



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Effectiveness of Use-value Assessment in Preserving Farmland: A Search-theoretic Approach

Edmund M. Tavernier and Farong Li*

Abstract

Search theory is used to present a theoretically defensible model to examine the effectiveness of use value assessment (UVA) in preserving farmland. The model is empirically tractable and supports the findings of past research. The analysis considers the impact of farm income, uncertainty, and the distribution of the offer price on the effectiveness of UVA in preserving farmland and shows, through the effect on the reservation price, that for a given distribution of the offer price, property-tax rate, and the difference between market-value and use-value of land, the preservation of agricultural land only takes place within a relevant range.

Key Words: farmland preservation, offer price, reservation price, search theory, uncertainty, use-value assessment

Introduction

Among the many farmland preservation policies, use-value assessment is perhaps the most controversial. The policy assesses agricultural land according to its productive use, rather than its highest and best use at fair market value thereby reducing the tax carrying cost of undeveloped land and is especially important to marginal farmers and farmers operating at the urban fringe where property taxes are likely to be high. However, the effectiveness of the policy has been questioned. Nelson (1992) argues that use-value assessment leads to speculation in, rather than the preservation of farmland.

Research on the effectiveness of use-value assessment has been mainly empirical and has shown mixed results. Ferguson (1988) provides an empirical test of the effectiveness of use-valuation in delaying the development of agricultural land and

finds that for three of four Virginia counties investigated, use-value assessment had no effect on delaying development. Lopez, Adelaja and Andrews (1988) argue that the capacity of property tax relief policies to offset the conversion of land from agricultural to nonagricultural uses is limited. It is also argued that use-value assessment, leads to the capitalization of farmland (Nelson, 1990; Beaton, 1991; Henneberry and Barrows, 1990), and in combination with agricultural zoning, simply delays the "impermanence syndrome," a phenomenon which discourages infrastructural investments and decreases agricultural productivity (Fuller and Mage, 1975).

From a theoretical point of view, the effectiveness of use-value assessment in delaying development has been studied using models of development timing (Anderson, 1993). Anderson follows in the tradition of Rose (1973), and assumes the farmer is also the property owner after

*Edmund M. Tavernier is an assistant professor in the Department of Agricultural Economics and Marketing, Rutgers University and Farong Li is a statistician at Johnson and Johnson, Health Care Systems Inc., New Brunswick, New Jersey. The authors wish to thank anonymous journal reviewers for their helpful comments and suggestions.

development, decides the time of development and has perfect information about the current and future income streams. In reality, farmers often sell their land to developers who are motivated by the potential for profit of the development of the land. Hence the decision to sell is not a static one shot problem, but a dynamic process which involves waiting and search elements. And because searching involves the acquisition of information, uncertainty also plays important role in this decision making process. Anderson's optimal control approach does not explicitly deal with uncertainty and does not yield empirically tractable results. The absence of a theoretical framework to test the empirical validity of the studies cited above, and the deficiencies of the optimal control approach argues for a comprehensive and theoretically defensible framework to explain farmer behavior within the context of farmland preservation policy.

In the next section, a simple search-theoretic model of the land market is developed by modeling the decision making problem of farmers as a sequential search process. From the search model, a reservation price, the minimum price a farmer will accept to sell his land, and an important determinant of farmland preservation, is derived. In section three, the impact of use-value assessment on the reservation price is examined, and the waiting period before land conversion takes place is illustrated. Further, for a given distribution of the offer price, factors that affect the effectiveness of use-value assessment on farmland preservation are identified. In section four, the important role that the distribution of offer price plays in the effectiveness of use-value assessment is examined. The impact of uncertainty on the effectiveness of farmland preservation is also examined using the concept of mean-preserving spread. A numerical example is provided in section five. The paper concludes with a brief summary in section six.

