Commentary

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Stan Johnson's paper focuses largely on aspects of alternative statistical designs for policy models, rather than alternative designs of models or alternative modeling approaches. His paper has as its major objectives the explanation of different theoretical specifications of models and methods of localizing these models. His emphasis is almost entirely on statistically or econometrically estimated models. He also mentions that the subject of the paper is designing policy models as decision aids.

He has provided a very good synthesis of reasons why econometric models may not always have provided accurate forecasts or served efficiently for policy decisions. His main interest in the paper is in model specifications which simultaneously have theoretical justification and predictive accuracy. He properly emphasizes that the theory reflecting the specification is sometimes incomplete or nonexistent. He mentions that the performance of the models as decision aids has sometimes broken down because, although the internal resolution of the models has been good, predictions have partly depended on environmental variables which cannot be accurately projected. His suggestion for solving this problem is to endogenize these variables and have them predicted along with the rest of the system.

Other major modifications which he sees as necessary to improve the functioning of policy models include maintaining a current data base or set of observations and continuous model revisions. He states that optimal model design should have a configuration conforming with the decisions or actions that the output is to support. That is, variables should be included whose magnitudes will be determined as part of the system and by which the system can be evaluated by the decisionmaker. The model also should include the variables representing instruments to be controlled by the decision maker. He states that the structure should permit the analysis of decision rules in a construct that has predictive integrity. Since especially statistical or econometric models, are approximations of systems, they should reflect responses or behaviors of the appropriate system.

He mentions that the record of policy models for predicting and guiding decisions has not been good for either economy-wide models or sector models. Although this statement may well apply to economy-wide models, I am not as pessimistic for some agricultural sector models. Too, not all agricultural models are for predictive purposes. But to the extent they have been inefficient in the respects mentioned, the reason may be more that in the past too many persons have been concerned with building "one night stand" models as an end in themselves. That is the model per se has been an end rather than the means of prediction and decision aids. We have quite a trail of models, especially in the graduate schools, where the analyst built a model, estimated its parameters then abandoned it to go on and build another model which also was subsequently abandoned. This approach was in keeping with earlier research in agricultural economics where the analyst completed a discrete study, published a research bulletin or journal article from it, "wrapped up thus," and moved on to a completely different discrete study. In this early process of modeling, the theoretical appeal of the specification was frequently the purpose of the model activity and the existence of "wrong signs," the inability to predict well even within the sample of observations and related deficiencies were given little weight. The goal was to be a modeler, rather than to assist decisions through models. Improvement in models is more likely to come about when they are used continuously, kept updated, and repeatedly respecified to meet changes in data, economic environments, and experienced model deficiencies. Perhaps the commercialization of models (i.e., the use of ongoing models to generate predictions which are sold to clients) will best fulfill this role in the long run. This would seem to be a necessity if existing or new commercial models are to endure and a market for their services is to be maintained.

There is opportunity and need for public institutions to build and maintain more ongoing models for similar decision purposes for public policy. Once this goal is attained, I believe that some of the deficiencies that have been identified for previous models will be more readily overcome. Of course, some able analysts prefer not to engage in such a continuous activity since it does not involve going on to something new and different and may seem that they are performing a service in the manner of an extension specialist or a business economist. But I believe the criticism of Stan Johnson and some other economist has been that econometric models have not sufficiently or efficiently provided the services needed by decision-makers. Hence, I can see no reason why stigma should attach to individuals, institutions or firms who stay with their models and continue to use them while they are updated in terms of observations and respecified to provide more meaningful results. Some modeling efforts seem to follow cycles paralleling those of agricultural surpluses. A half a dozen years back, we had several people simultaneously working grain storage or buffer stock models. But we have little if any continuing work because each person published his results and went on to something else. After all, one wouldn't be in style if one persisted in perfecting his original model so it would be more useful in the next phase of the cycle. Modeling is an ongoing process, not a discrete activity. Many people are unwilling to follow the continuous respecification, updating, and estimating process because it does not bring noteriety and promotion. A young assistant professor probably would have a difficult time getting promotions, if he only kept up a well specified and updated model for continuous use.

