The Environmental Quality Incentives Program In Kentucky: Does It Address Environmental Quality Problems?

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Abstract

The ability of Kentucky's EQIP program to address important natural resource quality problems is investigated by estimating a set of endogenous equations representing total county EQIP applications, resulting EQIP funding, and environmental quality concerns. This system was estimated using 2SLS where the dependent variables follow a Poisson distribution. Only the county animal waste concern ranking was consistent with the actual measure of animal waste for each county, but generated the least applications for cost share funding and received the least funding. Effectiveness of the EQIP program can be improved by decreasing its reliance on the ranking of local environmental concerns.

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Large amounts of money are spent by federal and state agencies within many states on programs designed to improve environmental quality. One program, called the Environmental Quality Incentives Program (EQIP), was established as part of the 1996 Farm Bill [also known as Public Law No. 104-127, or the Federal Agricultural Improvement and Reform Act of 1996 (see the National Agricultural Law Center)]. Section 334 of this act established the program. EQIP was the result of an effort to improve the performance of the Agricultural Conservation Program (ACP) in targeting watersheds and regions and to encourage farmers/rancher to adopt practices that reduce environmental and resources problems. EQIP, administered by USDA Natural Resources Conservation Service (NRCS), provides money to reduce soil erosion, improve water quality and related natural resource concerns in watersheds, regions, or areas of special environmental sensitivity. Cost-share money (up to 75 percent of the project cost) is granted to producers as an incentive to adopt best management practices (BMPs) that reduce environmental and resource problems (ERS NRCS 2000). EQIP funds are also used for providing education and technical assistance (Section 334 of H.R. 2854).

The purpose of this study is to evaluate the effectiveness of the EQIP program in addressing natural resource problems in Kentucky, a state that has substantial natural resource quality problems. Given the voluntary nature of the participation of farmers in the program, it is conceivable that EQIP is addressing priorities for environmental improvements in only a limited way. We attempt to determine if the money was spent instead to address natural resource quality problems that were perceived to be important at the local level as required by the “bottoms-up” approach of the EQIP program. If EQIP expenditures in a county are aligned more closely with perceived problems and perceptions, then these local perceptions must closely match real natural resource quality problems before EQIP can show that they are addressing key environmental and resource problems. How money is allocated is an indicator of revealed priorities.

A complicating factor in this study is that program expenditure data collected by NRCS is aggregated and is not tied to a particular environmental category. Expenditures on “popular” environmental problems could be wasted if the problem addressed comes from a priority ranking of concerns at the local level and does not correlate with actual environmental quality indicators. Furthermore, total aid is fixed, thus aid to one county may mean no aid to another county. Counties with actual problems where expenditures can have the greatest impact may not receive aid.

There are two levels of choice. The first level of choice is made by the farmers when they apply for an environmental project cost share. At this level the amount of money spent and environmental projects financed at the county level predetermines the second level of decision making. The second level of decision making is where EQIP can only choose from this set of applications and apply priority considerations in further limiting which of the farmer applications merit the allocation of funds.

A few studies have attempted through benefit-cost analysis to examine the balance between value gained and resources committed to water quality protection (Freeman 1982, Hahn 1994). When information on benefits has been difficult to obtain, cost-effectiveness has been used to evaluate costs per unit of pollution avoided (Fraas and Mumley, 1989). Given that the marginal cost of improving some resource and environmental problems is higher than others, it cannot follow that more money allocated to a given problem equates with a greater quality improvement. A simple comparison between expenditure and resource and environmental problems can only show that some problems are targeted rather than others. Thus, it is common to judge a pollution control regulatory program for its effectiveness rather than its efficiency, (Davies and Mazurek, 1998, Weiss, 1972). Effectiveness in this context refers to whether the program is accomplishing the objectives specified in legislation and regulation (Rossi, 1993).

It is possible to accomplish all the objectives but still have a deterioration in the resource and environmental quality simply because the program was not targeting the most important problems (Hahn, 1994, NAPA, 1995, Wholey et al., 1973). Park and Monteith (1989) evaluated the cost-effectiveness of the variable cost-share option versus the uniform cost share in the Agricultural Conservation Program (ACP) during the mid 1980s in West Tennessee. They concluded that the variable cost-share option was less cost-effective than the uniform cost-sharing approach in targeting highly erodible watersheds. The erodible lands required much higher total costs per acre for the BMPs.

Several studies examined the potential reduction in environmental program costs through use of incentive based policies and alternative policy approaches concluding that gains from trading and banking of marketable permit systems are significant (Carlin 1992, Rubin and Kling 1993) A subsidy based on the observed level of environmental quality, rather than emissions, can induce efficient abatement (as well as entry/exit behavior) on the part of non-point polluters (Segerson, 1988). Subsidies to induce adoption of best management practices have been the general policy approach to agricultural non point source pollution (Cook 1985, Reichelderfer 1990, Rubin and Kling 1993).

In this study, we specify a set of endogenous equations representing total county applications for the EQIP program and resulting EQIP funding and a set of equations representing environmental quality. The environmental variables of choice include county ranking of concerns related to animal waste management, soil erosion, water quality, and wildlife management which are targeted by EQIP. The endogenous aspect of the model is best described as follows. Funding increases with the number of applications, but larger funding levels generate more applications. However, the primary focus is the extent to which environmental concerns determine EQIP applications and funding given that county leaders have expressed their county constituent's interest in environmental concerns by ranking the importance of these and other non-environmental concerns. Thus, this research evaluates whether rankings of environmental concerns match actual environmental problems. To the extent that EQIP relies on these rankings, the EQIP program will be effective if these rankings match actual environmental problems. Furthermore, EQIP funding applications and actual expenditures are examined to determine whether, in general, funding can be found to match priority environmental concerns within a county.

The EQIP Program

EQIP is designed to be a bottoms-up program in which the local entities within each state decide on the ranking of environmental concerns that define "priority areas" and focuses on watersheds, regions, or areas of special environmental sensitivity. The range of EQIP targets include erosion, animal waste management, water quality and wildlife management.

All farmers in the state of Kentucky are required to file an environmental plan with the state and are required to choose from a list of approved BMPs (Best Management Practices) which also meet requirements for participation in some Federal Agricultural programs (Claasen et al., 2004). Because smaller farms and animal operations are included in the new USDA/EPA regulations, waste management costs can be reduced through EQIP. Large animal feeding in confinement operations may not use cost-share money to construct animal waste management facilities.

