A Critique of the Report, "Economic Impact of Methyl Bromide Cancellation"

by

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In early January 1996, the California Department of Food and Agriculture (CDFA) released a "non-partisan study" that described economic impacts that were predicted to result from the potential suspension of methyl bromide registration. Titled *Methyl Bromide: An Impact Assessment*, the report was described in a CDFA press release as having been prepared using data compiled by the University of California at Berkeley (UCB.)[1]

The California Institute for Rural Studies (CIRS) has no formal position in support or opposition to the pending legislation concerning whether or not to suspend or retain methyl bromide registration in California. At the same time, CIRS is fully committed to providing sound, reliable data upon which to base public policy decisions involving the agricultural and rural economies of our state. In what follows we do not attempt to answer the question of whether or not methyl bromide should be banned. Rather, given the trend toward more restrictions on pesticide use, the need for valid, useful economic modeling will become even more important.

We find the CDFA report to be seriously in error, and that the economic analysis on which it is based to be fatally flawed. In what follows we examine the CDFA report and relevant published reports from the economists of the UCB group.

At least three additional unpublished reports from the UCB group are cited as source material for the CDFA report but these have not been published as yet or, for that matter, even

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[1]. *California Department of Food and Agriculture, "Methyl Bromide: an Impact Assessment," Sacramento, California, January 9, 1996.*

released to the public.[2] CDFA's failure to release these materials unfairly precludes review by peers in the scientific community as well as by legislators called upon to consider this matter. Absent such scrutiny by the scientific community, these three additional reports must be dismissed as unreliable evidence.

CDFA claims adverse short-term impacts from suspension of methyl bromide will amount to between $287.7 and $346.3 million, including revenue losses of $248.3 million and job losses between 8,220 to 9,894.[3] Of the $248.3 million in imputed revenue losses, $147.4 million (59%) is attributed to the strawberry industry. As indicated above, the basis of these particular estimates is unpublished material not subject to the scientific review process and, on those grounds, can not be accepted.

Earlier published reports by the UCB economists arrived at a lower figure: $196 million in revenue losses.[4] Most of this loss is also attributable to the strawberry industry: $106 million in imputed losses in strawberry production and another $3.2 million in the strawberry plant nurseries.

This review concerns the report "Economic Impact of Methyl Bromide Cancellation" produced by a group of agricultural economists from the University of California at Berkeley.[5] The report was produced under contract to the California Department of Food and Agriculture. In summary, this report which concludes that methyl bromide cancellation will reduce farm income in California by more than $196 million annually, appears to be the result of combining bad science with an inadequate economic model. This marriage produces information based on anecdotal data and undocumented biological and economic relationships which were in turn

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[2]. *Ibid. See Footnotes #2 and #3, p. 9, and Footnote #4, p. 10. See also Footnote #31, p. 22.*

[3]. *Ibid. See p. 10 and p. 22.*

[4]. *Yarkin, et al, "All Crops Should Not Be Treated Equally," California Agriculture, Vol. 48:3, 1994, pp. 10-15.*

[5]. *David Sunding, Cherisa Yarkin, David Zilberman, Jerry Siebert and Alan Marco, "Economic Impacts of Methyl Bromide Cancellation," Department of Agricultural and Resource Economics, University of California at Berkeley, February 1993.*

used in an economic model biased towards maintaining the status quo with respect to pesticide use. Due to its structure, the model generates an exaggerated claim of damages for one group in society. Analysis such as this is unacceptable to the scientific community and can, if accepted by policy makers, cause harm to the vast majority of citizens.

Bad Science

What is meant by "Bad Science"? Quantitative models whether physical, economic or biological can only be tested using "real world" data. Use of incorrect, undocumented or data untested by scientific rigor in these models is considered unacceptable and the model's results are rejected because they can not be validated or the results replicated.

This study falls short of the standards of the scientific community in the following ways.