A Search Model

Search models have their roots in labor economics and have been used extensively by economists since the 1970's to investigate the housing market and job search activities, among others, but have not, to our knowledge, been applied to the landmarket. The many parallels between labor and land markets appear to make search

theory an appropriate tool to apply to the land market where sellers engage in a sequential search process (See Stigler, 1961; McCall, 1970). For example, workers willing to sell their labor like landowners looking to sell their land typically do not know the full range of opportunities available. In the case of workers, what vacancies exist in what fields and at what wages is typically not fully known. For landowners, how many, and what type of buyers exist and what they are willing to pay for land is generally not known. In neither case is complete information available when a transaction is made. It is also clear that in both cases time and resources have to be committed to obtaining information involving the various transactions. Moreover, the approach has proven very useful in analyzing the market for heterogeneous goods (see Lippman and McCall, 1976 for a review) though it has not been applied to the valuation of private property.¹

In this section, following Sargent (1987), a simple supply-side model is developed to illustrate the formation of the seller's reservation price. The reservation price is then used to analyze the effectiveness of use-value assessment in preserving farmland.

Suppose a farmer owns a parcel of land, size A , with attributes x , $x \in X$. For the purpose of this model assume $A = 1$, the normalized unit of the land.² The farmer obtains income, y_t from the land at time t . Hence a risk neutral farmer maximizes the present discounted expected income,

$$E \sum_{t=0}^{\infty} \beta^t y_t \quad (1)$$

where E is the expectation operator, β is the discount factor which equals $1/(1+r)$, r is the discount rate. Suppose further, that the farmer has the potential to sell the land. He gets an offer price p from the buyer. This means that he can obtain income y_t from one of two sources, farming or the sale of land. If he sells his land at time t , he gets price (one time income) p and stops the search process. Otherwise, he keeps on farming and continues his search activities. If the farmer continues farming he receives farm income z in the current period and waits to draw another offer in the next period. If $z < 0$, then the farmer is losing

money from farming. The variable, z , is determined exogenously and is subjected to the influences of agricultural product markets, government agricultural policies, as well as local property tax policies.

Define the offer price, p , as a nonnegative random variable with a cumulative probability distribution function $F(P/x)$ by,

$$F(P/x) = \text{prob}\{p \leq P | x \in X\} \quad (2)$$

The farmer does not observe all p , but the distribution, $F(P)$.³ The offer price p at time t is randomly drawn from that distribution. Clearly, F is the information provided by buyers, which itself might be the result of a search effort.⁴ For now, assume that the distribution, $F(P)$, is given for a particular parcel of land.

Because of the sequential nature of the search process, dynamic programming provides a convenient approach to model this problem. Let $v(p)$ denote the value of the expected discounted income of a farmer with offer p , deciding whether to accept or to reject the offer. Without recall, the Bellman's functional equation can be expressed as,

$$v(p) = \max\{p, z + \beta \int_0^\infty v(p') dF(p')\} \quad (3)$$

where the maximization is over two actions, (1) to accept offer p , or (2) to reject the offer and continue to receive z this period and draw a new offer p' from distribution of F in the next period. The value function $v(p)$ has the following form,

$$v(p) = \begin{cases} p & \text{if } p \geq s \\ z + \beta \int_0^\infty v(p') dF(p') & \text{if } p < s \end{cases} \quad (4)$$

where s is the reservation price of farmer. The above equation says that if the offer price is greater than or equal to the reservation price, the farmer will accept the offer, otherwise he continues his waiting (search) activities. Hence, once land is on the market, it follows that there exists an offer price which equates the value of continued search activities and the value of selling the land. That value, which is the reservation price that equates the

offer price, is obtained by converting equation (4), evaluated at $p=s$, into an ordinary equation. More formally,

$$\begin{aligned} s &= z + \beta \int_0^\infty v(p') dF(p') \\ &= z + \beta \int_0^s s dF(p') + \beta \int_s^\infty p' dF(p') \end{aligned} \quad (5)$$

After some tedious manipulation,⁵ we arrive at,

$$s - z = \beta E p + \beta \int_0^s F(p') dp' \quad (6)$$

Equation (6) has a unique solution.⁶ The left side of the equation is the cost of waiting one more period when an offer p is made. The right side represents the expected benefit from searching in terms of the expected present value associated with drawing $p' > s$. Equation (6) also enables the farmer to set s such that the cost of searching in one more period equals the benefit from waiting.