Prior to the 2002 Farm Bill, EQIP funds could be used either in “priority areas” or on a statewide basis. States were instructed to use at least 65% of their funds in priority areas. These areas were generally identified on a watershed basis and encompassed parts of one or more counties. The 2002 Farm Bill eliminated the required use of priority areas (Farm Security and Rural Investment Act of 2002).

During the period 2000-2002, Kentucky funded all of its priority areas. Just because a priority area was funded does not mean that every farmer application, or even every county in that area, received funding. During this period, 2,675 applications for federal cost-share funds were received totaling about $24 million. About 750 of these applications were funded with a total allocation of approximately $9.6 million. Technical assistance by NRCS over the period 2000-2002 was directed toward implementing and maintaining approved BMPs including livestock manure storage systems, livestock watering stations, filter strips, riparian buffers and fencing, wildlife plots, grassland restoration, and soil erosion control systems.

The Data

This investigation develops an empirical model of EQIP funding based on logical propositions and understanding of the EQIP program. We posit that EQIP expenditures in a county depend upon the demand for EQIP services measured by farmer applications for EQIP funds. But even if there are a number of applications, no EQIP funds will be transferred to farmers unless they live in an area with an identified environmental problem. Here, environmental problems illegible for EQIP funding are determined by local consensus (via a ranking of concerns). Thus, EQIP expenditures, EQIP applications, and perceived environmental conditions are correlated or endogenous. An increase in the number of applications increases the likelihood of funding, and at the same time an increase in funding increases the number of applications. Both funding and applications depend on the presence of a higher-ranked environmental problem in that county.

A system of equations (developed below) is used to estimate the relationship between EQIP expenditures, EQIP applications, and perception of local environmental quality. Four variables are included to measure the perception of local environmental quality in animal waste management, soil erosion, local water, and wildlife habitat management. Thus we estimate a system of six equations using two-stage least squares where: AWR is animal waste ranking, SER is soil erosion ranking, WQR is water quality ranking, WMR is wildlife management ranking, TA is total applications, and EF is EQIP funding for each of the 120 Kentucky counties. The term "ranking" in the definitions for AWR, SER, WQR, and WMR measures local perception as to the importance of this environmental variable among all relevant environmental variables in a county.

The data for this investigation are obtained from the USDA - NRCS, USDA Soil Conservation Service (SCS), USDA Economic Research Service (ERS), USDA National Agricultural Statistics Service (NASS), the US Census Bureau, the Kentucky Department of Fish and Wildlife, the Kentucky Department of Mines, and the University of Kentucky Extension Service. Data were obtained for all 120 Kentucky counties. Most of the data represent a point in time (e.g., the 2000 census or the 2002 Census of Agriculture). The data for total applications (TA) and total funding (EF) are the sum of values from the years 2000 to 2002.

The Commonwealth of Kentucky exhibits great variation in geographic and socio-economic variables from north to south, and east to west. Thus, all estimated equations include an identical set of dummy variables that represent location within Kentucky. Local EQIP program responsibilities are administered at the county or NRCS Resource Conservation and Development Area (RCDA) level. In Kentucky there are 14 RCDAs and for each RCDA a dummy (or dichotomus or binary) variable was created. For example, the variable RCDA01 represents the Jackson RCDA in far western Kentucky. If a county resides in the Jackson RCDA, then the variable RCDA01 retains the value of 1 and is 0 otherwise.

In 2000, the Kentucky Division of Conservation with the aid of the State office of the NRCS conducted a county level environmental concerns survey to gauge priority concerns and assist in setting statewide priorities for EQIP (Coleman, 2001). “Blue Ribbon” panels comprised of local government, business owners, extension agents, and other civic leaders were asked to rank concerns within their county. The list of concerns was diverse and included topics related to environmental quality, flooding, land use, and economic development.

The Blue Ribbon Panels were given little guidance, thus some counties ranked concerns for specific locations within the county in addition to the “county-wide” concerns desired. As a result some counties ranked as few as twelve concerns while others ranked as many as fifty two with-in county and county-wide concerns. Only the county-wide concerns were included in this study. Because not all counties provided a ranking for all possible county-wide concerns, a value of 0 was assigned to all concerns that were not ranked for that county. Also, the variable RMax was added to the data set (as an exogenous variable) to control for the total number of with-in county and county-wide concerns ranked by each county. The logic behind RMax is that being ranked first out of four concerns is less meaningful than being ranked first out of fifty concerns. Finally, the set of all possible county-wide concerns was reduced to those targeted by the EQIP program, specifically, AWR, SER, WQR, and WMR.

Because AWR, SER, WQR, and WMR are rankings, these variables are endogenous. For example, if AWR is ranked the top concern, then SER, WQR, and WMR cannot be the top concern and if AWR and SER are ranked first and second, then WQR or WMR can only be ranked third. Furthermore, care must be exercised when interpreting model results. Given that the values contained in AWR, SER, WQR, and WMR are rankings, a smaller number indicates a higher ranking while a larger number indicates a lower ranking.

The Model

What follows is a detailed description of each equation. Variable descriptions and parameter assignments are provided in Table 1. In Equations 1 through 6 (and Table 1) the symbol δ is used to identify the parameter estimates of endogenous variables and the symbol β is used to identify the parameter estimates of exogenous variables. Additionally, the first digit of the parameter subscript identifies the equation number.

Equation 1 is used to estimate the relationship between the endogenous and exogenous variables and animal waste management ranking (AWR). The variables Manure and PSYAWM are included to measure the extent to which actual environmental measures correlate with or relate to local county perception of environmental quality (in this case AWR). The variable Manure measures the quantity of manure produced by county grown livestock in pounds. The variable PSYAWM measures the percent of time that NRCS staff spend on animal waste management issues in the county.

The higher the amount of Manure produced and/or the percent of a NRCS staff year devoted to animal waste issues (PSYAWM), the greater is the likelihood that animal waste management issues are a concern in the county. However, actual presence of a concern does not guarantee that the concern was recognized by county leaders when they established their priority ranking. Thus, it is not possible to state a priori if AWR is correlated with Manure and (or) PSYAWM and, if correlated, the nature of the relationship. It is desirable, however, that AWR be negatively correlated with Manure and (or) PSYAWM (remember that a decrease in ranking number means that the issue is of a higher priority). Such a correlation would indicate that county leaders are cognizant of animal waste management issues in their county.

The variable RMax is included in Equation 1 to control for the total number of total concerns ranked by each county. Including RMax allows one to test if ranking a larger number of concerns increases the ranking of animal waste concerns.

