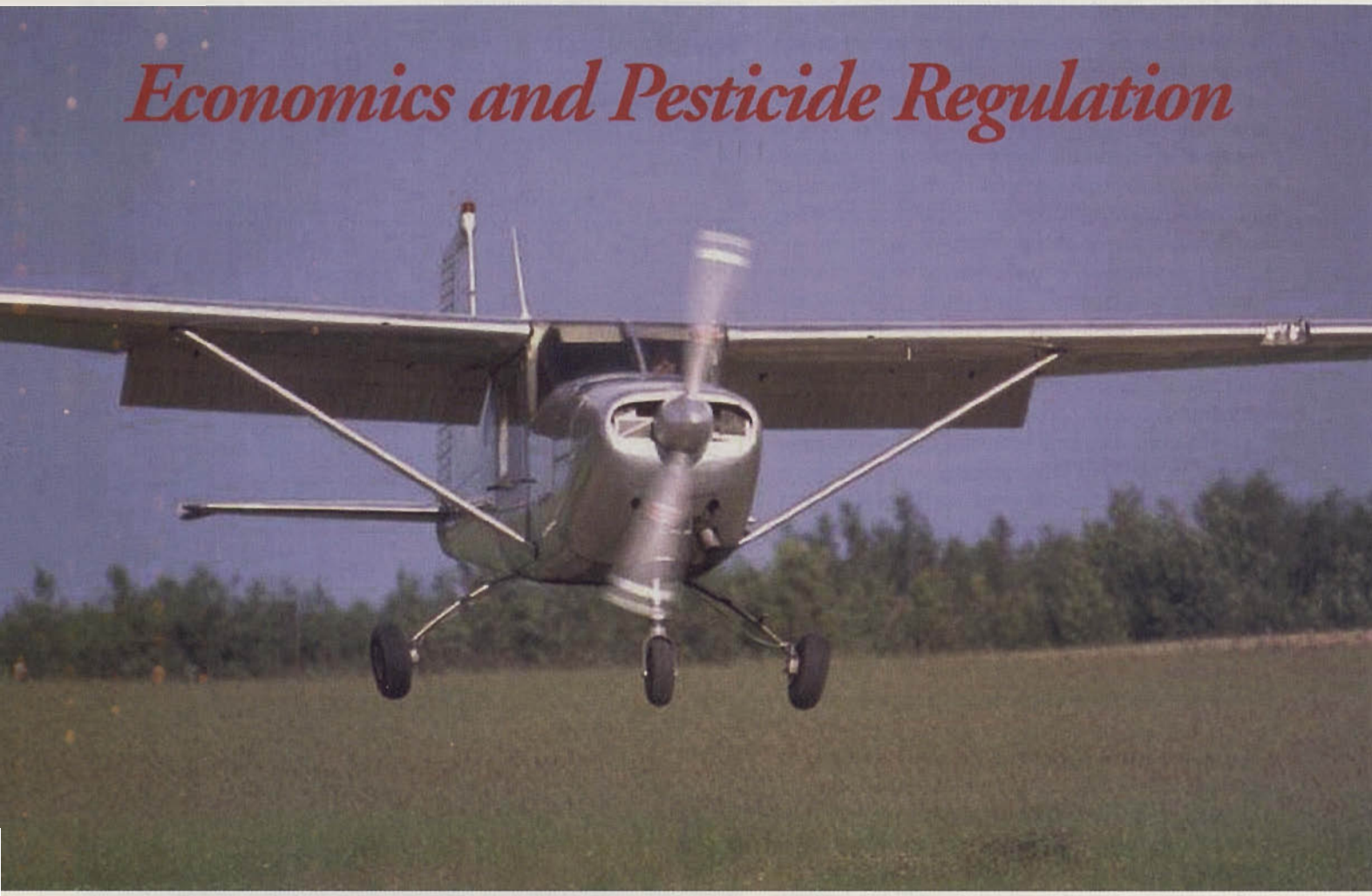
Economics and Pesticide Regulation



by Erik Lichtenberg, Douglas D. Parker, David Sunding, and David Zilberman

The productivity and environmental effects of pesticides are highly controversial. The farm community has tended to defend vigorously the use of pesticides, arguing that they are responsible for large increases in agricultural productivity. The environmental community has tended to stress ecological damage and threats to human safety and health from pesticides. The Environmental Protection Agency (EPA) is charged with striking a balance between the production of food and fiber and protection of the environment in regulating pesticides. Moore and Villarejo (*Choices*, Third Quarter 1996) present some fundamental objections to the ways in which EPA tries to assess those tradeoffs, holding up our work as an example of wrong ways to do so. While we disagree with the specific criticisms they level at our analysis, we believe that they raise some general points meriting serious discussion.