Use-Value Assessment and Farmland Preservation

In this section the effectiveness of use-value assessment in preserving farmland is examined along with the various factors which affect the effectiveness of a given distribution of the offer price. Implications for farmland preservation are provided.

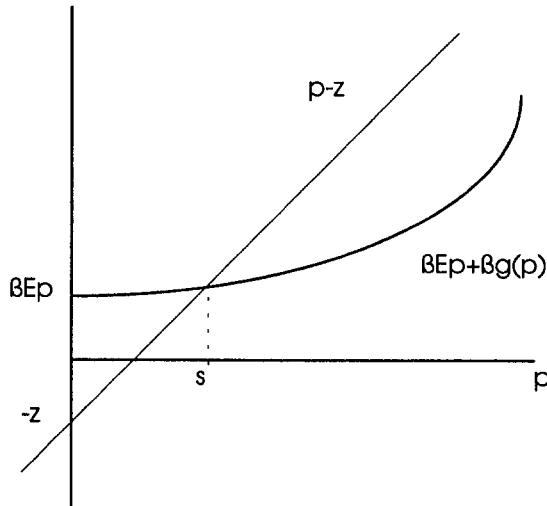
For convenience, let

$$g(s) = \int_0^s F(p') dp' \quad (7)$$

Note that, $g(0) = 0$, $g'(s) = F(s) > 0$, and $g''(s) = F'(s) > 0$. Hence equation (6) becomes,

$$s - z = \beta E p + \beta g(s) \quad (8)$$

Using the properties of the function $g(s)$, the solution to equation (8) is given graphically in figure 1. The left hand side of equation (8) represents the straight line which crosses the vertical axis at $(-z)$. The convex curve represents the right hand side of equation (8) and crosses the vertical axis at $\beta E p$. The unique solution is the point of

Figure 1. Determinants of the Reservation Price in the Search Model

intersection of the two curves; this gives the reservation price, s .

From Figure 1, notice that as farm income, z increases, the reservation price, s , also increases. This is illustrated as a shift of straight line to the right, all other things held constant. If z is negative, then the farm is losing money and could be interpreted as the opportunity cost of not selling given the current offer price. Increases in the opportunity cost, or decreases in farm income, z , make it difficult for the farmer to seek a higher price, because search costs are increased, causing s to decrease. These factors do not mean the immediate conversion of farmland because that also depends on the distribution of the offer price which has to be considered in determining the final impact on farmland preservation. The model does suggest that a reservation price lower than the offer price increases the chances that farmland will be sold at the current offer price or vice-versa.

Following the definition of $F(P)$, let $F(s)$ be the probability of offer prices lower than the reservation price.⁷ The search model suggests that the farmer rejects an offer with probability $F(s)$ and searches for another offer in the next period. Thus, the probability that farmer accepts an offer in period n is $(1-F(s))(F(s))^{n-1}$. This follows a geometric distribution giving a mean waiting period of,

$$T = 1/(1-F(s)) \quad (9)$$

Equation (9) says that the amount of time land remains in farming before it is sold equals the reciprocal of the probability of an accepted offer on a single trial. Note that any increase in s , increases T and delays the sale of farmland. Hence, for a given F , the mean waiting period, T , before land is sold, is a monotonically increasing function of the reservation price, s , and can be used as a measure of the impact of public policies on farmland preservation.

The above result suggests that any policy which increases z directly or indirectly also increases s and delays the sale of land, a condition which enables land to remain in agriculture for longer periods and provides temporary relief from the pressure of urban development. In the case of use-value assessment, because the tax burden of farmers is reduced, current farm income is increased, leading to a positive impact on the farmland preservation. This impact is further demonstrated below.

Let,

$$z = q - \tau v \quad (10)$$

where q is the pre-tax net farm income, τ is the property tax rate and v is the land value. Recall that use-value assessment taxes land according to its agricultural-use value rather than its market value.

Define the agricultural-use and market values by v_1 and v , respectively, where $v_1 < v$.