1. **Anecdotal data** are used admittedly by the authors as measures of variables critical to the end results of the model. For example:

a. The yield losses used in the study under the assumption that methyl bromide is canceled for all annual crops comes from an individual at the California Strawberry Advisory Board. Even if valid for strawberries, although no evidence was offered towards this conclusion, there is no scientific basis for extending this anecdotal data point to all other annuals. The assumption that yields of all perennial crops would decrease by five per cent if methyl bromide were canceled is also anecdotal.[6]

b. Costs of production changes such as the cost of applying substitute fumigants of $540 per acre are also anecdotal.[7] Systematic field survey research which directly measure

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[6]. *Ibid. p. 4.*

[7]. *Ibid. p. 4.*

actual costs of production under different regimes are essential to providing accurate measures of costs.

c. "Typical" market prices were based on anecdotal or a single year's data. Prices for the same commodity grown in different counties are reported to differ even though the commodity is traded in national and world markets.[8] Market prices in agriculture are well-known to vary widely from year-to-year, and within a given season. It is a generally accepted practice among agricultural economists not to rely on a single year's price, but instead use multi-year average values of price when quoting crop valuations. For example, the United States Department of Agriculture as well as other agencies require the use of 5-year "Olympic averages" of market prices when establishing the value of crop losses.

d. Market demand parameters used in the model are anecdotal or based on beliefs the subject commodity may behave in a manner similar to one that had been estimated. The source of these estimates was not documented.[9]

Anecdotal data is just that. It is anecdotal, it is not the product of rigorous scientific research that can be generalized to a population. As everyone's medical advisor, Dr. Dean Adell, says time and again, "one observation is just that, and results can't be generalized without a well-designed, replicated research protocol."

2. **Undocumented Relationships.**

a. Although the authors are modeling the economic impact of the biological relationships between pest populations and the removal of the major agent currently being used to control these pests, there is no documentation of this relationship. There are no references to studies of the populations of these pests and the economic yield of the crops being grown

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[8]. *Ibid. Table 1.*

[9]. *Ibid. p. 31.*

across different types of soils and/or the life of the crop. Thus, we must accept without reference or documentation, the assumption that, four years of solar sterilization for perennial crops is equal to four weeks of solar sterilization for annual crops or that summer fallow "enhances nutrient availability." Are we to take this on faith or is there documentation of this somewhere in the literature?[10]

b. The UCB group assumes that 95 per cent of all growers of targeted commodities use methyl bromide each time they plant, annuals or perennials. According to CDFA, "Strawberries are an annual crop. Each field planted to strawberries will be treated once with methyl bromide prior to planting during each growing season...Virtually all strawberry fields in California are treated with methyl bromide..."[11] The imputed losses cited above are also based on this central assumption, although the UCB group assumes that just 5% of strawberry acreage is not treated each year.[12]

We have tested this assumption by examining all California pesticide use reports pertaining to methyl bromide use in 1993 as obtained from the Department of Pesticide Regulation (DPR) data base. In the course of this analysis we found major errors in individual use reports and it was essential to correct them before proceeding to utilize the findings (see Table I). The original data was corrected for a wide range of types of errors and the total crop land treated with methyl bromide was determined (unduplicated treatment acres). Errors identified by CIRS included duplicate reports, incorrect quantities and units, incorrect geographical identification, and incorrect grower ID number.

For the two most important crops (ranked by the amount of reported methyl bromide use in 1993), we find that only 29 per cent of new grape plantings in the state and 62 per cent of new strawberry plantings reported using methyl bromide as a soil fumigant. If methyl

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[10]. *Ibid. p. 4.*

[11]. *California Department of Food and Agriculture, op. cit., p. 1 of Addendum.*

[12]. *Sunding et al, op. cit., p. 4.*

bromide is so critical to these commodities, why didn't more growers use it?[13] And why were damages calculated assuming higher utilization rates than DPR reported?

