Pesticides and Environmental Quality: A Discussion
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The four papers in this session explore the ability of different policies to reduce the environmental and health risks associated with pesticide use in US Agriculture. Ferraioli and Fernandez-Cornejo and Fernandez-Cornejo and Jans consider the effect of alternative Integrated Pest Management (IPM) practices on the demand for pesticides. Courbois evaluates the determinants of pesticide registration and considers the progress made by the EPA toward streamlining the registration process and approving the safety of pesticides. Gunter and Centner looks at how states deal with the disposal of unwanted pesticides.

Ferraioli and Fernandez-Cornejo and Fernandez-Cornejo and Jans estimate the impacts of various IPM practices (chemical, biological, and cultural techniques) on the demand for pesticides in US peach and corn production. In both papers, the analysis starts by estimating the probability that a farmer adopts a given IPM bundle using probit analysis. Next, a system of equations is estimated for the supply of the crop, the demand for pesticides, and the per acre variable profit function incorporating the predicted probability of adoption for various IPMs and the corresponding Mills ratio to correct for self-selection.

In Ferraioli and Fernandez-Cornejo, the use of biological IPM bundles significantly decreases pesticide use as expected. While one of the goals of IPMs is to reduce the amount of pesticides applied, the authors find that IPMs designed to enhance the efficiency of pesticide applications tend to increase the demand for synthetic insecticides

and non-synthetic fungicides. Cultural IPMs are found to have little effect on the demand for pesticides.

The USDA, FDA, and EPA are working together to reduce the environmental and health risks associated with pesticide use in agriculture. By targeting the adoption of IPM practices on 75% of US farmland by the year 2000, the USDA hopes to significantly reduce the use of pesticides. However, the authors' results suggest that not all IPM strategies will help accomplish this goal. Therefore, the USDA will find greater success if they target specific IPM strategies, such as biological controls.

In Fernandez-Cornejo and Jans, the pesticide demand estimates are used to develop a point system for ranking IPM practices. Points are assigned based on the reduction in pesticides accompanied by a one-percent increase in the rate of adoption of the IPM. If a particular IPM practice increases pesticide use, the practice is assigned no points.

Given the USDA's emphasis on using IPM to reduce the use of pesticides, it is important to develop measures to assess which IPM practices can provide the greatest benefit and those practices that are counter productive. Fernandez-Cornejo and Jans develop a methodology that takes a useful step towards obtaining a more objective measure of the benefits of different IPM practices in terms of reduced pesticide applications.

The authors' analysis in both papers is carefully performed. Though, I have some questions about the authors' independent estimation of the probit equations. The authors justify their method by stating "the regressors are the same across all the equations and there are no theoretical restrictions for the regression coefficients." While this statement is

correct, a farmer's decision to adopt a practice is not independent of his decision to adopt other practices. For instance, in Ferraioli and Fernandez-Cornejo, a farmer choosing to use biological techniques may be substituting for chemical pesticides and thus does not consider the adoption of chemical IPM practices. Therefore, the use of biological IPM and chemical IPM will be strongly and negatively correlated. Comparing the coefficient estimates in the authors' table 2 for biological and chemical techniques supports this hypothesis. With the exception of farm size and the dummy variable for California, all other coefficient estimates are of opposite signs. It would be useful if the authors could discuss the reasonableness of estimating independent probit equations for IPM adoption given these choices are interdependent. Is there a way to estimate the equations jointly? Can the joint estimation of the adoption equations improve the estimates in the second stage of the procedure? Is there any concern that the coefficient estimates in the second step of the procedure will be systematically biased due to positive or negative correlation between different IPM practices?

The point system derived in Fernandez-Cornejo and Jans is more objective and useful; still, some subjective judgements may eventually have to be made and have been made by the authors. For instance, the authors assign no points to practices that increase pesticide use. Why not assign negative points? Should the USDA discourage these practices since they hinder progress towards pesticide reductions? Also, the authors' estimate the impact of IPM for three classes of herbicides. The USDA could sum points across all herbicide classes to obtain a final rating, but this would imply that the USDA is equally concerned about all herbicide classes. Is there toxicity or some other kind of information on herbicide classes that would allow points to be more objectively weighted

to reflect the USDA's concerns regarding the potential environmental and health impacts of different types of herbicides? Maybe the analysis of past USDA policy decisions can be used to determine the USDA's preferences for the use of alternative herbicides.

Courbois uses pesticide registration data with a discrete choice logit model to evaluate the determinants of pesticide registration and whether or not the determinants of pesticide registration have change between 1995 and 1997. Two questions addressed are 1) does the EPA's process for registering pesticide tend to overlook pesticides for "minor crops" and 2) have recent initiatives by the EPA to improve the registration process increased the number of pesticides registered while improving the pesticide safety.

The EPA has attempted to streamline the registration process while also registering safer pesticides. Courbois results indicate that the EPA has made progress, pesticides were more likely to gain approval in 1997 relative to 1995. However, safer pesticides are not more likely to be registered. Also, pesticides for more valuable crops are more likely to be registered, so pesticides for "minor crops" are generally less likely to obtain approval.

Courbois results pose some interesting questions for further investigation. While the EPA has worked to improve the safety of the pesticides it registers, the probability of pesticide registration declines in safety. Two important questions that would be useful to explore are 1) why is the likelihood of registration declining in pesticide safety and 2) were safer pesticides more likely to be approved in 1997 relative to 1995? One potential explanation for the decline in the probability of registration as safety increases is that safer pesticides may in general be less effective or have a narrower range of control. Identifying and incorporating measures of pesticide efficacy could help the author address the first

question. For the second question, the interaction terms with year and safety suggest safer pesticides may have been even less likely to be registered in 1997. However, a more explicit test of this hypothesis would be useful. As a final note, a more detailed description of the regression equation and how variables were coded would help readers interpret the results in the paper. For example, it is not clear how Yr 1995 and Yr 1997 were coded?

Gunter and Centner discusses an important problem not only for US agriculture but also for US industry and households: what should be done about disposing of unwanted hazardous chemicals? The authors discuss five different options currently being used by different states to deal with unwanted agricultural pesticides and then rank these options based on efficiency and equity for both existing and future stocks of unwanted pesticides.

Gunter and Centner has identified an important issue that must be addressed in order to reduce the environmental and health risks associated with pesticide use. Their efficiency and equity rankings help organize and identify important considerations for the disposal of unwanted pesticides. Interestingly, the authors indicate that a state's regulatory framework is not an important indicator of the success of waste collection programs, but the authors need to justify their assertion. If the authors have information on the types of programs being implemented by states and the amount of hazardous material collected by these states, it would be helpful if they could present this information along with some more detailed analysis that addresses why states adopt various programs.