Past studies have suggested that as income increases, the demand for environmental quality increases through an income effect, and that public and private resources available for environmental improvement and clean-up increase as well (Hilton and Levinson, 1998, Seldon and Song, 1994, 2003, Harbaugh et al, 2002). We use county median income (Inc) to test for increased demand for environmental quality (here AWR) where the demand for environmental quality is expressed as an increase in ranking of an environmental concern.

Kentucky counties have a large variation in size. Thus, the size of each county (Mi^2, in square miles) is used as an indicator variable. The variables unemployment (UnEmp), percent of population over 60 (% Over) and percent female head of households (F) in the county are also included as indicator variables. When county unemployment (UnEmp) is high, it is reasonable to expect that county leaders will respond to the needs of their unemployed constituents by promoting economic development. In such cases, environmental variables will be rated lower (or as less important). A higher proportion of individuals over 60 in a county could indicate a higher regard for environmental causes due to health and lifestyle factors.

County aggregate farm acres (FAc) is included to indicate the extent to which farm production is correlated with perception of environmental quality. It is important to keep in mind that the surveyed rankings were established by county leaders who may or may not be involved in agriculture. From the perspective of county leaders it is anticipated that more farm acres will increase the ranking of agriculture-related environmental concerns.

Resource limited farms (RLF) are typically smaller farms that have limited access to capital or other resources that can be used to improve the farm business. In Kentucky, resource limited farms tend to be minority owned. The relationship between environmental ranking and RLF is difficult to determine a priori. In some cases county leaders are simply not cognizant of resource limited farms in their county. In other cases, much political goodwill is extended to these farms. Thus, the relationship between RLF and environmental ranking depends on the extent to which county leaders viewed resource limited farms as having an impact on the environment.

The final 13 variables included in Equation 1 account for spatial or location specific differences across the state. As discussed above there are 14 RCDA's in Kentucky and each represents a unique area of the state. Note that the RCDA for region 6 (the Eagle district or RCDA06) is excluded from the analysis to avoid perfect collinearity between the included group of RCDA dummy variables and the intercept term. RCDA06 was chosen for exclusion because it is adjacent to major metropolitan counties that are not included in a RCDA (i.e., Jefferson, Boone, Kenton, and Campbell counties). The purpose of the RCDA dummy variables is to "absorb" some of the variation in the dependent variable (here AWR) due to differences in location. The error term for Equation 1 is represented by $e_{1,1}$.

Equation 1. Animal Waste Management Ranking

$$\begin{aligned} AWR_i = \; & \delta_{12}SER_i + \delta_{13}WQR_i + \delta_{14}WMR_i + \delta_{15}TA_i + \delta_{16}EF_i + \\ & \beta_{100} + \beta_{101}RMax_i + \beta_{102}Inc_i + \beta_{104}UnEmp_i + \beta_{106}\%Over_i + \beta_{107}F_i + \\ & \beta_{109}FAc_i + \beta_{110}RLF_i + \beta_{111}InAg_i + \beta_{113}Mi^2{}_i + \beta_{115}Manure_i + \beta_{126}PSYAWM_i + \\ & \beta_{134}RCDA01_i + \beta_{135}RCDA02_i + \beta_{136}RCDA03_i + \beta_{137}RCDA04_i + \\ & \beta_{138}RCDA05_i + \beta_{139}RCDA07_i + \beta_{140}RCDA08_i + \beta_{141}RCDA09_i + \\ & \beta_{142}RCDA10_i + \beta_{143}RCDA11_i + \beta_{144}RCDA12_i + \beta_{145}RCDA13_i + \\ & \beta_{146}RCDA14_i + e_{1,i} \end{aligned}$$

Equation 2 estimates the relationship between the county soil erosion-ranking (SER) and the rest of the endogenous variables. In Equation 2 the variables SE and PSYSE are included to measure the extent to which actual environmental measures correlate with local county perception of environmental quality (SER). The variable SE measures the potential for soil erosion in a county. The variable PSYSE measures the percent of time that NRCS staff spend on soil erosion issues in the county. The higher is SE and /or PSYSE, the greater is the likelihood that soil erosion is a concern in the county.

The variables Rmax, Inc, UnEmp, %Over, F, FAc, RLF, InAg, Mi^2, and RCDA are defined above. The variable county aggregate farm cash receipts (CR) is included in Equation 2 to indicate the extent to which the value of farm production is correlated with perception of environmental quality. Cash receipts do depend on farm acreage (FAc), but also depend on crop mix (or rotation) and crop price. Like FAc, it is anticipated that county leaders of counties with higher cash receipts will increase the ranking of agriculture-related environmental concerns (including SER).

Equation 2. Soil Erosion Ranking

$$
\begin{aligned}
SER_i = \; & \delta_{21}AWR_i + \delta_{23}WQR_i + \delta_{24}WMR_i + \delta_{25}TA_i + \delta_{26}EF_i + \\
& \beta_{200} + \beta_{201}RMax_i + \beta_{202}Inc_i + \beta_{204}UnEmp_i + \beta_{206}\%Over_i + \beta_{207}F_i + \beta_{208}CR_i + \\
& \beta_{209}FAc_i + \beta_{210}RLF_i + \beta_{211}InAg_i + \beta_{213}Mi^2{}_i + \beta_{216}SE_i + \beta_{227}PSYSE_i + \\
& \beta_{234}RCDA01_i + \beta_{235}RCDA02_i + \beta_{236}RCDA03_i + \beta_{237}RCDA04_i + \\
& \beta_{238}RCDA05_i + \beta_{239}RCDA07_i + \beta_{240}RCDA08_i + \beta_{241}RCDA09_i + \\
& \beta_{242}RCDA10_i + \beta_{243}RCDA11_i + \beta_{244}RCDA12_i + \beta_{245}RCDA13_i + \\
& \beta_{246}RCDA14_i + e_{2,i}
\end{aligned}
$$

Equation 3 is used to explain the county ranking of water quality concerns. Note that in the context of the survey, poor water quality was not defined. As a consequence, poor water quality could result from any contaminant including agricultural runoff, manure runoff or soil erosion. Thus, there is reason to believe that WQR is correlated with AWR and SER, not only in terms of ranking, but by definition.

In Equation 3, Inc^2 is income squared, NF is nitrogen fertilizer losses from farm fields, PR is pesticide runoff from farm fields, PL is pesticides leached from farm fields, Coal is a dummy variable indicating if the county produced coal in 2000, Mined is the number of years that coal was mined in the county, DWV is the number of drinking water violations received by county based water treatment plants, AWQC is a measure of county ambient water quality for conventional contaminants, TRI is a measure of toxic materials released into the environment, (obtained from the EPSs Toxic Release Inventory) and PSYSE is percent of a NRCS staff year devoted to water quality issues. The variables RMax, Inc, UnEmp, %Over, F, FAc, RLF, InAg, Mi^2, and RCDA are defined above.

