Tenancy and Soil Conservation in Market Equilibrium

Erik Lichtenberg
Department of Agricultural and Resource Economics
University of Maryland
College Park, Maryland

Presented at the annual meeting of the American Agricultural Economics Association, Chicago, IL August 5-8, 2001.

Tenancy and Soil Conservation in Market Equilibrium

The question of whether tenancy influences soil conservation decisions is, as Soule, Tegene, and Wiebe have noted, one of the classic questions of economics. It is well established in the theoretical literature that farmland owners tend to have strong incentives to conserve soil as a means of protecting the value of their land over the long run. It is equally well established that renters tend to have insufficiently strong incentives for conserving soil adequately. Renters have use of a plot of land only temporarily, and thus concern themselves with investment in maintaining productivity only over the expected life of the rental contract (including anticipated renewals). Moreover, since more erosive farming methods are frequently more profitable in the short run, renters typically have incentives to disinvest in soil, that is, mine soils excessively (see for example McConnell).

The empirical literature on adoption of soil conservation measures has produced ambiguous results regarding the influence of tenancy. Some studies have found weak evidence indicating less soil conservation on rental land. Norris and Batie found a weak negative correlation between rented land's share of total acreage operated and Virginia farmers' conservation expenditures. Lynne, Shonkwiler, and Rola found that Florida owner/renters used a larger number of conservation practices than either pure renters or pure owner-operators. Featherstone and Goodwin found a negative correlation between the proportion of cropland rented and Kansas farmers' conservation expenditures. In contrast, neither Norris and Batie nor Rahm and Huffman found a significant correlation between tenancy and the adoption of conservation tillage while Lee and Stewart found that owner-operators were less likely than renters to adopt conservation tillage.

One possible explanation of these contradictory results is that these studies fail to distinguish between types of rental contracts. Soule, Tegene, and Wiebe have argued that tenants renting land under share contracts have different incentives than those paying cash rent. They show that share renters, like owner-operators, are more likely to find it profitable to adopt conservation measures with short term payoffs (e.g., conservation tillage) than cash renters. Conservation measures with medium term payoffs are unambiguously less profitable for cash renters than owner-operators, but the same cannot necessarily be said for share renters. Using data from U.S. corn producers, they find that cash renters are less likely to use conservation tillage and medium term conservation measures than owner operators. Share renters are as likely to use conservation tillage as owner operators but less likely to use medium term conservation measures.

Most of these discussions of the relationship between tenancy and soil conservation are partial in nature, considering the problem only from the perspective of one of the agents involved (usually the tenant). In actuality, both agents interact in determining stipulations of rental agreements. Thus, if landowners could monitor renters' farming methods costlessly, they could write and enforce rental contracts that would require renters to conserve soil optimally. If monitoring and enforcement are excessively costly, as seems likely (monitoring renters' farming methods could virtually require continuous presence on the farm, while enforcing such contract terms would likely require expensive legal action), it might be still possible to write rental contracts in ways that mitigate incentives for overexploitation of soils. For example, Allen and Lueck have shown that, in some circumstances, share rental agreements may mitigate tenants' incentives to overexploit soils by reducing the value of the marginal product of soil (in the form of erosion or degradation of soil quality). Empirically, they find that share contracts are more likely in the Northern Plains in situations in which tenants have greater ability to exploit soil.

Landowners have another way to enforce adequate levels of soil conservation: They can invest in soil conservation structures, thereby limiting physically the extent to which renters overexploit soil. Lewis and Sappington have shown that such investments may be desirable in order to create countervailing incentives in cases of hidden information. This paper examines such a possibility in cases where renters' soil exploitation is non-contractible. We begin by developing a theoretical model of contract structure and levels of investment in such structures in rental land market equilibrium when renters' soil exploitation non-contractible because they are either unobservable or unverifiable. Assuming that both landlords and renters are risk neutral, we show that landlords will invest more than the first best level in conservation structures on rented land. Empirically, we use farm-level data on Maryland farmers' use of erosion control structures and other easily observable best management practices that reduce erosion (e.g., contour farming). Linear and Poisson regressions indicate that farmers who rent a larger share of the land they operate use a larger number of such structures and practices than farmers with the same total land operated, topography, and cropping patterns. Thus, the empirical results are consistent with landlords' investing in soil conservation structures on rental land as a means of counteracting renters' overexploitation of soil.