The arguments presented above suggest that the reservation price s_1 of v_1 land enrolled in a program which utilizes use-value assessment will be higher than the reservation price, s , of market value land, v , which is not use-value assessed. Further, given the same environment, the "holding cost" of v_1 land is much less than v -type land because use-value assessment decreases search costs. As a result farmers can seek higher land prices which lead to the capitalization of land values. Using equations (8) and (10), the capitalization effect can be expressed as,

$$s_1 - s = \tau(v - v_1) + \beta \int_s^{s_1} F(p) dp \quad (11)$$

where s is the reservation price of v -type land. Clearly, $s_1 - s > 0$.

A second effect is also implied by equation (9). For a given distribution of $F(P)$, use-value assessment results in the preservation of farmland. Using Lagrange's mean value theorem and equation (9), the land preservation effect can be expressed as,

$$T_1 - T = (s_1 - s) \frac{f(t)}{(1 - F(t))^2}, \quad t \in (s, s_1) \quad (12)$$

$T_1 - T$ represents the increase in the mean waiting period resulting from the use-value assessment program; $T_1 - T > 0$. A larger value in equation (12) implies a more effective current farmland preservation program. Note, however, that this value is a function of both the change in the reservation price and the value of $F(t)$. Also note that for a given distribution of offer price, two factors are important in determining the effectiveness of use-value assessment in preserving farmland. These factors are, (i) the property tax rate, t , and (ii) the difference between market value and use value of land, $v - v_1$. Anderson (1993) also shows that both factors have a positive impact on the effectiveness of use-value assessment. However, our analysis suggests that this is true only within some range, and implies that the effectiveness of use-value assessment in preserving farmland is not constant.

From equation (11), higher property tax rates in combination with use-value assessment leads to an increase in the difference between reservation prices, s and s_1 . However, higher property tax rates alone result in lower reservation prices and have a negative effect on farmland preservation. As a result of decreases in reservation prices, $f(t)$ which follows the distribution of $F(P)$, also decreases. Hence we conclude that higher property tax rates increase the effectiveness of use-value assessment only if the increase in $(s_1 - s)$ offsets the decrease in $f(t)$.

A similar argument holds in examining the effectiveness of use-value assessment on farmland preservation, when there exists divergence between the market value and use-value of farmland. As this difference increases, farmers realize greater property tax relief. According to the analysis from the search model, this results in increased farm income and reduces the pressure to convert land to more profitable ventures in development (preservation effect). However, even with use-value assessment, because the difference between market value and use-value of farmland is often due to a high market value, the high market price itself will lead to higher property taxes which will depress farm income.⁸ That factor has a moderating effect on the reservation price and $f(t)$ [equation (12)]. In the final analysis the effectiveness of use-value assessment in preserving farmland becomes an empirical issue.

Offer Price and Farmland Preservation

Section 3 examined the impact of property tax rates and the difference between market value and use-value assessed land on the effectiveness of use-value assessment for a given offer price. This section, analyzes the impact of factors that affect the distribution of the offer price and the implications for farmland preservation. The analysis assumes that farmers are risk neutral and observe only the distribution of the offer price and not the true offer price, creating a risky decision-making environment. Rothschild and Stiglitz (1970) argue that an increase in $g(s)$ [in equation (8)] without a corresponding change in Ep results in a mean-preserving increase in spread.

Recall that, $g(0) = 0$, $g'(s) = F(s) > 0$, and $g''(s) = F'(s) > 0$. Hence from equation (8), an increase in the mean-preserving spread increases the chance of a high future offer (shift of the convex curve to the right in figure 1, holding all other things constant). This increase in spread induces farmers to increase their reservation price, contrary to traditional risk analysis, and suggests that volatility in the buyer's market can result in a higher reservation price and a longer waiting period before land is sold. Equation (8) also, suggests that an increase in the mean offer price increases the reservation price. However, the final impact of the change in the distribution of the offer price on the land preservation is undetermined.

