05
Distance from DC	43,706
Distance from Baltimore	29,071
Distance from road	315
N (number of farms)	24

Table 2. Summary Statistics for MALPF in Calvert County

Purchase price per acre ($1990)	$2221
Total acres per purchased farm	145
Ln(total acres per purchased farm)	4.83
Proportion of farms with prime soil	0.43
Proportion of acres with prime soil	0.33
Proportion of farms with moderate soil	0.13
Proportion of acres with moderate soil	0.12
Proportion of farms with land in crops	0.43
Proportion of acres in crops	0.37

Proportion of farms with land in pasture	0.04
Proportion of acres in pasture	0.10
Proportion of farms that are forested	0.43
Proportion of acres in forest	0.37
Proportion of farms that are waterfront	0.26
Distance from DC	57,719
Distance from Baltimore	83,885
Distance from road	235
N (number of farms)	23

V. Preliminary Conclusions

Previous research has shown that MALPF has paid a lower price per acre for easements than the counties' menu-based programs. Economic evidence from a broad range of studies shows that programs can purchase most inexpensively by having farmers compete to enter the program, as in the MALPF and in other programs such as the CRP. Critics say however that these programs only get "fire-sales" – landowners in a financial crisis that need an influx of cash – or parcels that do not contribute substantially to the continuing economic viability of the agricultural industry in the state. While fire sales may be unavoidable, several of the programs including MALPF have attempted to "adjust" the bids to account for characteristics valued by the program. Minimum criteria have been established to ensure that working farms rather than hobby farms have a higher probability of enrolling.

Previous research has also shown that MALPF has preserved larger parcels than the menu-based programs. MALPF sets a minimum of 100 acres and appears to have

strictly abided by this criterion. Since larger parcels have lower development value per acre, these growers may have bid lower than farmers with smaller parcels. The Calvert County program set the same criteria as MALPF but has not been as successful in preserving large parcels. Further analysis is needed to determine why this has occurred.

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