Theoretical Model

A landlord owns a piece of land that she offers for rent in a competitive market for rental land. Like Soule, Tegene, and Wiebe or Lichtenberg, we use a two-period version of

McConnell's optimal soil conservation model. Let T denote the multi-product technology set of feasible input-output combinations on that piece of land. We represent the technology using a revenue function $R(p,w,s,x_0,I) = \max_{y,z} \{p \bullet y - w \bullet z: (x,y,s,x_0,I) \in T\}$ that gives the revenue generated from the profit maximizing choice of crop output levels y and other input levels z as a function of soil loss s, a vector of other inputs z, the initial soil stock x_0, the amount invested in soil conservation structures I, and the vectors of input and output prices w and p, respectively. We assume that production (and thus the revenue function) is increasing in s and x_0, decreasing in I, and concave in all arguments. Assume also that soil conservation investments impair the marginal productivity of soil loss s ($R_{sI} < 0$).

The value of the piece of land at the end of the lease period is $V(x_1)$, an increasing, concave function of the soil stock at the end of the lease period x_1. The state transition equation is

$$x_1 = x_0 - h(s,I).$$

Assume that the reduction in soil stock h(.) is increasing in s, decreasing in I, and convex in all arguments. Assume also that $h_{sI} < 0$, soil conservation investment lowers the marginal reduction in soil stock due to soil loss. Let β denote the landlord's real discount factor and c the unit cost of increasing soil loss s.

Finally, assume that both tenants and landlords are risk neutral.

First Best Soil Conservation Investment

The first best combination of soil loss s and soil conservation investment I maximizes the expected present value of the current return from renting the land plus the value of land at the end of the lease period (normalized to one year for simplicity):

$$\max_{s,I} R(p,w,s,x_0,I) - cs - I + b\, v(x_0 - h(s,I)) .$$

The necessary conditions for a maximum are:

(1) $$R_s - c - b\, V' h_s = 0$$

(2) $$R_I - 1 - b\, V' h_I = 0 .$$

The first best choices of soil loss (s*) and soil conservation investment (I*) equate the values of their respective marginal products with the sum of their unit prices and a user cost equal to the present value of the changes in the value of the land they induce (McConnell, Lichtenberg).

Soil Conservation Investment in a Cash Rental Contract

A renter appropriates none of the value of the land at the end of the lease period, i.e., to a renter $V(x_1) = V'(x_1) = 0$ always. Examination of the necessary conditions for a maximum under this latter restriction gives the usual results for a renter. Condition (1) indicates that optimal soil loss is greater for a renter than a landlord, since the marginal cost of soil loss to the renter (c) is less than the marginal cost of soil loss to the landlord ($c+\beta V' h_s$). Condition (2) indicates that the renter will never undertake any conservation investment of her own volition: When $\beta V' h_I = 0$ (as it does for a renter), the left hand side of condition (2) is always negative, implying that a corner solution I = 0 is optimal.

In principle, the landlord could achieve the first best by including in the rental contract a stipulation that the renter restrict soil loss to the first best level s* and by either making the first best soil conservation investment I* or stipulating that the tenant do so. In practice, soil loss is likely to be non-contractible. The renter can make adjustments in day-to-day farming practices that can influence soil loss substantially. Monitoring those adjustments is likely to be prohibitively costly. Moreover, problems of verification would arise even if monitoring were economically feasible. Assume, then, that the renter's soil loss decisions are non-contractible. (An equivalent assumption is that both current production and land value at the end of the lease period are subject to additive white noise that render the renter's choice of soil loss unobservable, e.g., revenue is $R(p,w,s,x_0,I)+\varepsilon$ and land value is $\beta V(x_1)+\eta$, where ε and η both have zero mean.) As a alternative to contracting on soil loss directly, the landlord can make a soil conservation investment I and then offer to rent the land for a fixed rental payment t. (Equivalently, the landlord can offer a rental contract stipulating the level of investment I.) Potential tenants bid for the rental contract. If the rental market is competitive, the winning bidder is the one expecting to generate the greatest profit during the lease period. Once the rental contract is signed, the tenant chooses soil loss s maximize her return. Both tenants and landlords are assumed to be risk neutral.