I am not sure where Stan Johnson's discussion nets out with respect to complexities and completeness of the specifications and their underpinning theory. He seems to emphasize refinement in theoretical and specification aspects of models. However, he also suggests that complexity be avoided to the extent that decisionmakers or users can understand the model. I am not sure that the latter should be a tight requirement. The communications of the results or outputs of a model so that they can be understood and used by a decision or policymaker generally need not interfer with the construction of a model which is theoretically sound and generates dependable predictions. It seems to me that in most cases, the specification and estimation of a model is an activity differing from the interpretation and explanation of the results to users. I am sure that quite a large number of models, if not the majority, have been developed with an audience only of academicians in mind and with little expectation of real world use by policymakers or decisionmakers. It often is these models where the developer is more concerned with the theoretical and mathematical sophistication of the specifications than with the quantitative results and whether they give wrong signs, exploding paths, etc. But where the analyst does develope and apply a model for actual use in prediction and thus for use by policy and decisionmakers, he should develop a model of the complexity needed to perform useful and dependable predictions. Then, as a separate step, he or others should translate these results for use by the appropriate policymaker. It will be only an exceptional case where an assistant secretary of agriculture, a state secretary of agriculture, or an administrator in SCS will want to know the internal structure or understand the statistical techniques used in generating quantities reflecting the future under different scenarios or policies.

Because this is true and because the user will have to depend on the integrity of the modeler and interpreter, it is more important that dependable models, regardless of their complexity, be used, rather than resort to oversimplicity to an extent that all users can understand the model. For the good of users, the dependability of the model is more important than its simplicity. However, since it will probably remain that many users will not understand the theory, mathematics, statistics, and basic validity of the model (including its consistence with theory and the real world), the model builder needs to be trustworthy in the sense that the predictions he propagates are dependable.

One of Stan's major concerns is in model designs which do not have predictive integrity because certain variables of the economic environment cannot be accurately projected. Hence, model projections may "go wild" or "blow up." His solution is to endogenize these variables so that their values are determined within the system. This suggestion is fine for variables that can be so handled. But there are many which cannot be adequately handled in this manner (for example, those relating to wage agreements, price indexing, grain embargoes, OPEC pricing policy, and many others which have been mentioned at this conference). However, I have no objection to exercizing a bit of judgement and allowing these exogenous variables to take on alternative values (i.e., alternative scenarios) with prediction of other variables generated accordingly. Then the modeler and user may decide on the most likely alternative and use the corresponding set of model outputs. Too, there is no reason why the user or policymaker's judgement of the future values of exogenous variables should not be used in the analysis. There is great need for greater interaction between developers and users as the model is developed and applied — especially as it is applied. In the 1980 RCA analysis, we made 69 solutions of a national model. In five of these, we made our own assumptions about the future levels of a set of exogenous variables. In the other 65 solutions, the users (an interagency coordinating committee within the U.S. Department of Agriculture) provided their estimates of levels of exogenous variables and relationships such as exports, irrigation technology, public expenditure as in agricultural research, etc. They then could review outcomes under a range of scenarios which they helped devise and on which they were as well informed as the modelers. Also, they could use their own subjective probabilities, which were undoubtedly as good as those of the modelers, in selecting the most likely future.

While the reasons for, or uses in, building models are numerous, there are five major ones. One reason for building models is to generate theses which will serve for degree purposes of graduate students while allowing them exercize in applying statistics, econometrics, and economic theory. Another is to generate materials for a journal article where it is a presentation of the model per se, rather tan predictions from it used for decisions, which is the objective. These first two are fairly commonplace reasons for models and usually result in one night stand models which are seldom used again. A third major reason is to provide short-term forecasts of commodity prices, grain inventories, and other trading information for policy and other decision uses. A fourth major reason is to provide estimates of the effects of alternative policies, technological changes and market conditions on agricultural structure including such items as numbers, size, and distribution of farms, employment, capital purchases and inventories, farm income, etc.

To the extent that they are used for the latter two uses, the models will be mainly positive or predictive in nature. However, a fifth major use may call for a model which is more normative in character. This is the case of an imposition on agriculture of a policy or set of circumstances which have never previously been experienced and thus cannot be reflected in time series or sample data. It also is the case when we want to know the resource or production potentials of agriculture in a manner which cannot be estimated through a model predicted from time series data. For example, in recent years, the nation has had before it questions of whether its resources were sufficient to invoke controls and conservation measures which would improve the environment and maintain soil productivity at selected levels. Generally, a programming or simulation model is necessary for such purposes simply because there is no time series basis for estimating coefficients of water runoff, soil loss, and the like for different land classes, crop systems, and cultural practices.

However, while normative models may be needed to assess these potentials, we also may need predictive modules to estimate price and related outcomes if these potentials in environmental improvement, soil conservation, and productivity maintenance were attained. Increasingly, policy will have to concern itself more with issues of this nature. Hence, there also is a need to be concerned with more than the predictive ability of econometric models. A much greater mix of positive and normative models may be necessary for major agricultural policy issues of the future.