We'd like to make clear at the outset that we welcome Moore and Villarejo's attempt to evaluate our analysis of the impacts of canceling ethyl parathion uses in light of subsequent developments, regardless of our disagreements with the particulars of that evaluation. The state of the art in performing pesticide impact analyses could use improvement, and retrospective evaluations of those analyses can identify gaps and weaknesses in analytical methods and thus point out fruitful directions for further methodological development. Many of our own writings on pesticide regulation are attempts to draw general methodological lessons from pesticide impact analyses (see, for example, Lichtenberg, Parker, and Zilberman 1988; Zilberman et al.; Lichtenberg, Spear, and Zilberman; Sunding).

Moore and Villarejo have three main criticisms of our work: that we rely too heavily on biased subjective estimates of crop experts, that our models fail to capture the adaptive resilience of industry, and that we ignore farmworker safety and environmental benefits of restricting pesticide use.

Why experts?

Moore and Villarejo contend that experts' subjective judgments play too large a role in analyzing likely productivity effects of pesticide use restrictions. They argue that these judgments are usually biased in the direction of inflated claims of grower losses from increased crop losses, higher pest control costs, or both. While one can easily

find cases of such biases, we believe that expert judgment has and will continue to play a crucial role in these analyses.

Predicting what will happen if and when EPA decides to restrict or eliminate the use of a pesticide on a particular crop is perhaps more difficult than most realize. Pest complexes differ from region to region, even from field to field, so the likely effects of usage restrictions are highly variable. Application methods and chemical prices vary, too, as do the effects of the pesticide on human health and safety and on wildlife. Like politics, most pesticide problems are fundamentally local, so that the effects of pesticide usage restrictions are highly diverse.

Diversity matters in these analyses because EPA has flexibility to follow elementary economic logic by tailoring its restrictions to match the relative costs and benefits of pesticide use on different crops in different regions. Uses on crops or in regions that present little risk of environmental harm but have significant cost-effectiveness advantages should be allowable, while uses with high risk of environmental harm and low cost-effectiveness advantages should not. Moreover, the effects of canceling registration of a pesticide aren't limited to those using it. One of the striking results of our analyses was that nonusers may expand production and market share significantly. In short, there is no "one number" that summarizes adequately the impacts of canceling the registration of a pesticide; even on a single crop, the impacts vary too much across growing regions and (in cases like lettuce) seasons.

That diversity creates tremendous problems for analysts. Assessing the impacts of pesticide use restrictions requires identification of target pests and chemical and nonchemical alternative control methods. Current usage patterns, likely usage of substitute control methods, and the corresponding yield and cost effects must be estimated. That information must be gathered quickly, too, so that EPA can make decisions in a timely manner. The relaxed timetables of academic research don't apply in these situations; reports must be completed in a matter of months, lest EPA be accused of foot-dragging.

Expert judgment has played a critical role under these circumstances. The information provided by crop scientists, extension personnel, consultants, and others in the field is essential for identifying the key issues for analysis. All too often, hard data on pesticide usage patterns don't exist or can't be obtained in a timely fashion, so that expert judgment is the only source of data on usage. Even when hard data on pesticide usage patterns are available, as they are in California, those data can't be used to identify target pests—limiting their usefulness in assessing likely substitute chemicals—or potential nonchemical control methods. Moreover, expert judgment is frequently needed to make sense of the hard data that is available.