The variable Inc^2 is included to test if the relationship between perception of environmental quality (here WQR) and income is non-linear. We are testing whether the environmental Kuznets curve applies, i.e. that water pollution rises as income rises, but eventually the amount of pollution declines as income continues to rise (Grossman and Krueger, 1995; Hilton and Levinson, 1998; Shafik, 1994). If the Kuznets relationship holds in this investigation, then the parameter estimate for Inc^2 will be positive.

Poor water quality is not necessarily due only to agricultural polluting activities. As a result a number of exogenous variables are included to measure water quality. The variables NF, PR, and PL are included to account for agricultural sources of pollution. The variables Coal and Mined are included to account for water pollutants arising from the mining industry and TRI is included to account for pollutants arising from manufacturing. The variable DWV (drinking water violations) is included to account for general water quality. It is assumed that municipal water treatment plants in areas with poorer water quality will receive more fines. However, it is acknowledged that fines are also a function of management. The variable AWQC (ambient water quality of conventional contaminants) is also included to account for general water quality, but unlike DWV, the variable AWQC is more directly tied to actual measures (recorded by the EPA) of water quality. For the water quality variables, a higher value of NF, PR, PL, Coal, Mined, TRI, DWV, and AWQC indicates poorer water quality.

Equation 3. Water Quality Ranking

$$\begin{aligned} WQR_i = {} & \delta_{31}AWR_i + \delta_{32}SER_i + \delta_{34}WMR_i + \delta_{35}TA_i + \delta_{36}EF_i + \\ & \beta_{300} + \beta_{301}RMax_i + \beta_{302}Inc_i + \beta_{303}Inc^2_i + \beta_{304}UnEmp_i + \beta_{306}\%Over_i + \\ & \beta_{307}F_i + \beta_{309}FAc_i + \beta_{310}RLF_i + \beta_{311}InAg_i + \beta_{313}Mi^3_i + \beta_{314}Den_i + \\ & \beta_{317}NF_i + \beta_{318}PR_i + \beta_{319}PL_i + \beta_{321}Coal_i + \beta_{322}Mined_i + \beta_{323}DWV_i + \\ & \beta_{324}AWQC_i + \beta_{325}TRI_i + \beta_{328}PSYWQ_i + \\ & \beta_{334}RCDA01_i + \beta_{335}RCDA02_i + \beta_{336}RCDA03_i + \beta_{337}RCDA04_i + \\ & \beta_{338}RCDA05_i + \beta_{339}RCDA07_i + \beta_{340}RCDA08_i + \beta_{341}RCDA09_i + \\ & \beta_{342}RCDA10_i + \beta_{343}RCDA11_i + \beta_{344}RCDA12_i + \beta_{345}RCDA13_i + \\ & \beta_{346}RCDA14_i + e_{3,i} \end{aligned}$$

Equation 4 is used to explain the county ranking of wildlife management concerns. In Equation 4 the variables PCW and PSYWM are included to measure the extent to which actual environmental measures correlate with local county perception of wildlife quality or wildlife management concerns (WMR). The variable PCW measures the percent change in wildlife population. Specifically, PCW is the percentage change in county rabbit and quail populations over a 4 year period measured via mail-carrier population surveys. The variable PSYWM measures the percent of time that NRCS staff spend on wildlife management issues in the county. The lower is PCW (and PCW can be negative in the case of a population decline) and the higher is PSYWM, the greater is the likelihood that wildlife management is a concern in the county.

As with Equations 1 through 3, the variables Rmax, Inc, UnEmp, %Over, F, FAc, RLF, InAg, Mi^2, and RCDA are defined above. Indicator variables added to Equation 4 include %Rur and %H2O. The variable %Rur controls for the percent of the county population living in rural areas. The effect of %Rur on WMR cannot be determined a priori. The variable %H2O controls for the percent of the county covered by water. Rivers, streams, lakes, ponds, and wetlands are essential for wildlife health and habitat. Thus, counties with more water area are hypothesized to be correlated with a higher ranking for wildlife management concerns.

Equation 4. Wildlife Management Ranking

$$
\begin{aligned}
WMR_i = {} & \delta_{41}AWR_i + \delta_{42}SER_i + \delta_{43}WQR_i + \delta_{45}TA_i + \delta_{46}EF_i + \\
& \beta_{400} + \beta_{401}RMax_i + \beta_{402}Inc_i + \beta_{404}UnEmp_i + \beta_{405}UnEmp_i + \beta_{406}\%Over_i + \\
& \beta_{407}F_i + \beta_{409}FAc_i + \beta_{410}RLF_i + \beta_{411}InAg_i + \beta_{412}\%H2O_i + \beta_{413}Mi^2{}_i + \\
& \beta_{420}PCW_i + \beta_{429}PSYWM_i + \\
& \beta_{434}RCDA01_i + \beta_{435}RCDA02_i + \beta_{436}RCDA03_i + \beta_{437}RCDA04_i + \\
& \beta_{438}RCDA05_i + \beta_{439}RCDA07_i + \beta_{440}RCDA08_i + \beta_{441}RCDA09_i + \\
& \beta_{442}RCDA10_i + \beta_{443}RCDA11_i + \beta_{444}RCDA12_i + \beta_{445}RCDA13_i + \\
& \beta_{446}RCDA14_i + e_{4,i}
\end{aligned}
$$

The remaining equations (5 and 6) concern total county applications (TA) to the EQIP program and total county funding (EF) of the EQIP program. Equations 5 and 6 include the variables FAc, RLF, Mi^2, and RCDA from above in addition to the variables representing actual environmental quality measures (Manure, SE, NF, PR, PL, and PCW). Again, the variable %Rur controls for percent of the county population living in rural areas. Most EQIP applications come from, and most EQIP funds go to, counties with larger rural populations. It is hypothesized that TA and EF increase with increases in %Rur.

In Equation 5, the variable Tobacco controls for variation in tobacco acreage across the state. Both burley and dark varieties of tobacco are included. The effect of tobacco acreage on county applications is not known a priori, but tobacco is an important cash crop with significant political ramifications in tobacco producing counties. The variable LVSTK, number of cattle and pigs in a county, is included to control for large variation in livestock numbers across the state. A large portion of EQIP applications and funding concerns livestock related BMPs including manure management (storage and application) systems (to improve water quality) and construction of watering stations and fencing to keep cattle out of streams (reduces stream bank erosion and improves water quality).