The landlord's objective is to choose the level of soil conservation investment I, and the fixed rental payment t to maximize the expected present value of the current return from renting the land plus the value of land at the end of the lease period (normalized to one year for simplicity):

$$\max_{t,I}\ t - I + b\ V(x_0 - h(s,I))$$

subject to the renter's participation and incentive compatibility constraints

(3) $$R(p,w,s,x_0,I) - cs - t \geq 0$$

(4) $$s = \arg\max\{R(p,w,s,x_0,I) - cs - t\}.$$

The renter's participation constraint reflects the assumption of competition in the market for rental land, which implies that the winning bidder will be the one who can generate the greatest current profit during the lease period. The renter's participation constraint will always bind, so that the fixed rental payment t will equal the full rent generated by the land,

(5) $$t = R(p, w, s, x_0, I) - cs \, .$$

The tenant's incentive compatibility constraints imply that the choice of soil loss s satisfies the first order condition

(6) $$R_s - c = 0 \, .$$

The tenant's optimal choices of s is an implicit functions s(I) of the landlord's soil conservation investment choice. Differentiating with respect to the level of soil conservation investment I gives:

$$\frac{\partial s}{\partial I} = -\frac{R_{sI}}{R_{ss}} < 0$$

under our assumptions.

Substituting, the landlord's objective function can thus be rewritten:

$$\max{}_I \;\; R(p, w, s(I), x_0, I) - I - cs(I) + b \;\; V(x_0 - h(s(I), I)) \, ,$$

which has the first order condition:

(7) $$R_I - 1 - b\, V' h_I - b\, V' h_s \frac{\partial s}{\partial I} = 0 \, .$$

Soil loss and soil conservation investment in rental land market equilibrium, s^o and I^o, are defined by equations (6) and (7).

Soil Conservation Investment and Soil Loss in Rental Market Equilibrium

Figure 1 compares the first best levels of soil loss s* and soil conservation investment I* with soil loss and soil conservation investment in rental land market equilibrium, s^o and I^o. The concavity of the objective functions in (I,s) in both cases means that all four first order conditions are downward sloping in (I,s) space. Stability of equilibrium requires that the slope of the first order condition for I be greater in absolute value (i.e., steeper) than that of the first order condition for s in both cases. Comparing equations (1) and (6) indicates that the first order condition for s in the rental land market equilibrium lies above and to the right of the first order condition for s in the first best. Alternatively, evaluate equation (6) at the first best levels of soil loss s* and soil conservation investment I*: The left hand side is negative, indicating that equation (6) lies above equation (1) in (I,s) space. Similarly, comparing equations (2) and (7) indicates that the first order condition for I in the rental land market equilibrium also lies above and to the right of the first order condition for I in the first best case.

As Figure 1 indicates, the rental land market equilibrium features soil loss greater than the first best ($s^o > s^*$), soil conservation investment greater than the first best ($I^o > I^*$), or both ($s^o > s^*$, $I^o > I^*$). If the vertical distance between equations (6) and (1) is greater than the vertical distance between equations (7) and (2), soil conservation investment in rental land market equilibrium will be greater than soil conservation investment in the first best ($I^o > I^*$); soil loss s^o in this case may be greater or less than the first best level s*.

Further insight can be gained by considering a first order approximation of equations (1) and (2) defining the first best levels of soil loss and soil conservation investment (s*,I*) around the rental land market equilibrium levels (s^o,I^o) which can be solved for the differences in soil loss (s^*-s^o) and soil conservation investment (I^*-I^o):

(8) $$s^* - s^o = \frac{b\,V'\,h_s\left[C + B\dfrac{\partial s^o}{\partial I^o}\right]}{AC - B^2}$$

(9) $$I^* - I^o = \frac{-b\,V' h_s \left[B + A \frac{\partial s^o}{\partial I^o} \right]}{AC - B^2}$$

where

$$A = R_{ss} - b\,V' h_{ss} + b\,V'' h_s^2$$

$$B = R_{sI} - b\,V' h_{sI} + b\,V'' h_s h_I \,.$$

$$C = R_{II} - b\,V' h_{II} + b\,V'' h_I^2$$

Our assumptions imply A ≤ 0, C ≤ 0, and $AC-B^2 \geq 0$. The sign of B is ambiguous. The first term, which represents the impact of soil conservation investment on the marginal productivity of soil loss in current production, is negative. The second and third terms, which represent the impact of soil conservation investment on the value of the land at the end of the current lease, are both positive. If the land value effects of soil conservation investment (the second and third terms in B) outweigh the current productivity effects (the first term in B), then B is positive. In this case, $I^*-I^o < 0$ and $s^*-s^o > 0$, i.e., soil conservation investment in rental land market equilibrium is greater than the first best level while soil loss is lower than the first best level. In other words, when soil conservation investment has larger effects on land price than on current land productivity, landlords will tend to overinvest in soil conservation to such an extent that soil loss will be lower than the first best.