Table I

Pesticide Use, 1993 Methyl Bromide Applications
Acres Treated
CAL-DPR (as reported) & CIRS (corrected-unduplicated)

COMMODITY	CAL-DPR ACRES	CIRS ACRES
Almonds	370,175.41	20,189.35
Grapes	1,347.03	705.60
Grapes, wine	2,254.95	3,055.42
Nectarines	359.11	485.07
Peaches	4,223.70	4,040.44
Soil Application	3,018.88	1,195.49
Strawberries	159,381.03	13,876.58
Walnuts	6,193.02	6,225.67

The CIRS findings clearly contradict the CDFA assertion as well as the UCB group's central assumption. We find that 38% of all new (annual) strawberry plantings were not treated with methyl bromide in 1993. Out of an estimated 22,276 acres of new (annual) strawberry plantings in 1993, just 13,876.58 acres (unduplicated total) were reportedly treated with methyl bromide. The estimated new (annual) strawberry planted acreage cited above is derived from the statewide total strawberry production area of 25,029 acres in 1993.[14] About 11% of strawberry acreage is on a two-year planting cycle, the balance is planted annually.[15] This implies that 22,276 acres were planted in 1993 and are expected by both CDFA and the

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[13]. *Ibid, p. 6.*

[14]. *California Strawberry Commission, private communication, December 1995.*

[15]. *Ibid.*

UCB group to have been treated with methyl bromide.

c. Vapam is a "safer" alternative to methyl bromide for soil fumigation but the authors use anecdotal or undocumented assertions as to its higher costs and efficacy. For example, why does it cost as little as $465 per acre to fumigate the soil for grapes in one county, but $1,200 per acre to control the same pests for the same crop in another county? Where is the evidence that yield losses when using Vapam are 20 per cent for annuals and 5 per cent when used on perennials as compared to methyl bromide?[16]

d. Crop rotation benefits based on anecdotal evidence gathered on one farm are unacceptable in policy research.[17]

e. There is no documentation of growers receiving catastrophic yield declines when both Vapam and methyl bromide are withheld. If this assumption is true, then 100 per cent of all new plantings would have been treated but the DPR pesticide use reports show contrary evidence. See item (b) above.[18]

f. The assumption that use of methyl bromide is "optimal" is negated by the evidence reported by the DPR pesticide use reports. See item (b) above.[19]

g. Results in Sunding's Table 2 show that Vapam is not always the loss minimizing strategy. Thus, use of only the Vapam alternative in calculating the VMP of methyl bromide is incorrect and causes the value of methyl bromide to be overstated.[20]

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16. *Sunding et al, op. cit., p. 11.*

17. *Ibid, p. 14.*

18. *Sunding, et al, op. cit., p. 12.*

19. *Ibid. p. 17.*

20. *Ibid, p. 17.*

h. No justification is given for the use of a 4 per cent interest rate as the time value of money. The best estimate of the time value of money in agriculture is the borrowing rate on farm loans, this is much closer to 9 per cent. In fact, discounting the data shown in Table 3 at 9 per cent changes the ranking of the alternatives and thus calls into question the validity of the results shown in both Table 2 and Table 3 of Sunding.[21]

i. In the section on fumigation of fresh fruit, the authors assert without documentation that growers "typically" export fresh cherries at an average price of $1.66/lb. whereas the domestic fresh market price is $0.40/lb. and processing cherries sell for $0.17/lb. We are not told the source of these data, the time span over which they were averaged nor the pricing point. Are these farm gate prices, FOB packing house, terminal market prices or CIF landed prices in foreign markets?[22]

j. We are expected to accept without question the statement, "Based on Federal-State Market News data and an estimate of the price elasticity of domestic cherry demand of -2.0 it follows that domestic cherry prices would have to fall from $0.40 to $0.38/lb. to clear the market." The previous paragraph states that the domestic fresh market price averaged $0.40/lb., e.g., the market clearing price would have to be zero. The price elasticity of demand for fresh fruit reported by George and King in their classic study of food demand, "Consumer Demand for Food Commodities in the U.S.," provides a demand elasticity of only -0.6 which would generate entirely different policy implications than the above. Nowhere are we given the absolute quantity of the relative per cent or the California cherry crop exported.[23]

k. In the section on dried fruits and nuts the authors discuss the impact of methyl bromide cancellation on the walnut industry in California. They describe the time pressure to