Equation 5. Total Applications

$$TA_i = \delta_{51}AWR_i + \delta_{52}SER_i + \delta_{53}WQR_i + \delta_{54}WMR_i + \delta_{56}EF_i + \beta_{500} + \beta_{505}Rur_i + \beta_{509}FAc_i + \beta_{510}RLF_i + \beta_{513}Mi^2_i + \beta_{515}Manure_i + \beta_{516}SE_i + \beta_{517}NF_i + \beta_{518}PR_i + \beta_{519}PL_i + \beta_{520}PCW_i + \beta_{532}Tobacco_i + \beta_{533}LVSTK_i + \beta_{534}RCDA01_i + \beta_{535}RCDA02_i + \beta_{536}RCDA03_i + \beta_{537}RCDA04_i + \beta_{538}RCDA05_i + \beta_{539}RCDA07_i + \beta_{540}RCDA08_i + \beta_{541}RCDA09_i + \beta_{542}RCDA10_i + \beta_{543}RCDA11_i + \beta_{544}RCDA12_i + \beta_{545}RCDA13_i + \beta_{546}RCDA14_i + e_{5,i}$$

In Equation 6, the variable PNE measures private non-farm employment and controls for economic forces that vary across counties. Conventional wisdom is that counties with higher levels of private non-farm employment are more engaged in business and development representing a more healthy local economy. Counties with larger values of PNE are also likely to be non-agrarian counties. Thus, it is hypothesized that EQIP funding will be lower in counties with larger levels of PNE.

Finally, CSA (county corn and soybean acreage) is included in Equation 6 to control for county variation in corn and soybean acreage. Although tobacco is Kentucky's most valuable crop, corn and soybean production accounts for 46% of all crop acreage (including tobacco and hay; 84% without hay). However, county corn and soybean acreage increases greatly from eastern to western Kentucky. Counties with more acreage in corn and soybeans are viewed by state and local leaders as being more "agrarian", and it is these counties that are assumed to receive more EQIP funding.

Equation 6. EQIP Funding

$$
\begin{aligned}
EF_i = \; & \delta_{61}AWR_i + \delta_{62}SER_i + \delta_{63}WQR_i + \delta_{64}WMR_i + \delta_{65}TA_i + \\
& \beta_{600} + \beta_{605}Rur_i + \beta_{609}FAc_i + \beta_{610}RLF_i + \beta_{611}InAg_i + \beta_{613}Mi^2{}_i + \\
& \beta_{615}Manure_i + \beta_{616}SE_i + \beta_{617}NF_i + \beta_{618}PR_i + \beta_{619}PL_i + \beta_{620}PCW_i + \\
& \beta_{630}PNE_i + \beta_{631}CSA_i + \\
& \beta_{634}RCDA01_i + \beta_{635}RCDA02_i + \beta_{636}RCDA03_i + \beta_{637}RCDA04_i + \\
& \beta_{638}RCDA05_i + \beta_{639}RCDA07_i + \beta_{640}RCDA08_i + \beta_{641}RCDA09_i + \\
& \beta_{642}RCDA10_i + \beta_{643}RCDA11_i + \beta_{644}RCDA12_i + \beta_{645}RCDA13_i + \\
& \beta_{646}RCDA14_i + e_{6,i}
\end{aligned}
$$

Estimation Results

This model is unique in that the dependent variables include a large number of 0 observations. Specifically, 60 of 120 Kentucky counties did not rank animal waste concerns (AWR), 14 did not rank soil erosion concerns (SER), 8 did not rank water quality concerns (WQR), 52 did not rank wildlife management concerns (WMR), 45 counties did not receive applications for EQIP funding (TA), and 50 counties did not receive funding (EF). Thus, count-data (or Poisson) models were estimated in place of ordinary least squares (OLS) models. Following standard two-stage (2SLS) estimation techniques, predicted values for the endogenous variables were determined from first round estimation of the appropriate reduced form equation. Next, appropriate predicted values were included as left-hand variables in second round estimation of the primary model equations.

In Table 3, we present the results of estimation of Equations 1 through 6. All rankings were affected by the total number of concerns expressed by each county (RMax). The higher the number of concerns expressed by a county, the lower the ranking of each of the relevant environmental and natural resource concerns (AWR, SER, WQR, and WMR). The variable representing the number of resource limited farmers (RLF) was never significant in any of the equations.

Animal waste concerns (AWR) ranked higher in counties that also had higher rankings for the wildlife management concerns (WMR) and lower rankings for water quality concerns (WQR: Equation 1). Counties with higher rankings for the animal waste (AWR) concern had higher median incomes and higher farm employment (InAg). Higher ranking for the animal waste concern (AWR) was associated with counties that have a higher proportion of the population is at least 65 years old (%Over), are larger in size (Mi^2), and have more acreage devoted to crops (FAc).

Counties with higher amounts of manure (MANURE), ceteris paribus, had a higher ranking for the animal waste management concern, thus reflecting the actual environmental conditions in the county. Counties with higher rankings for the animal waste concern had fewer applications for EQIP funding (Equation 1).

Soil erosion concerns (SER) by county were ranked lower as the number of concerns ranked by a county increased (RMAX; Equation 2). Higher rankings of the soil erosion concerns (SER) were associated with higher rankings for the water quality concern (WQR). Counties with higher rates of unemployment (UnEmp) and less cash receipts from farming (CR) had lower rankings for the soil erosion concern. There was no significant association of counties with high rankings for the soil erosion variable and the actual indicator for soil erosion (SE).

Higher rankings for water quality concern (WQR) came from counties that also ranked wildlife management concerns (WMR) highly (Equation 3). Counties with higher unemployment rates ranked the water quality concern lower. Drinking water violations (DWV) and ambient water quality contamination (AWQC) were associated with lower rankings of the water quality concern. The actual measures of nitrogen fertilizer application (NF), run off (PR) and leaching (PL) were not significant.

The wildlife management concern(WMR) was ranked higher in counties that also had higher rankings for animal waste (AWR) and soil erosion (SER) concerns (Equation 4). Although less applications for EQIP funding are associated with counties that ranked the wildlife management concern higher, there was more EQIP funding going to these counties. Counties with higher median incomes, higher rates of unemployment, more acres in crop production, a higher proportion of female head of households (F), and a higher percentage of surface covered by water (%H2O) had a higher ranking for the wildlife management concern. The actual measure of wildlife (PCW) was not significant.