Parathion use on lettuce provides a good case in point. Moore and Villarejo note that the California Pesticide Use Reporting System clearly indicated that parathion use on lettuce showed a clear downward trend from 1980 on, and that this trend was apparent by 1986, when we performed our study. What Moore and Villarejo fail to realize is that this statewide trend was due to declines in one region alone, the San Joaquin Valley. As our report discussed, these same data showed that in the Salinas Valley ethyl parathion use on lettuce decreased from 1980 until 1983, then increased sharply in 1984 and again in 1985, while parathion use on lettuce in the southern desert area fluctuated every year with no apparent trend (Lichtenberg, Parker, and Zilberman 1987). Making sense of the Salinas data (which reflected the spread of the lettuce root aphid) required more information than could be gleaned from these data. Moreover, the statewide aggregate trend was highly misleading, because it masked a potentially severe problem in the Salinas Valley.

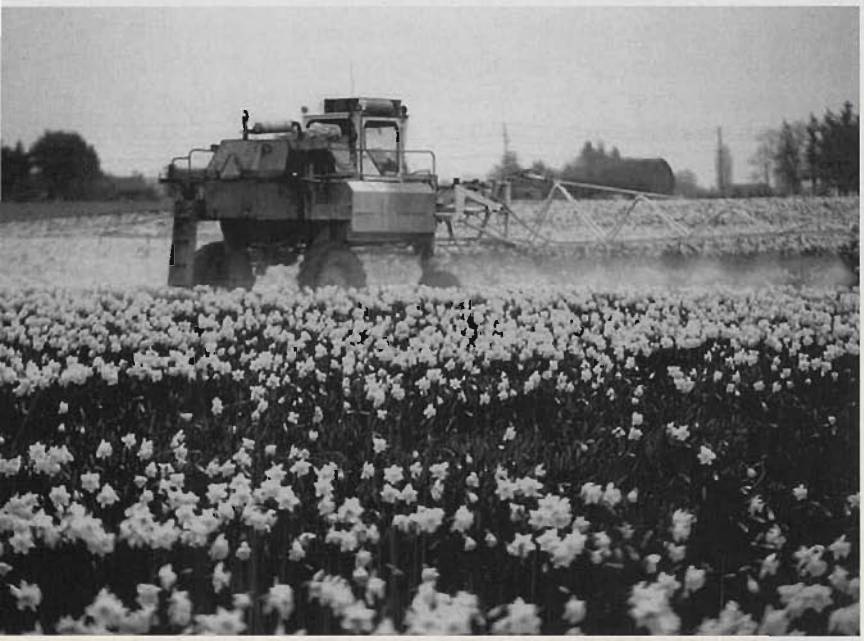
The increased availability of quantitative pesticide use data since 1986, when we conducted our studies on parathion, eases the task of performing such analyses. California's pesticide use data base has been expanded from restricted-use compounds to all pesticides. ERS conducts periodic surveys on pesticide use, and the National Agricultural Pesticide Impact Assessment Program has funded surveys aimed at documenting pesticide uses on numerous crops. Still, the available data do not cover a broad enough range of crops and growing regions to cover all situations EPA faces. Further collection of quantitative pesticide use information is probably a sound investment, particularly as falling computer prices keep lowering the cost of such investments. But there are uses so small that the expected return from data collection may never justify the cost, so that expert judgment will likely remain the sole source of information. And expert judgment will contribute critical insights into analyses of cases where quantitative information is available.

Economic models and industry adaptation

Moore and Villarejo claim that our model overstated potential industry losses from canceling parathion use on lettuce because it failed to take into account the ability of the industry to shift production to new land and of growers to switch to alternative crops. In fact, the principal methodological lesson we drew from our work on parathion was the importance of taking such effects into account.

The paper we published on the impacts of canceling parathion use on tree crops emphasized the notions that pesticide cancellations alter comparative advantage among growers in different regions and facing different pest complexes, and increases in production from current nonusers of a pesticide could offset decreases in production from current users to a significant degree (Lichtenberg, Parker, and Zilberman 1988). A subsequent paper on pesticide use restrictions more generally underscored the idea that such restrictions will have small impacts when the capacity for shifting production is large (Zilberman et al.).

