Invited Presentation

The Optimal Quantity of Land in Agriculture: Discussion

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Over the last several decades, the Northeast region of the United States has experienced considerable population and economic growth resulting in increased development pressures. This has created a situation of growing demand for land resources leading, in part, to the use of agricultural land for urban and suburban development. Farmland conversion has occurred throughout the Northeast and, in response, several states have developed programs to help preserve farmland. The primary goal of these programs has been to curb the loss of agricultural land through various land use control mechanisms such as deed restrictions, zoning, preferential tax policies, outright purchase by the state or purchase of development rights programs. One of the problems, as the author points out in his introduction, is that we as economists, in addressing these issues, tend to focus on preserving or saving farmland and not on how much to preserve or what we get for its preservation. The paper just presented focuses on this problem by developing a simple, yet rather clever, model which reveals the optimal quantity of land in agriculture. The paper also provides a useful examination of some important problems inherent in analyzing the decline in agricultural land, especially in the Northeast.

At the outset, prior to developing the model, the author makes a number of key points on agricultural land use and preservation in general with which I agree. The first of these important points is that in researching the question: What is (or should be) the optimal quantity of land in agriculture?; economists often suggest that it is too great because of the existence of negative externalities from cultivation, such as groundwater pollution, and because of subsidies from farm support programs. Yet there are other benefits which do exist and which are recognized as important and of value. These may include benefits derived from open space, for example, and may in fact partially offset any accrued negative externalitites. All of these should be incorporated in determining optimal land in agriculture.

The second key point is that, although it yields a flow of benefits in addition to those accruing from agricultural production, the preservation of agricultural land in and of itself is not without costs, besides the obvious costs of purchasing land or its development rights. A major cost to society is that farmland so preserved, by whatever method, is not available for development, hence the supply of developable land is restricted, and this may well contribute to higher prices paid for residential and commercial land.

A third important point is that although the introduction of nonmarket benefits into the debate about preserving farmland is critical, it must be understood that agricultural land preservation is not a perfect; or even nearly perfect, substitute for the placing of land in the domain of public open space. Although a category of nonmarket benefits from agricultural land preservation does exist in theory, and is positive in reality, such benefits only amount to a subset of total benefits accruing from open space when the public owns the land outright.

Having made these points, the author begins the presentation of model development by stating that the question of preserving farmland is quantitative in nature and entails answering the following question: What is the optimal quantity of farmland? He then develops a model of optimal land use which addresses this question. The model, as it is presented, utilizes an optimization framework to develop conditions for maximizing social returns to land in its different uses, assumed here to be of three types: agricultural, park and public, and urban. Marginal social return

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to farmland use is defined as approximately equal to the value of the marginal product of an acre of production adjusted for any external effects accruing from production or commodity programs. The marginal social return to park and public land is the willingness to pay for the services of land as a public natural resource, and the return to urban land use is the total willingness to pay for such use approximated by the rental values of built-up land.

The optimization is performed subject to the constraint on the total availability of land. The model does not solve for the optimal amounts to be allocated to each use per se because no functional forms are given, but rather, results in the derivation of formulas which allow for observations on optimal land use rates of change. When time is incorportated into the model, differentiating the maximum conditions with respect to t yields arithmetic growths in social marginal products of land use, which can be used to derive the percent growth rates in social marginal values of the different land uses. The system is then solved for the growth in land use and then for land use growth rates for each of the three types of use. Formulas for the latter are rather complex and utilize the following three sets of parameters as major components: the relative proportions of land in different uses, the elasticities of the marginal social value functions, and the growth rates in the marginal social values. The model is then illustrated with a simple numerical example for the State of Maryland, assuming values for the three sets of parameters mentioned above. The results show the optimal rate of change in agricultural land to be negative in all cases under a variety of assumed values for key parameters. Although the parameter values are not based on real numbers, they seem to be reasonable and yield plausible results.

In his paper the author states early on that he is attempting to force the debate on the preservation of farmland into the framework of a simple model of optimal land use. However, the model does not explicitly incorporate a mechanism for answering the question of whether or not land should be preserved. One can only assume that, if model results reveal the optimal rate of change in agricultural land is negative, then no land should be preserved. The result of the modeling exercise as I see it is to provide some insight into the determinants of optimal rates of change in farmland, and not to ascertain whether or not land should be preserved.

Given the model and its set of assumptions, a positive growth rate for agricultural land in the Maryland example would be highly unlikely under any reasonable set of circumstances. Since optimal growth is then negative, the author uses this as a basis for stating that there may be more efficient ways to use money spent on saving farmland. I have difficulty with such a statement. I am basically in favor of agricultural land preservation programs for a number of reasons, a few of which are the following. Although the optimal rate of growth in agricultural land may be negative, the existence of such programs may prevent farmland in the aggregate from disappearing too quickly or in other words, may help prevent a negative growth rate which is greater, in the absolute sense, that the optimal. Secondly, it may also aid in preventing the removal from agriculture and subsequent development of acreage which may be considered a uniquely valuable resource based on a particular soil type, topography, or location, for example. Furthermore, the above statement is based on defining the marginal social return to farmland use as the value of the marginal product of an acre in production, adjusted for externalities associated with production and the existence of commodity programs. If the definition of the marginal social return to farmland is revised to incorporate marginal social benefits from open space or nonmarket benefits, then the optimal solution may call for less of a reduction of land in agriculture, and some form of government intervention, such as a PDR program or outright purchase, might be required to achieve such a result.

One problem with the paper, as I see it, is that it fails to establish a link between the model and its use in policy formulation. Early in the paper the author states that the model was formulated in the static framework to help understand the impact of various public policies on optimal land use. It would have been helpful if he had explicity provided an illustration or two of this use. While this paper is very helpful in illustrating, in much technical detail, the problems surrounding determining optimal land use patterns, it could be enhanced by further discussion of relevant policy issues and appropriate policy instruments for achieving desired results.

The paper ends by citing a number of limitations of and conclusions from the analysis,

which point to areas where future work is needed. The focus here is on the need for additional research on the role of nonmarket valuation in measuring the costs and benefits of externalities associated with agricultural land preservation. The author's concluding remarks offer important suggestions for future research.