To see this, define the distribution of offer price as $F(p, x)$. The impact of a change in parameter x , on the mean waiting period, T [using equations (8) and (9)] is given by,⁹

$$\begin{aligned} \frac{dT}{dx} &\propto \frac{dF}{dx} = \frac{\partial F}{\partial x} \frac{\partial F}{\partial s} \left[\frac{\partial S}{\partial E} \frac{dE}{dx} + \frac{\partial s}{\partial g} \frac{dg}{dx} \right] \\ &= \frac{\partial F}{\partial x} + \beta \frac{\partial F}{\partial s} \left[\frac{dE}{dx} + \frac{dg}{dx} \right] \end{aligned} \quad (13)$$

The effect on land preservation depends on the sign and magnitude of these derivatives and the value of β . An increase in the value of x has positive impact on land preservation only if,

$$\beta > - \frac{\partial F}{\partial x} / \frac{\partial F}{\partial s} \left[\frac{dE}{dx} + \frac{dg}{dx} \right] \quad (14)$$

or,

$$\beta < -1 - \frac{\frac{\partial F}{\partial s} \left[\frac{dE}{dx} + \frac{dg}{dx} \right]}{\frac{\partial F}{\partial x}} \quad (15)$$

Equations (14) and (15) suggest that farmland is preserved only if the impact of factor x on the distribution of the offer price is dominated by the impact of the reservation price. This impact of factor x on the effectiveness of use-value assessment can be derived by combining the results of equation (12), (14) and (15) although the overall

preservation effect is ambiguous and therefore an empirical question.

Numerical Example

The arguments put forward in the paper show that use-value assessment has both preservation and capitalization effects. However, the effectiveness of the policy under different conditions is far from clear. In this section, to illustrate and clarify the analytical results and examine their implications for land preservation, a numerical example is provided. Table 1 provides the value of the parameters used in the simulation. The data are taken from the 1992 New Jersey Agricultural Statistical Annual Report. The current average land value is used as a proxy for E_p , the mean of the offer price. The variable σ_p is the standard deviation of the offer price, taken as 5% of the mean. The variable z , is the current average net farm income per acre. The property tax rate is assumed to be 1% and the discount factor, 95% reflects a discount rate of approximately 5%. Agricultural-use value is taken as 20% of the market value of land. Finally, the distribution of the offer price is assumed to be truncated normal above zero.

The first experiment simulates the response of reservation price and mean waiting period to different property tax rates with use-value assessment. The results for reservation prices at different tax levels are reported in Table 2. Recall that the search model suggests, that because use-value assessment taxes land at its agricultural use instead of its market value or development potential, both farm income and the reservation price increase. With use-value assessment and a tax rate of 1%, the reservation price increases from \$5099.3 to \$5236.9. At all tax levels, the reservation price without use-value assessment is less than the reservation price with use-value assessment as predicted by the theoretical model. Also note that as the tax rate increases, the difference between land that is use-value assessed and land that is not, increases.

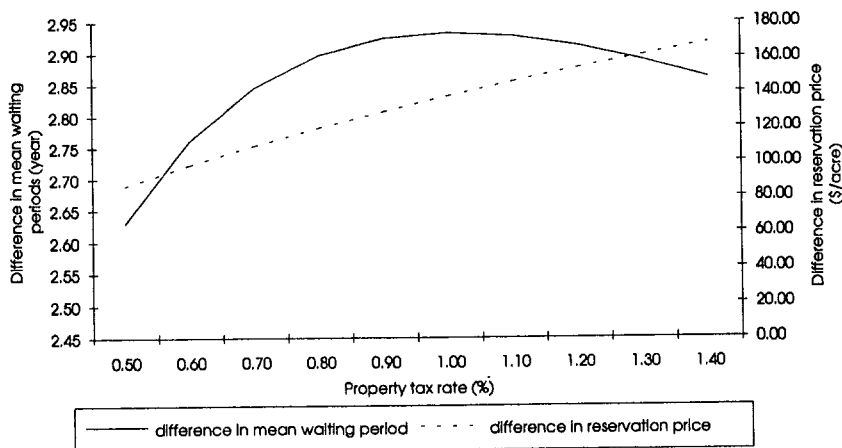
Figure 2 shows the relationship between the property tax rate, and differences in the mean waiting period and reservation price. The concave pattern indicates that the effectiveness of use-value assessment in preserving farmland decreases after