From the results ranking the environmental concerns we can conclude that only the animal waste management concern ranking, as expressed by the counties, represents actual environmental conditions in the county. However counties with higher rankings for the waste management concern and corresponding actual environmental problems generated fewer applications for EQIP funding. Reliance on these rankings for allocating EQIP funding as required by legislation would help increase the effectiveness of the EQIP program. This is not the case, however, with the rankings for soil erosion, water quality and wildlife management. None of these correlates with the actual environmental condition in the county.

Simultaneity between the number of applications from each county (TA) and the proportion of cost-share money given to each county (EF) is indicated in Table 3, as both endogenous variables are significant (Equations 5 and 6). This simultaneity reflects the dependence of funding on applications received that follows the design of the EQIP program. Most applications for cost-share money came from counties that ranked lower the water quality concern (WQR) lower relative to the other environmental concerns. All other concern rankings were not statistically significant with the number of applications for each county. What we do not know is the nature of the environmental project proposed by the applicants. Counties with greater actual erosion problems (SE) generated a larger number of applications for cost-share assistance. A larger number of applications came from counties with relatively more acreage in crops (FAc). Larger size counties (Mi^2) that are more rural (%Rur), counties with more actual runoff (PR) and counties with more tobacco production (Tobacco) had a smaller number of applications.

The proportion of EQIP funding of projects in each county was positively related to the number of applications requesting cost-share funds from each county (Table 3). We do not know the amount of money requested by each applicant from each county or the type of environmental project for which they applied (soil erosion, water quality, animal waste, and wildlife management). A higher proportion of funds went to counties that had ranked soil erosion (SER) as a more important concern relative to water quality (WQR). Animal waste management,(AWR) concerns were negatively associated with EQIP cost-share funding. More EQIP cost-share money was given to counties that actually had a relatively higher soil erosion (SE) and nitrogen fertilizer loss rates (NF). More EQIP cost-share money was given to counties that actually had a relatively high population of wildlife (PCW) but had less acreage in row crops (CSA).

More EQIP funding went to counties that ranked soil erosion high as a concern (SER in Equation 6), despite the fact that soil erosion was ranked high by counties that did not have high actual levels of erosion (SE in Equation 2) and fewer application came from counties that had high actual levels of erosion (SE in Equation 5). Yet if a county did have high actual levels of soil erosion, this county received funding (SE in Equation 6).

More EQIP funding is going to counties that have higher nitrogen fertilizer loss rates (NF in Equation 6). Yet fewer applications for funding came from counties that ranked water quality high as an environmental concern (WQR in Equation 5). Furthermore, counties expressing a high ranking for water quality were not counties with actual water quality problems (Equation 3). Similarly, counties that had high rankings for wildlife management also had fewer applications for cost share funds (TA in Equation 4), but received relatively more EQIP funding (EF in Equation 4) although their concerns were not relating to the actual indicator for wildlife quality (PCW in Equation 4)

The rating for animal waste concerns did relate to the indicator for actual animal waste levels (Manure in Equation 4). However, relatively fewer applications for EQIP cost-share money were received by the counties that had ranked animal waste management problems high (TA in Equation 1). As a consequence, funds from EQIP did not end up in counties that highly ranked the animal waste management concern (AWR in Equation 6). Thus, probably, the EQIP program was not able to address concerns in counties that had more severe problems with animal waste management.

Conclusions

The effectiveness of the EQIP program in Kentucky in addressing existing important natural resource quality problems was the subject of this investigation. The EQIP program is designed to address animal waste, soil erosion, water quality, and wildlife management concerns. However it can only provide project funds to those counties from which the farmer applications were generated and it must consider priority areas as determined by local environmental concern rankings. The results of this study show that counties expressing a high ranking for soil erosion, water quality, and wildlife management concerns were not counties with lower levels of environmental quality in those areas. Only the county animal waste concern ranking was consistent with the actual measure of animal waste for each county. However, the counties that had high animal waste levels generated the least applications for cost share funding and received the least funding.

In future studies, EQIP data needs to report the number of applications and the amount of funding going to address specific environmental concerns in each county. This would allow a complete evaluation of the effectiveness of EQIP in achieving it's goals. The EQIP program would improve its effectiveness in addressing important environmental and resource problems by decreasing its reliance on the ranking of local environmental concerns because they do not match well actual environmental conditions.

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Table 1. Variable names, descriptions, and assigned parameter values for all endogenous and exogenous variables used in Equations 1 through 6.

Variable	Variable Description	Parameter[1]
	The Endogenous Variables	
AWR	County ranking for animal waste concerns	δ_{j1}
SER	County ranking for soil erosion concerns	δ_{j2}
WQR	County ranking for water quality concerns	δ_{j3}
WMR	County ranking for wildlife management concerns	δ_{j4}
TA	Total county applications for CREP funding	δ_{j5}
EF	Total county EQIP funding in $10,000	δ_{j6}
	The Exogenous Variables	
Intercept		β_{j00}
RMax	Total number of county concerns ranked	β_{j01}
Inc	County median family income ($1,000)	β_{j02}
Inc^2	County median family income squared ($1,000)	β_{j03}
UnEmp	Number of unemployed persons of working age	β_{j04}
%Rur	Percent of the county population living in rural areas	β_{j05}
%Over	Percent of the county population that is 60 years of age or older	β_{j06}
F	Percent of the county population that is female head of household	β_{j07}
CR	County aggregate farm cash receipts ($1,000)	β_{j08}
FAc	County aggregate farm acres (10,000 acres)	β_{j09}
RLF	Number of resource limited farmers	β_{j10}
InAg	Number of individuals employed in agriculture	β_{j11}
%H2O	Percent of the county covered by water	β_{j12}
Mi^2	Size of the county in square miles	β_{j13}

1. The subscript j = 1 .. 6 for each j equation (6 total) estimated in the endogenous system of equations (see Equation 1).

Table 1. (Continued) Variable names, descriptions, and assigned parameter values for all endogenous and exogenous variables used in Equations 1 through 6.