Unfortunately, Stan Johnson did not concern himself with other than positive models. (I consider an input-output model to be more descriptive or positive in character than normative). To answer many future policy questions, we will have to apply models where the coefficients of variables are derived from technological knowledge, simulated methods and other means than statistical production from time series data. In too many of the papers of this conference, it has been assumed that there is only one type of model — one estimated statistically or econometrically from time series data. The issue in modeling for policy purposes must focus more broadly than on econometric models alone. They represent one tool from the modeling kit. What we need to be concerned with is the whole set of quantitative tools and the one (or the combination) which is best for analysis of a particular policy question or problem. The set includes econometric, linear and nonlinear programming, input-output, systems simulation, and operations research generally. Often the task is that of combining two or more of these quantitative methods into a model suitable to the purposes. Discussions which treat modeling as if it concerned only econometric, time series constructs, as in the case of Bruce Gardner at this conference, are too narrow and inflexible. While we keep ongoing time-series econometric models, one of the greatest user demands from our model set over the last 15 years has been for national-interregional programming models.

At Iowa State University we have developed a large set of models in order to be able to analyze the impacts on agriculture of a wide range of changes in agricultural policies, market and export conditions, technological and structural changes, and previously unexperienced conditions such as fuel alcohol production, "forced conservation programs," reallocation and revised pricing of water, and others.

These analyses require both positive and normative type models. Normative type models are used especially where regional differentials are desired and the phenomena of concern has not been experienced previously. They are used to evaluate potentials in production, alternative use of resources, environmental conditions, water reallocations, etc., and especially to provide interregional interrelationships relating to various land classes, soil loss and environmental impacts. At one extreme in this normative set, we have a model which incorporates 223 producing regions, 12 land classes in each, 25 market and export regions, and endogenous transportation submodel, endogenous crop and livestock production activities, endogenously determined livestock rations, and soil erosion rates for each crop for each tillage method and each conservation practice on each soil type of each region.

This general model can be restructed so that production regions or land classes can be aggregated into a smaller number, so that livestock production and ration composition can be either endogenous or exogenous, etc. It generates results for national, state, producing regions, river basins, watersheds, land classes, and other entities. It can trace the relationship of a change in an irrigated region in Oklahoma on a dryland farming region of Washington. It can be used to estimate potential supply price effects of a range of policy, market, resource use, and technology situations. It has been used in all major national assessments of agricultural resource use and technology over the past 15 years.

As a modification, demand functions have been incorporated as a positive feature, while supply remains are expressed normatively through the programming proponent. These quadratic programming modifications allow simultaneous (nonsequential) analyses not only of the potentials of programs, technologies, environmental or conservation restraints, and resource changes or supplies, but also of the possible price impacts if these potentials were realized. These models provide great detail by region, commodity, resources, and other facets of agriculture.

At another extreme we have long used and extended an econometric, recursive simulation model. It has not emphasized short-run commodity price forecasts but has major focus on estimating, at the national level, the longer-run effects of changes in policies, market conditions, technological change, factor prices, and similar variables and our farm structure generally — including numbers and sizes of farms, resource demand and input use, farm income, capital use and farm expenses, and similar variables.

These projections are based, as is typically true for statistical or positive-type models, on relationships of the past. This model is structured on an annual sequential basis since we are interested in tracing out the impact of such changes over a fairly extensive time period such as 10 or 20 years. Quarterly commodity prices or similar variables have little importance in these uses. While we are in the process of regionalizing this econometric recursive model and adding more simultaneity, we have also developed linked or hybrid models of the national econometric model and the interregional programming model. These hybrid models also are recursive, with the econometric component determining prices when fed to the programming model where commodity supplies and resource demands are generated for the next period, etc., for subsequent periods. Again the hybrid model provides, for all of the nation's production regions, a normative analysis of potential should we try to produce as much food as possible, lower soil loss to specified levels, attain specified levels of environmental improvement, reallocate or price water on the basis of its marginal productivity, etc. But it also, in terms of its positive or econometric component, allows examination of the potential equilibrium price and impacts of these changes.

As a variant of this linked model, we have developed a regional model which has promise for several purposes. The econometric structure is retained for commodity demands, equilibrium price determination and commodity supplies outside the region of particular analysis. Supply in the region of special analysis is generated through a programming submodel and is added to the supply for the rest of the nation as predicted from the econometric model. The model is mainly normative for the problems being analyzed in the particular region, but more or less of a positive nature for the rest of the nation. This model was built at the request of the International Institute of Systems Analysis but promises to have considerable use potential in U.S. regional analyses.

Of course, various modifications and respecifications of the above model set can be and have been made to study specific problems. Modifications include specific models to analyze energy supply and price effects, energy production potentials in agriculture, alternative water pricing systems, and tradeoffs in soil conservation, production costs, energy use, and exports.

The problems of agriculture are so heterogeneous and the quantities which need to be analyzed, either to forecast short-term economic outcomes or analyze long-run potentials, are so various that no single model form can meet all of these needs. Hence, there continues to be justification for further development of a variety of models which can help answer problems related to different facets of the agricultural economy.