Our lettuce model did take industry adaptability into account implicitly by distinguishing between production regions and between parathion users and nonusers in each region, and we did find that losses suffered by growers who were heavily dependent on parathion would be offset significantly by growers not using parathion. The main message of our lettuce study was thus that the impacts of canceling parathion use would be quite small. We did use high estimates of the acreage affected by the lettuce root aphid and of the corresponding yield losses; the scenario we forecast did not come to pass for reasons that were unforeseeable at the time, as Leonard Gianessi discusses in his letter to the editor in the second quarter 1997 issue of *Choices*. Even so, we estimated that output of lettuce in the summer in the Salinas Valley would fall by only 8 percent, that summer lettuce production in the United States would fall by only 7 percent, that the $16.7 million loss suffered by summer lettuce growers using parathion would be counterbalanced in part by $7.7 million extra earned by summer lettuce growers not currently using parathion, and that the losses involved for consumers and producers would each amount to only 3 to 4 percent of annual lettuce sales (Lichtenberg, Parker, and Zilberman 1987; Zilberman et al.). We also estimated that if an effective control method for lettuce root aphid were available, reductions in summer lettuce output would be negligible—as turned out to be the case. If anything, our report strengthened the case for canceling parathion use on lettuce.



Health and safety and environmental effects

We agree with Moore and Villarejo about the importance of integrating health, safety, and environmental effects into analyses of the impacts of pesticide regulation. Much of our research over the past decade has attempted to do just that. We published one of the few studies examining the costs and benefits of regulations aimed at protecting field workers from parathion poisoning (Lichtenberg, Spear, and Zilberman) and have published economic analyses of groundwater contamination by other pesticides (Lichtenberg, Zilberman, and Bogen; Sunding et al.). We didn't include these other effects in our lettuce study because EPA requested very specific analyses from us, preferring to integrate estimates of market-level effects with estimates of health and safety and other environmental effects themselves.

Incorporating nonmarket effects on health, safety, and the environment is not easy, though. Problematic data and reliance on expert judgment figure even more prominently in assessments of human health and ecological effects of pesticides than in estimates of productivity and price effects. Moreover, the expert judgments involved in estimating productivity and market-level effects are less prone to error and more easily verified than those involved in health and ecological risk assessments. Hard evidence documenting that pesticides cause long-term human health effects like cancers and birth defects exists only in a few exceptional cases—most of which involve pesticides long since canceled by EPA. Instead, potential cancers and birth defects are evaluated using screening protocols developed according to the best expert judgment available and relying heavily on expert judgment for detailed study design and interpretation of results. Similarly, public health statistics suggest that pesticide poisonings of farmworkers are rare. Experts' assertions that these poisonings are systematically underreported are largely responsible for the EPA's belief that they are sufficiently prevalent to be of concern. The same can be said for most of the evidence of ecological damage (for example, bird

and fish kills) in recent years, which is largely anecdotal rather than systematic and quantitative.

Rather than demonizing experts, it needs to be understood that analysts preparing assessments of regulatory impacts face a quintessentially economic decision about the use of information. Better-documented, more quantitative—in short, higher-quality—information provides a basis for better decisions. But information is costly in terms of time and resources. Choices among types of information should be made to achieve the greatest net benefit, given the available set of information sources, a set that includes expert judgments as well as quantitative information. These choices are inherent in all analyses involved in pesticide regulation, including assessments of human health and safety impacts and ecological effects as well as estimates of impacts on food and fiber markets. In such a context, partial information is clearly better than none, and the costs of obtaining more and better information (in terms of time as well as money) are frequently not justified by the potential benefits.

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Estimates based on such partial information will always be subject to error. To us, it seems best simply to acknowledge that fact and to provide policy makers with estimates of the extent of that error—in other words, of the uncertainties associated with the estimates provided—as we have done in several pesticide studies.

Moore and Villarejo accuse us of allowing excessive Kentucky windage in our analysis of the market effects of canceling ethyl parathion use on lettuce. Contrary to their claims, we believe subsequent events have demonstrated that our aim was true. We disagree with their pessimistic view on the role of expert judgment. In our view, ignoring the experts leads to less, rather than more, reliable information. But we nonetheless agree with them on the usefulness of retrospective analysis, the need to use quantitative data in addition to expert judgment, the need for economic models that capture industry adaptation, and the importance of integrating environmental and human health and safety concerns into economic models of pesticides.

For more information

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