More generally, equation (9) indicates that rental land market equilibrium soil conservation investment I^o will exceed the first best level I^* whenever $B+A[\partial s^o/\partial I^o] > 0$. Substituting for A, B, and $\partial s^o/\partial I^o$ gives:

$$B + A\frac{\partial s^o}{\partial I^o} = b\,V' \left[h_{ss} \frac{R_{sI}}{R_{ss}} - h_{sI} \right] - b\,V'' h_s \left[h_s \frac{R_{sI}}{R_{ss}} - h_I \right],$$

which is unambiguously positive under our assumptions. Thus, rental land market equilibrium soil conservation investment I^o will always exceed the first best level I^*.

Empirical Application: Maryland Farmers' Use of Soil Conservation Practices

The empirical application uses data from a 1998 telephone survey of 487 Maryland farmers. The sample for the telephone survey was drawn from the Maryland Agricultural Statistics Service (MASS) master list. Because of the large percentage of small, non-commercial farms in Maryland, the sample was stratified, with large operations oversampled and small ones undersampled. The survey was administered by MASS, which also provided weights based on annual sales to correct for the stratification.

The survey contained information on farm operation, farm finance, farm topography, human capital of the farm operator, and use of 25 different soil and water conservation practices. Farm operation information included total land operated, owned, rented in, rented out; acreage of corn, soybean, small grains, hay, pasture, tobacco, vegetables, and other crops; and livestock numbers (milk cows, other cattle, hogs, sheep, poultry, horses, and other livestock). Farm financial information included annual sales (recorded as a categorical variable), the percentages of sales derived from crops and livestock, and the percentage of income derived from farming. Topographical information included the percentages of land operated with slopes of 2-8 percent and with slopes greater than 8 percent. Human capital indicators included age, education, and years spent managing a farm.

Farmers were asked whether they used each of 25 different types of conservation technologies: critical area seeding, filter strips, riparian buffers, contour farming, stripcropping, cover crops, minimum or no tillage, grade stabilization, grass- or rock-lined waterways, terraces, diversions, ponds, sediment troughs, manure storage structures/lagoons, permanent vegetative cover, wildlife habitat, stream fencing/stream crossings/watering troughs, pre-plant soil testing, pre-sidedress nitrogen testing, manure crediting, split fertilizer application, manure incorporation, fertilizer incorporation, manure composting, and dead bird composting. Thirteen of these practices qualify as long term investments in erosion or sediment control of the kinds that landlords can make themselves or write into enforceable rental contracts. Some are structures that are costly to remove (grade stabilization, grass- or rock-lined waterways, terraces, diversions, ponds, sediment troughs). Others are sufficiently easy to monitor that they can be considered contractible (critical area seeding, filter strips, riparian buffers, contour farming, stripcropping, permanent vegetative cover, wildlife habitat).

We use these data to explore the relationship between land rental and investment in contractible soil conservation measures. We cannot test the hypothesis that landlords overinvest in these measures because we lack sufficient information about topography, soil quality, and other relevant characteristics for every field operated by each farmer that would allow us to infer the first best level of investment. Instead, we investigate the hypothesis that the non-contractibility of renters' soil exploitation enhances landlords' propensity to invest in contractible soil conservation measures.

We measure soil conservation investment on each farmer's operation as the total number of these contractible practices used. The mean is about 2 (Table 1). About 40 percent use none of these practices while over 30 percent use more than two.

Like most previous studies, we use the rented proportion of total land operated to measure the influence of renting on soil conservation investment. Our theoretical model suggests that in rental market equilibrium landlords will invest more in contractible soil conservation measures than owner-operators. We thus expect to observe a positive correlation between the share of land rented and the number of conservation measures used.