Table 1. Parameter Values Used in Simulation

variable	value
E_p	\$5000 /acre
σ_p	\$250 /acre
z	\$250 /acre
tax rate	1%
β	0.95

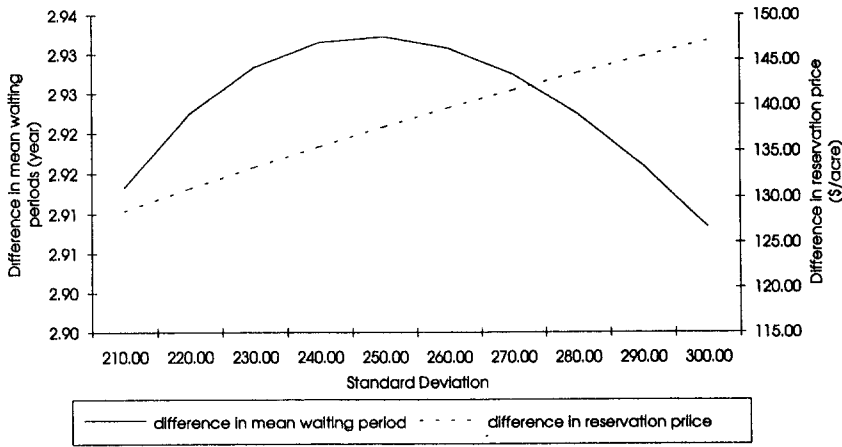
Table 2. Impact of Tax rate on Reservation Price

tax rate %	reservation price (\$/acre)		
	without use-value	with use-value assessment	difference
0.5	5175.661	5261.715	86.0547
0.6	5158.389	5256.522	98.1325
0.7	5142.270	5251.449	109.1783
0.8	5127.134	5246.491	119.3568
0.9	5112.845	5241.643	128.7984
1.0	5099.292	5236.900	137.6080
1.1	5086.386	5232.257	145.8709
1.2	5074.053	5227.709	153.6559
1.3	5062.232	5223.252	161.0204
1.4	5050.868	5218.882	168.0142

Figure 2. Property-tax Rate and the Effectiveness of Use-value Assessment

some critical value and is therefore not constant as implied by Anderson. This observation also implies that an optimal tax rate which corresponds to the preservation effect and reservation price impacts may be estimated empirically. However, in order to calculate the "true optimal tax rate" and find its relationship to the length of time land is preserved and the difference in reservation prices, would require modeling the government's decision-making problem as part of in the search-theoretic framework.

The results of the next experiment are illustrated in figure 3. The experiment investigates the response of the reservation price and mean waiting period to different levels of uncertainty under use-value assessment. As risk associated with the offer price increases, the difference in the reservation price also increases. However, the difference in mean waiting period first increases then decreases with increased risk which means that the effectiveness of use-value assessment varies at different risk levels in the offer price.

Figure 3. Effect of Uncertainty on Mean Waiting Period and Reservation Price

Conclusion

This paper applies search theory to the land market in order to examine the effectiveness of use-value assessment and explain the behavior of farmers towards farmland preservation. The theoretical framework developed fills a gap in the literature and is empirically tractable.

The analysis identifies farm income, uncertainty and the distribution of the offer price, as important factors affecting the effectiveness of use-value assessment. The results show that any policy which increases farm income directly or indirectly, and increased volatility in the buyer's market, increase the reservation price of farmers and leads

to the capitalization of land values and the preservation of farmland. The extent to which land values are capitalized and farmland preserved are explicitly defined by the model.

The simple framework presented here assumes that the offer distribution is constant and that the farmer's horizon is infinite, leading to the conclusion that a reservation price approach is optimal when the offer distribution is known. An interesting question for further research is the examination of the consequences when those assumptions are relaxed to allow for an unknown offer distribution and the possibility of having different reservation prices in each period.

Reference

- Anderson, J.E. "Use-value Property Tax Assessment: Effect on Land Development", *Land Economics* 69(1993):263-269.
- Beaton, W.P. "The Impact of Regional Land-use Controls on Property Values: The Case of the New Jersey Pinelands," *Land Economics* 67(1991):172-194.
- Bellman, R. *Dynamic Programming*, Princeton, N.J.:Princeton University Press, 1957.
- Ferguson, J.T. "Evaluation the Effectiveness of Use-value Programs." *Property Tax Journal*, 7(1988):157-165.
- Fuller, A.M. and J.A. Mage, Part-time farming, Proceedings of the First Rural Geography Symposium, Ontario: University of Guelph, 1975.