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[21]. *Sunding et al, p. 17.*

[22]. *Ibid, p. 28.*

[23]. *George and King, "Consumer Demand for Food Commodities in the U.S.," Giannini Foundation for Agricultural Economics, Monograph No. 26, California Agricultural Experiment Station, 1971; Sunding et al, p. 28.*

get the crop harvested, fumigated, processed and shipped to Europe in time for the Christmas market. They go on to estimate the loss in grower revenue if methyl bromide was canceled using a domestic demand elasticity of -0.7 and an export demand elasticity of -2.0 based on "evidence from industry sources." Again, no documentation.

One industry statistic we have gleaned from the Economic Research Service, USDA, "Fruit and Nut Outlook Report" is that the California walnut crop carryover has ranged from 18 per cent to 36 per cent of the California crop in recent years. This raised the question, wouldn't it be more economical to simply use the slower but environmentally safer phosphine as a fumigant and carry over a sufficient quantity of nuts to meet the Christmas European market?[24]

l. In the section "Factors Likely to Mitigate Adjustment Costs," the authors fail to discuss the impact of the GATT and NAFTA agreements on non-tariff restrictions on imports of California agricultural products.[25]

m. What is the $196 million estimate annual loss as a per cent of total annual California agricultural income?

The Economic Model

Economic theory asserts that a market is not efficient unless **all** costs and benefits "to whom so ever they may accrue" are reflected in the costs incurred by the user of any commodity. That is, efficiency requires the cost of all externalities to be reflected back to the pesticide user. The economic model used in the study under review here is a partial equilibrium model. It is used to estimate the change in economic well-being of growers using

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[24]. *"Fruit and Nut Situation and Outlook Report," Economic Research Service, U.S. Department of Agriculture, various years; Sunding et al, p. 29.*

[25]. *Sunding et al, p. 33.*

methyl bromide operating as if there are no third party recipients of injuries to farm workers or especially the environment. That is, there is no social accounting for off-site or on-site illness or damage.

The UCB group has used the same economic model to estimate welfare costs associated with the cancellation of the registration of other pesticides in California. In the case of parathion the UCB group made a similar prediction of substantial economic loss.[26] Parathion was canceled in late 1991 and we have tested their predictions in this case. We found that the predicted reduction of lettuce yields, as much as 25% among fully half of Central Coast lettuce, did not occur. In fact, lettuce yields were unaffected by the loss of parathion. For further discussion of the short-comings of this approach and its incorrect application to the computation of the welfare costs in the case of pesticide cancellations, see Moore and Villarejo.[27]

When measuring changes in one or more groups' well-being, it is important to specify the starting point. That is, the groups' welfare prior to cancellation. In the case of pesticides, the correct starting point is the welfare of each stakeholder group prior to the introduction of the pesticide. If there are significant third party effects (externalities), the base line for measuring changes should be that one generated by an efficient market where the total social cost of the pesticide is reflected in the costs of the pesticide user. That is, the starting point should be the state and distribution of benefits and costs after all externalities have been internalized. Otherwise, if one group has use of an input where a portion of the costs are carried by third parties (externalities), the policy analysis will be biased toward the maintenance of the status quo. The latter is the case with the UC Berkeley model.