Variable	Variable Description	Parameter[1]
	The Exogenous Variables (Continued)	
Den	Density of the county (Population/Mi^2)	β_{j14}
Manure	100,000 pounds of livestock produced manure	β_{j15}
SE	Soil erosion (an NRCS index value)	β_{j16}
NF	Nitrogen fertilizer loss from farm fields (an NRCS index value)	β_{j17}
PR	Pesticide runoff potential (an NRCS index value)	β_{j18}
PL	Pesticide leaching potential (an NRCS index value)	β_{j19}
PCW	Percent change in wildlife between 1996 and 2002	β_{j20}
Coal	A dummy variable that is 1 if the county produced coal in 2000	β_{j21}
Mined	Number of years that coal has been mined from the county	β_{j22}
DWV	Drinking water violations (measured by EPA)	β_{j23}
AWQC	Ambient water quality of conventional contaminants (from EPA)	β_{j24}
TRI	10,000 pounds of toxic release to the environment (from EPA)	β_{j25}
PSYAWM	Percent of a NRCS staff year devoted to animal waste issues	β_{j26}
PSYSE	Percent of a NRCS staff year devoted to soil erosion issues	β_{j27}
PSYWQ	Percent of a NRCS staff year devoted to water quality issues	β_{j28}
PSYWM	Percent of a NRCS staff year devoted to wildlife management	β_{j29}
PNE	Private non-farm employment (1,000 individuals)	β_{j30}
CSA	County corn and soybean acreage (1,000 acres)	β_{j31}
Tobacco	County tobacco acreage	β_{j32}
LVSTK	County head of cattle and pigs (1,000 head)	β_{j33}

1. The subscript j = 1 .. 6 for each j equation (6 total) estimated in the endogenous system of equations (see Equation 1).

Table 1. (Continued) Variable names, descriptions, and assigned parameter values for all endogenous and exogenous variables used in Equations 1 through 6.

Variable	Variable Description	Parameter[1]
	The Exogenous Variables (Continued)	
RCDA01	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #1 (Jackson)	β_{j34}
RCDA02	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #2 (Green River)	β_{j35}
RCDA03	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #3 (Pennyrile)	β_{j36}
RCDA04	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #4 (Lincoln)	β_{j37}
RCDA05	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #5 (Mammoth Cave)	β_{j38}
RCDA07	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #7 (Heritage)	β_{j39}

1. The subscript j = 1 .. 6 for each j equation (6 total) estimated in the endogenous system of equations (see Equation 1).

Table 1. (Continued) Variable names, descriptions, and assigned parameter values for all endogenous and exogenous variables used in Equations 1 through 6.

Variable	Variable Description	Parameter[1]
	The Exogenous Variables (Continued)	
RCDA08	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #8 (Cumberland/Green Lakes)	β_{j40}
RCDA09	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #9 (Thoroughbred)	β_{j41}
RCDA10	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #10 (Cumberland Valley)	β_{j42}
RCDA11	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #11 (Licking River Valley)	β_{j43}
RCDA12	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #12 (Gateway)	β_{j44}
RCDA13	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #13 (Big Sandy)	β_{j45}
RCDA14	Dummy variable that is 1 if the county is located in Kentucky NRCS Resource Conservation and Development Area #14 (Kentucky River)	β_{j46}

1. The subscript j = 1 .. 6 for each j equation (6 total) estimated in the endogenous system of equations (see Equation 1).

Table 2. Estimated mean, standard deviation, maximum, and minimum values for all endogenous and exogenous variables used in Equations 1 through 6 for all 120 Kentucky counties.

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
		The Endogenous Variables		
AWR	3.992	5.587	0.000	27.000
SER	4.183	3.699	0.000	19.000
WQR	3.100	2.862	0.000	14.000
WMR	7.417	7.791	0.000	31.000
TA	7.675	12.076	0.000	57.000
EF	8.067	13.158	0.000	65.000
		The Exogenous Variables		
RMax	16.300	8.540	5.000	52.000
Inc	31.661	8.382	17.062	64.895
Inc^2	1,072.117	598.646	291.112	4,211.361
UnEmp	6.663	2.637	2.500	15.600
%Rur	75.961	24.931	2.800	100.000
%Over	17.692	2.930	10.343	24.363
F	10.757	1.982	0.300	18.000
CR	28.801	39.973	0.068	291.547
FAc	11.112	6.835	0.223	30.962
RLF	0.793	0.116	0.477	1.000
InAg	494.550	485.633	26.000	3,712.000
%H2O	1.791	2.635	0.000	15.876
Mi^2	336.742	130.597	100.110	788.840

Table 2. (Continued) Estimated mean, standard deviation, maximum, and minimum values for all endogenous and exogenous variables used in Equations 1 through 6 for all 120 Kentucky counties.

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
The Exogenous Variables (Continued)				
Den	108.103	204.057	21.500	1,801.200
Manure	194.975	228.756	1.997	1,190.129
SE	0.867	0.591	0.000	1.742
NF	4.175	3.775	0.007	16.450
PR	1.926	0.649	0.187	3.000
PL	2.261	0.987	0.000	3.000
PCW	91.404	199.104	-94.737	1,216.667
Coal	0.267	0.444	0.000	1.000
Mined	42.217	58.027	0.000	183.000
DWV	151.404	480.010	0.000	3,125.000
AWQC	0.558	0.591	0.000	2.000
TRI	59.045	138.134	0.000	1,042.304
PSYAWM	19.608	6.987	5.000	37.000
PSYSE	49.942	10.257	22.000	80.000
PSYWQ	0.933	4.555	0.000	26.000
PSYWM	11.642	4.823	4.000	25.000
PNE	12.232	39.769	0.155	406.891
CSA	19.888	34.983	0.000	151.700
Tobacco	1.105	0.914	0.000	3.590
LVSTK	22.055	19.298	0.000	87.400

Table 2. (Continued) Estimated mean, standard deviation, maximum, and minimum values for all endogenous and exogenous variables used in Equations 1 through 6 for all 120 Kentucky counties.

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
The Exogenous Variables (Continued)				
RCDA01	0.067	0.250	0.000	1.000
RCDA02	0.058	0.235	0.000	1.000
RCDA03	0.075	0.264	0.000	1.000
RCDA04	0.050	0.219	0.000	1.000
RCDA05	0.083	0.278	0.000	1.000
RCDA07	0.083	0.278	0.000	1.000
RCDA08	0.083	0.278	0.000	1.000
RCDA09	0.058	0.235	0.000	1.000
RCDA10	0.083	0.278	0.000	1.000
RCDA11	0.067	0.250	0.000	1.000
RCDA12	0.075	0.264	0.000	1.000
RCDA13	0.058	0.235	0.000	1.000
RCDA14	0.067	0.250	0.000	1.000

Table 3. Parameter estimates and statistical level of significance for each variable of the 6-equation system defined as animal waste ranking, soil erosion ranking, water quality ranking, wildlife management ranking, total EQIP applications, and total EQIP expenditures (Equations 1 through 6).

