Soil Erosion and Land Prices: Discussion

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A significant controversy has arisen over the ability of the land market to reflect adequately the long-term deleterious effects of soil erosion in land prices. Most arguments for market failure rest on one of two implicit assumptions: (*a*) the private rate of discount is higher than the social rate, at least in the long run; or (*b*) because of the high cost of information on the effects of erosion on productivity, individual decision makers are unwilling to invest to obtain sufficient information on the long-term effects. Additional arguments for market failure are couched in terms of the length of the planning horizon but could be stated equivalently in terms of differentials in discount rates. The finite planning horizon hypothesized for farmers' decisions on rented lands is conceptually equivalent to an infinite discount rate for benefits accruing in later periods.

A closely related topic is the capitalization of soil conservation investments in land prices. To avoid confusion in this discussion, we can divide soil conservation expenditures into two disjoint subsets: expenditures on capital structures which affect the rate of erosion for more than one production period (conservation stock expenditures) and expenditures that affect erosion during a single production period (conservation flow expenditures). Examples of the first would be terraces and grass waterways. Conservation tillage, rotations, and residue management would fall into the latter category.

The distinction based on erosion effects does not mean that conservation flow expenditures fail to affect soil productivity over a longer time horizon; they do. However, benefits past the current period should be captured in the implicit value of the soil stock. There is no reasonable distinction one can make in the value between equivalent sites that have the same current and long-run productivity potential based solely on past practices. If an investment is made in conservation stocks, however, the land value at the end of each production period can be divided into the implicit value of the soil stock and the remaining present value of the conservation investment as a function of future decreases in erosion rates and the associated delay in potential productivity losses.

This discussion focuses on the papers that have been presented in this light. The papers by Ervin and Mill (EM) and Gardner and Barrows (GB) reflect ad hoc attempts to evaluate empirically the ability of the land market to capture the effects of erosion. The paper by Hertzler, Ibañez-Meier, and Jolly (HIJ) presents an optimization-based approach to developing estimates of the present value of the effects of alternative conservation approaches on specific soil characteristics. HIJ's approach provides a more adequate theoretical base for future tests of the social efficiency of land markets.

Econometric Approaches

The papers presented by EM and GB reflect the conundrum that applied economists face when attempting to test for market failure from a societal perspective. Measures of the impact of soil erosion on long-term soil productivity require a substantial data base and are quite site specific (Pierce et al.). Available data do not easily reflect or measure the impacts of a variety of discrete characteristics on land price.

EM and GB both base their estimation procedures on the hedonic pricing model developed by Rosen. The hedonic pricing approach assumes there are attributes of the good in question to which value can implicitly be assigned. For land, such attributes may include fertility, location, pH, water holding capacity, bulk density, slope, etc. The list potentially could include all of the attributes that soil scientists and agronomists use in describing soils and crop growth potential as well as the market related variables that economists normally add. What will not be on the list is whether the farmer used conventional (erosive) or conservation (nonerosive) tillage five years ago.

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Such variables only enter the model through the effect on the characteristics for which implicit prices are estimated.

The paper by EM fits the above categories well and points out the data problems inherent in the analysis. The analysis seems a reasonable attempt at identifying erosion-price effects reflected in available land market data. Two comments on their econometric analysis are in order. There is some potential confusion over the effect of the percentage of soil with erosion phase II over favorable subsoils. Early in the paper the authors state that "a linear form was assumed when preliminary tests did not reveal curvilinear relationships." However, while discussing their results they note the unanticipated sign on the relevant coefficient may be caused by the inability of the base productivity index to reflect adequately the productivity of the Marshall soil association. Although it is not possible to comment on this fully without access to the original data or more complete statistics, it may be that a nonlinear term in the productivity index would help. Multicollinearity diagnostics may have been useful in interpretation of their results. If the data warrant, a better approach may be to use dummy variables for the major soil associations. EM used average slope as the appropriate variable that "measures the effect of future potential erosion damages." However, slope needs to be weighted by the effect of erosion on the productivity as a function of the base soil association to capture this effect fully. The implicit assumption in their analysis is that the effect of slope and subsoil mixing in the plow layer are independent of soil type, an assumption too strong to be maintained if the soil types within the sample vary significantly.

The tacit assumption in the EM analysis is that the market will overestimate future soil productivity by failing to reflect benefits of expenditures to ameliorate productivity declines in prices. Such an assumption seems overly strong. The null hypothesis that the proportion of future productivity benefits from conservation captured in the land price is zero is equivalent to testing for an infinite discount rate for such future benefits. A more appropriate null hypothesis seems to be that the proportion reflected is greater than or equal to the actual value versus an alternative that the market systematically understates future productivity values.

Possibly the most interesting part of the EM paper is the discussion of the role of information in estimating productivity costs. Additional work in the evaluation of the nonexclusive or nonrivalry nature of information on erosion impacts seems warranted. EM also indicate that avoided off-site damages need to be added to productivity benefits in the benefit-cost calculation for evaluating the provision of public information. This point needs to be reinforced. It is the benefits of the off-site damages that can be avoided that are critical to the decision; the level of off-site damages are not of primary importance.

GB appear to fall into the trap of testing the effect of past conservation flow expenditures on land prices. As discussed, there is no economic reason why erosion control benefits should be capitalized in any way outside of soil characteristics and productivity unless such controls are from capital expenditures which remain in place. In such a case, the impact on land values should be related to the present value of future gains from erosion control caused by such structures or the cost of replacing the structures, whichever is less. An additional alternative is that the proportion contour plowed acts as a proxy for omitted variables on land quality that have not been included. None come readily to mind, however.

The conclusions that the authors reach based on their model and methodology are not surprising. If their results had been otherwise, it would imply either an irrational market or that the use of conservation tillage practices systematically picked up a productivity measure that had been neglected or not included in the data set.

Dynamic Optimization

The paper by HIJ presents a radically different approach to the evaluation of erosion effects on land prices. Rather than ascertain price effects hidden in market data, they develop a profit-maximizing model of conservation choice which provides an estimate (user cost) of the cost of soil erosion. Although the model presented does not include all variables desired to measure soil productivity, the variables they include (measures of water-holding capacity and soil fertility) are the major determining factors in most analyses. HIJ are able to capture the essence of the problem in a relatively small model.

Although one could quibble with individual assumptions on prices, costs, or yields, it seems more appropriate to confront their model with the data necessary to test their conclusions. Given the relative minor importance of the user costs for the variables of interest, however, one should be aware that a relatively large data set would most likely be required to test adequately the implications of their model.

Summary

We have listened to three papers that attempt to evaluate the effects of soil erosion on agricultural land prices. The empirical results are, to say the least, inconclusive. It seems apparent that the problem needs a better resolution before economists can provide empirical input into the conservation policy process based on price-erosion effects.

On another note, it may be difficult to evaluate the results obtained unless and until greater consensus is reached on the true productivity impacts of excess erosion. Although there has been increasing research in this area by the physical scientists, accurate estimates are not yet available for most (perhaps any) areas of the United States. Such estimates are necessary to compare the efficiency of the market process. Hedonic pricing models appear to be a sound econometric approach for the problem at hand, but the data required for adequate analysis may be difficult to obtain. In addition, the results will be difficult to evaluate until benchmarks are developed.

The approach by HIJ seems a valid way of indirectly estimating such erosion effects. Additional work needs to be done on the sensitivity of their results to various assumptions. An attempt to estimate market effects of the results they obtain may be instructive.

These papers all make one thing abundantly clear. There remains a significant amount of work to be done in this area before definitive empirical results useful for policy analysis can be obtained.

References

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