We include total land operated in our models to control for the effect of size. Farmland in Maryland exhibits a relatively high degree of heterogeneity in terms of topography, soils, and other indicators of erosion potential. All else equal, a farmer operating more acreage is likely to encounter greater variability in land quality, making it more likely that a larger number of different kinds of soil conservation measures will be profitable. Also, a study of Maryland farmers by Lichtenberg and Strand using an earlier survey found that a number of the soil conservation measures included in our analysis are complements. All else equal, a farmer operating more acreage is more likely to encounter conditions under which use of a package of measures is the most profitable. For both these reasons we hypothesize a positive relationship between total land operated and the number of conservation practices used.

We control for characteristics of the land operated by each farmer by including variables measuring topography and crops grown. Topography is measured by two variables: the percentage of land with moderate (2 to 8 percent) slope and the percentage of land with steep (greater than 8 percent) slope. Since greater slope is associated with greater potential erosion, we expect a positive relationship between these variables and the number of conservation measures used. We include acres of five major crops (corn, soybeans, small grains, vegetables, tobacco) to control for soil productivity and, to some extent, erosion potential. The row crops corn, soybeans, vegetables, and tobacco are associated with greater erosion potential. Small grains have lower erosion potential because of the soil cover they provide. But corn, soybeans, vegetable, and tobacco are also grown on more productive soils, indicating both greater returns from conservation investment and greater short run productivity losses from (and thus opportunity costs of) conservation investment. Thus, the coefficients of these crop acreage variables could be either positive or negative.

We use two regression models to explore the relationship between soil conservation investment, tenure, size of operation, land characteristics, and cropping patterns. The first is a simple linear regression. Since the dependent variable consists of count data (the number of conservation measures used is a non-negative integer), a Poisson regression model was also estimated. Both models were estimated using LIMDEP. Descriptive statistics of the data used in the regressions are given in Table 1. The estimated parameters are given in Table 2.

As hypothesized, the coefficient of the share of land rented is positive and significantly different from zero in both models. Thus, the regression results are consistent with the hypothesis generated by the theoretical model, namely that in rental land market equilibrium landlords will tend to invest in contractible soil conservation measures as a means of mitigating renters' non-contractible overexploitation of soil.

The coefficient of total acres operated is also positive and significantly different from zero in both models, indicating that a greater number of soil conservation measures are used on larger operations. This result is consistent with the notion that, in Maryland at least, larger operations tend to be more heterogeneous, so that it tends to be profitable to invest in a greater variety of soil conservation measures.

The coefficient of corn acreage is negative and significantly different from zero in both models. This result is consistent with the notion that the opportunity cost of these soil conservation measures (in terms of current productivity losses) is greater on land suited for corn production.

The coefficient of tobacco acreage is positive in both models, significantly different from zero at a 1 percent significance level in the Poisson regression, and significantly different from zero at a 10 percent significance level in the linear regression model. This result is consistent with the notion that gains from erosion control are greater on land used for tobacco. Limits on tobacco marketing due to government quotas also tends to limit the opportunity cost of soil conservation investments in terms of current productivity losses.

Conclusion

The relationship between tenancy and soil conservation has remained something of a puzzle. Theory clearly indicates that renters have less incentive than landlords to make investments that preserve soil. Yet the empirical literature, taken as a whole, has failed to establish an unambiguous impact of tenancy on soil conservation investment, let alone a negative correlation. One possible explanation is the literature to date has been one-sided, considering only renters' and landlords' incentives separately and ignoring renter/landlord interactions in markets for rental land.

This paper examines soil conservation investment in rental land market equilibrium. We focus on the role of soil conservation structures or other measures that are easily observable and costly to alter. Landlords can either install in these measures themselves or stipulate them as enforceable provisions in land rental contracts.

Investment in such measures gives landlords a means of mitigating renters' tendency to overexploit soil. We show theoretically that, when soil loss in non-contractible but such investments are feasible, landlords' investment in these measures in rental land market equilibrium will generally exceed first best levels. Soil loss, however, may be greater than the first best level even in the presence of such investments. An empirical study of Maryland farmers' use of these kinds of soil conservation measures confirms this hypothesis of a positive correlation between tenancy and soil conservation investment: Farmers operating larger shares of rental land use a greater number of these soil conservation measures.

The results of this analysis demonstrate the importance of taking into account the specific nature of soil conservation investments and the relationship between landlords and renters. Studies by Allen and Lueck and by Soule, Tegene, and Wiebe show that different forms of tenancy affect renters' soil conservation incentives. The results of this study show that landlord's ability to enforce provisions of rental contracts also influence renter's soil conservation. Certain kinds of soil conservation measures give landlords an ability to limit renters' overexploitation of soils. Investment in these measures in rental land market equilibrium differs markedly from investment in measures that are non-contractible.