Variable	Parameter Estimates by Equation					
	Animal Waste Ranking	Soil Erosion Ranking	Water Quality Ranking	Wildlife Mgmt. Ranking	Total EQIP Applicants	Total EQIP Funding
	Equation1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
The Endogenous Variables						
AWR		-0.0137	0.0041	-0.0274[b]	-0.0138	-0.0404[a]
SER	-0.0205		-0.0651	-0.0609[b]	0.0220	0.0548[b]
WQR	0.1176[a]	-0.1192[a]		0.0433	0.0612[c]	0.0516
WMR	-0.0381[a]	0.0147	-0.0366[b]		-0.0160	0.0048
TA	0.0261[c]	-0.0025	0.0221	0.0530[a]		0.0910[a]
EF	0.0035	-0.0047	-0.0273[c]	-0.0228[a]	0.0656[a]	
The Exogenous Variables						
Intercept	6.6183[a]	1.1854	0.2006	3.8938[a]	0.5868	0.4171
RMax	0.0814[a]	0.0395[a]	0.0514[a]	0.0694[a]		
Inc	-0.0925[a]	0.0080	-0.0647	-0.0411[a]		
Inc^2			0.0010			
UnEmp	-0.2256[a]	0.0684[c]	0.1041[b]	-0.0124		
%Rur				0.0006	-0.0084[a]	-0.0043[c]
%Over	-0.1401[a]	0.0140	0.0283	-0.0033		
F	-0.0331	-0.0069	0.0100	-0.0808[a]		
CR		0.0058[b]				
FAc	-0.0510[b]	0.0020	0.0021	-0.0489[a]	0.1189[a]	-0.0103

a. Parameter estimate is statistically different from 0 with 99% confidence or better
b. Parameter estimate is statistically different from 0 with 95 to 99% confidence
c. Parameter estimate is statistically different from 0 with 90 to 95% confidence

Table 3. (Continued) Parameter estimates and statistical level of significance for each variable of the 6-equation system defined as animal waste ranking, soil erosion ranking, water quality ranking, wildlife management ranking, total EQIP applications, and total EQIP expenditures (Equations 1 through 6).

Variable	Animal Waste Ranking	Soil Erosion Ranking	Water Quality Ranking	Wildlife Mgmt. Ranking	Total EQIP Applicants	Total EQIP Funding
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
The Exogenous Variables (Continued)						
RLF	-0.8009	-0.6730	-1.5814	-0.7458	0.3804	-0.1653
InAg	0.0001	-0.0003	-0.0001	-0.0002		0.0004
%H2O				-0.0525[a]		
Mi^2	0.0017[b]	-0.0004	-0.0009	0.0015[a]	-0.0030[a]	-0.0000
Den			-0.0005			
Manure	-0.0001				0.0005	-0.0005
SE		-0.0929			0.8437[a]	0.3055[c]
NF			0.0065		0.0749[a]	0.1202[a]
PR			0.3045		-0.6924[b]	-0.1088
PL			0.1195		-0.1402	0.1144
PCW				0.0001	-0.0003	0.0005[a]
Coal			-0.1714			
Mined			0.0021			
DWV			0.0004[a]			
AWQC			0.2993[b]			
TRI			-0.0001			

a. Parameter estimate is statistically different from 0 with 99% confidence or better
b. Parameter estimate is statistically different from 0 with 95 to 99% confidence
c. Parameter estimate is statistically different from 0 with 90 to 95% confidence

Table 3. (Continued) Parameter estimates and statistical level of significance for each variable of the 6-equation system defined as animal waste ranking, soil erosion ranking, water quality ranking, wildlife management ranking, total EQIP applications, and total EQIP expenditures (Equations 1 through 6).

Variable	Parameter Estimates by Equation					
	Animal Waste Ranking	Soil Erosion Ranking	Water Quality Ranking	Wildlife Mgmt. Ranking	Total EQIP Applicants	Total EQIP Funding
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
The Exogenous Variables						
PSYAWM	0.0331[b]					
PSYSE		-0.0201[a]				
PSYWQ			0.0204			
PSYWM				-0.0006		
PNE						-0.0046
CSA						-0.0111[a]
Tobacco					-0.1602[c]	
LVSTK					-0.0025	

a. Parameter estimate is statistically different from 0 with 99% confidence or better
b. Parameter estimate is statistically different from 0 with 95 to 99% confidence
c. Parameter estimate is statistically different from 0 with 90 to 95% confidence

Table 3. (Continued) Parameter estimates and statistical level of significance for each variable of the 6-equation system defined as animal waste ranking, soil erosion ranking, water quality ranking, wildlife management ranking, total EQIP applications, and total EQIP expenditures (Equations 1 through 6).

Variable	Animal Waste Ranking	Soil Erosion Ranking	Water Quality Ranking	Wildlife Mgmt. Ranking	Total EQIP Applicants	Total EQIP Funding
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
The Exogenous Variables (Continued)						
RCDA01	0.7183[b]	0.1882	0.8095	0.1095	0.4082	0.3434
RCDA02	-0.4668	0.4154	-0.0249	0.4498[b]	-0.4795	1.1436[a]
RCDA03	0.8066[b]	0.2466	0.3697	-0.2957	1.5179[a]	0.1890
RCDA04	0.0279	0.4919	0.5987	-0.3109	1.0880[a]	-0.8092[a]
RCDA05	-0.2045	0.8140[b]	0.6517	-0.1842	0.8164[b]	-0.2344
RCDA07	0.7082[b]	0.9387[a]	0.7719[b]	0.4206[c]	0.7241[b]	0.2979
RCDA08	-0.3882	0.7617[b]	0.3070	-0.7508[a]	1.0876[a]	-0.6928[b]
RCDA09	0.7522[b]	0.4533	-0.4147	-0.3561	0.7897[b]	-0.3928
RCDA10	-0.6179	0.8752[b]	1.4690[a]	-0.6957[b]	1.3782[a]	0.1955
RCDA11	-0.6757	0.5746	0.4556	0.2265	0.9864[a]	0.1710
RCDA12	0.5591	1.2889[a]	1.3066[a]	0.2458	0.8679[b]	0.1033
RCDA13	-0.7558	0.5390	1.4178[b]	-0.6224[c]	1.2676[b]	0.5600
RCDA14	-0.0244	1.3450[a]	0.7890	-0.8872[a]	1.6414[a]	-0.961

a. Parameter estimate is statistically different from 0 with 99% confidence or better
b. Parameter estimate is statistically different from 0 with 95 to 99% confidence
c. Parameter estimate is statistically different from 0 with 90 to 95% confidence