- Kim, S. "Search, Hedonic Prices and Housing Demand," *The Review of Economics and Statistics* 74(1992):503-508.
- King, D.A. and J.A. Sinden. "Price Formation in Farmland Market," *Land Economics* 70(1994):38-52.
- Lippman, S.A. and J.J. McCall. "The Economics of Job Search: A Survey," *Economic Inquiry* 14(1976):347-368.
- Lopez, R.A., A.O. Adelaja, and M. S. Andrews. "The Effects of Suburbanization on Agriculture," *American Journal of Agricultural Economics* 70(1988):346-358.
- McCall, J.J. "Economics of Information and Job Search," *Quarterly Journal of Economics* 84(1970):113-126.
- Nelson, A.C. "Preserving Prime Farmland in the Face of Urbanization," *Journal of the American Planning Association* 58(1992):477-488.
- , "Economic Critique of Prime Farmland Preservation Policies in the United States," *Journal of Rural Studies* 6(1990):114-142.
- New Jersey Department of Agriculture. *New Jersey Agricultural Statistics 1992*, Trenton, New Jersey.
- Rose, L.A. "The Development Value Tax," *Urban Studies* 10(1973):271-275.
- Rothschild, M. and J. Stiglitz. "Increasing Risk I: A Definition," *Journal of Economic Theory* 2(1970):225-243.
- Sargent, T.J. *Dynamic Macroeconomic Theory*, Cambridge: Harvard University Press, 1987.
- Stigler, G.J., "The Economics of Information," *Journal of Political Economics* 69(1961):213-225.
- Tavernier, E.M. and F. Li *Information and the Formation of the Offer Price in the Farmland Market*, Mimeo, Dept. of Agricultural Economics and Marketing, Cook College, Rutgers University, 1994.

Endnotes

1. King and Sinden (1994) incorporates search and bargain elements in an empirical model.
2. The fact that much farmland is rented does not affect the analysis because only land owners can sell land.
3. To simplify the notation, $F(p)$ is used instead of $F(p/x)$. We assume $F(0) = 0$, $F(\infty) = 1$ and F is a nondecreasing function, continuous from the right. We also assume F is bounded from above, i.e., there is a upper bound $B < \infty$ s.t., $F(B) = 1$.
4. It could be the case that F is also determined endogenously if sellers actively engage in influencing the offer price. However, the analysis is based on the decision to accept or reject an offer and not search intensity.

5.

$$\begin{aligned}
 s &= z + \beta \int_0^s s dF(p') + \beta \int_s^\infty p' dF(p') \\
 &= z + \beta \int_0^s s dF(p') - \beta \int_0^s p' dF(p') + \beta \int_0^s p' dF(p') + \beta \int_0^\infty p' dF(p') \\
 &= z + \beta \int_0^s (s - p') dF(p') + \beta \int_0^\infty p' dF(p') = z + \beta E(p) + \beta \int_0^s (s - p') dF(p') \\
 &= z + \beta E(p) + \beta \int_0^s F(p') dp'
 \end{aligned}$$

6. For proof that the above problem satisfies Blackwell's sufficient condition for a contraction mapping, see Sargent (1987).

7. Recall that sale of farmland occurs only if the offer price is higher than reservation price. Hence, the transaction price of farmland that one observes is truncated by the reservation price (see Kim, 1989). The implication for empirical analysis is explored by Tavernier and Li (1994).

8. New Jersey is a prime example. Even with differential property tax assessment, the state ranks second in terms of taxes per acre on farm real estate. Land values in New Jersey also rank second in the nation. Also in a recent farm survey, 50% of the respondents said that they were losing money in farming.

9. The "proportional to" sign is used because we omitted $1/(1 - F(s))^2$. Note that $\partial T/\partial x = \partial(1/(1 - F(s)))/\partial x = \partial F(s)/\partial x \cdot 1/(1 - F(s))^2$. Only the sign of the derivative in equation (13) is of interest.