References

Douglas Allen and Dean Lueck, "Contract Choice in Modern Agriculture: Cash Rent versus Cropshare", *Journal of Law and Economics* 35(1992):397-426.

Allen M. Featherstone and Barry K. Goodwin, "Factors Influencing a Farmer's Decision to Invest in Long-Term Conservation Improvements", *Land Economics* 69(1993):67-81.

Linda K. Lee and William H. Stewart, "Landownership and the Adoption of Minimum Tillage", *American Journal of Agricultural Economics* 65(1983):256-264.

Tracy R. Lewis and David Sappington, "Inflexible Rules in Incentive Problems", *American Economic Review* 79(1989):69-84.

Erik Lichtenberg and Ivar E. Strand, Jr., "Joint Adoption of Multiple Technologies: A Dual, Latent Variable Approach", Working Paper No. 00-, Department of Agricultural and Resource Economics, University of Maryland, College Park, 2000.

Erik Lichtenberg, "Agriculture and the Environment", in Bruce L. Gardner and Gordon C. Rausser (ed.), *Handbook of Agricultural Economics*. Amsterdam: Elsevier, forthcoming.

Gary D. Lynne, J.S. Shonkwiler, and Leandro R. Rola, "Attitudes and Farmer Conservation Behavior", *American Journal of Agricultural Economics* 70(1988):12-19.

Kenneth E. McConnell, "An Economic Model of Soil Conservation", *American Journal of Agricultural Economics* 65(1983):83-89.

Patricia E. Norris and Sandra S. Batie, "Virginia Farmers' Soil Conservation Decisions: An Application of Tobit Analysis", *Southern Journal of Agricultural Economics* 19(1987):79-90.

Michael R. Rahm and Wallace E. Huffman, "The Adoption of Reduced Tillage: The Role of Human Capital and Other Variables", *American Journal of Agricultural Economics* 66(1984):405-413.

Meredith J. Soule, Abebayehu Tegene, and Keith D. Wiebe, "Land Tenure and the Adoption of Conservation Practices", *American Journal of Agricultural Economics* 82(2000):993-1005.

Table 1. Descriptive Statistics of the 1998 Maryland Survey Data

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of Practices	1.918668	2.27093622	0	11
Share of Land Rented	0.134807	0.276404678	0	1
Percentage of Land with Moderate Slope	29.4774	34.0264043	0	100
Percentage of Land with High Slope	7.142756	15.9239967	0	100
Total Land Operated	186.188	267.815721	0	7100
Corn Acres	32.3996	95.0977194	0	2000
Soybean Acres	33.70176	108.06585	0	2000
Small Grains Acres	19.55664	61.8553595	0	1200
Vegetables Acres	1.750397	21.2753119	0	900
Tobacco Acres	0.349083	2.38280894	0	80

Table 2. Estimated Coefficients of Linear and Poisson Regression Models of Conservation Investment

	Linear Regression		*Poisson Regression*	
Variable	*Coefficient*	*Standard Error*	*Coefficient*	*Standard Error*
Constant	1.5086283**	0.18540346	0.560068**	5.50E-02
Share of Land Rented	0.9328389*	0.43551481	0.382164**	0.10999998
Percentage of Land with Moderate Slope	1.30E-02**	3.34E-03	4.95E-03**	8.98E-04
Percentage of Land with High Slope	5.88E-03	7.39E-03	2.69E-03	1.89E-03
Total Land Operated	4.18E-03**	9.49E-04	1.14E-03**	2.16E-04
Corn Acres	-6.23E-03**	2.34E-03	-1.97E-03**	6.15E-04
Soybean Acres	-2.42E-03	1.94E-03	-6.42E-04	5.22E-04
Small Grains Acres	-1.12E-03	2.85E-03	-5.18E-04	7.37E-04
Vegetables Acres	-2.44E-03	5.26E-03	-3.74E-04	1.38E-03
Tobacco Acres	8.26E-02	4.59E-02	2.01E-02*	8.13E-03

** denotes significantly different from zero at a 1% level.
* denotes significantly different from zero at a 5% level.

Figure 1. Comparison of First Best and Rental Land Market Equilibrium Soil Loss (s) and Soil Conservation Investment (I)