In addition, the model used in this report is deficient in the following ways:

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[26]. *Erik Lichtenberg, Douglas D. Parker, and David Zilberman, "Economic Impacts of Canceling Parathion Registration for Lettuce," Western Consortium for the Health Professions, 1987; ----, "Marginal Analysis of Welfare Costs of Environmental Policies: The Case of Pesticide Regulation," Amer. J. Agr. Econ., 70 (1988) 867-74.*

[27]. *Charles V. Moore and Don Villarejo, "A Review of Economic Models Used to Assess the Impact of Canceling Pesticide Registrations," California Institute for Rural Studies, December 1995.*

a. The model addresses only changes in the supply and price of the single target commodity ignoring the mitigating influence of the price and supply of close substitutes. For example, there are many close substitutes for strawberries such as other berries and fresh fruit. If the price of strawberries increases, consumption will decrease but consumption of substitute fruits will increase. There are also many substitutes for walnuts such as almonds, peanuts and filberts. Excluding information on the relationship of the target commodity with its close substitute produces an exaggerated estimate of the impact of cancellation.

b. On the supply side, the model ignores the cropping alternatives available to the grower if the target commodity became less profitable due to cancellation. There are many profitable crops annual and perennial available to growers in each of the micro-climates studied in this report. Assuming growers would continue to produce an unprofitable crop overstates the true economic impact.

c. Two key variables in an economic impact model are the price elasticity of demand and the elasticity of supply. Grower income is directly related to the sensitivity buyers show towards the market price. If a proportionate increase in price is related to a less than proportionate decrease in the amount consumers purchase, the commodity is considered "inelastic." In this case, total revenues to growers will actually increase when total supply decreases. In the report under review, for strawberries the authors chose a relationship that was just the opposite. That is, a very sensitive coefficient for their model. Contrary to published data (see George and King, 1971), they used an elasticity that caused total revenue to decrease if the total supply of strawberries decreased. Again exaggerating grower financial losses.

In the case of walnuts, the authors chose a demand elasticity that was sensitive to changes in total supply in the domestic market but insensitive to changes in the supply to the export market. While not giving either their method of estimation or their source, the combination of a supply sensitive (inelastic) domestic market and a supply insensitive export market produces the largest possible loss to domestic producers.

The authors should also have taken into account that walnuts are marketed under a Federal Marketing Order which has a provision for a "Reserve Pool." Activation of this pool allows the pool managers to remove walnuts from the market in the case of an extraordinary large supply. If the authors choose to utilize short term price elasticities they must also take into account normal and Reserve Pool carry over supply management practices.

The supply of a commodity in this study is assumed to be fixed in the short run. Methodologically this is correct when the planning horizon is short such as one year. However, if the authors use these results as an indication that these negative impacts will continue with no changes in planted acreage as prices change, they overstate the long run impact.

Conclusions and Policy Implications

Information has great value in policy making but no one has perfect information. Even information containing some errors has some positive value in decision making. However, information severely flawed by an erroneous data base, incorrect use of data or anecdotal data can lead to incorrect decisions and in fact have a negative value. The latter appears to be the case of the report under review.

This critique has reviewed the information sources which became the critical inputs to the economic model used to estimate impacts of the cancellation of methyl bromide. It was shown that anecdotal and undocumented data were used extensively in the model. These data came from single observations and undocumented beliefs of individual observers. These data were not the result of well designed and reproducible scientific experiments.

The economic model is a partial equilibrium model which focuses on the change in the well-being of a single group. **Not** included in the analysis are the third party costs and injuries attributable to the use of methyl bromide. Failure to include third party effects as the starting point biased the analysis towards the status quo.

The partial nature of the economic model overstates the negative impacts of cancellation on growers because the model assumes there are no substitute crops that can be grown. Also, no close substitute commodities were included in the model that could be purchased to mitigate consumer price increases. In fact, consumer well-being along with farm workers and the environment were completely ignored in the analysis.

Anecdotal information has no place in policy analysis. Use of anecdotal and undocumented data in an economic impact model invalidates that model and renders the results and conclusions unusable. Use of the data in making public policy will lead to policies and decisions contrary to the best interests of large groups of people both inside and outside the state.

It is recommended that given the magnitude of the projected losses to growers and the failure to include third party costs to farm workers and the environment that a small percentage of the estimated $196 million annual loss to agriculture be set aside for funding solid scientific research. The research scope should include not only documentation of a biological data base acceptable to the scientific community but also an equally rigorous research thrust for measuring the third party injuries, including negative impacts on the biosphere.