

Commentary

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I am approaching my assignment in this symposium from the viewpoint of a user of models of agriculture rather than that of a designer of models. Further, my viewpoint is that of an economist employed in the private sector in an industry engaged in supplying capital inputs to agriculture which must deal with an uncertain future in rather specific quantitative terms in supporting the business planning function. Long-term capital commitments involved specific decisions with respect to time, geographic location, size of the facility, and the equipment included within it. Short-term manufacturing production decisions are explicit with respect to the volume and specifications of the products to be produced and the timing of their production. The resulting purchase orders state in precise terms the specifications and volumes of materials required and delivery dates.

Reasonably reliable assessments of the most likely future course of economic events are required to establish the multitude of quantitative parameters involved in implementing such decisions. In an increasingly complex, volatile and changing economic environment, the penalty for errors in anticipating future economic developments can be severe, if not disastrous. By the same token, the rewards of correctly anticipating the future course of the economy can be substantial.

Since foresight in anticipating the future course of economic events yet falls far short of perfection, there exists the need for the capability to quickly re-evaluate future prospects when it becomes apparent that actual events deviate from forecasts either due to fundamental errors inherent in the forecast or as a result of the occurrence of new or unanticipated developments that require modi-

fication of plans within the limits of existing commitments. Both the cost of carrying through the analysis and the rapidity with which one can assimilate and respond to new information become important considerations. Timeliness of the analyses become a particularly important attribute.

There is a growing appreciation within the private sector of the usefulness of mathematical models in developing forecasts of business prospects, by allowing one to more fully and systematically take into account the increasingly complex set of interacting forces that impact the sector of the economy within which a firm operates. There is an increasing desire to have access to appropriately specified models as an analytical tool to enable one to more fully and more quickly evaluate the possible future implications of economic events as they occur. It is my impression, however, that this application of models is less fully developed within the agribusiness sector of the economy than it is in many other sectors.

While the end objectives of the application of models in the private sector may be somewhat different than the end objective of the application of models to policy analysis, the specification requirements for either application should be little different. In policy analysis the end objective is to evaluate the implications of a range of policy alternatives for the purpose of providing insight as to the most appropriate choice of policy mix. In the private sector, the end objective is to develop a forecast of economic conditions that impact a firm's future business prospects, usually under a given set of policies, or if policies are altered to determine the impact of a changed policy upon a firm's future business prospects. In either application the relevant and significant linkages between the agricultural sector and other sectors of the economy, as well as the relevant policy variables and their linkages to the economy, need to be specified in the model if reliable interpretations are to be made.

As Professor **Penson** has particularly emphasized, the growing interdependency between agriculture and the remainder of the economy has tightened the linkages between the agricultural sector and other economic sectors. Increasingly, agriculture must compete with the other sectors of the economy for resources used in common: energy, water, capital, land, labor, metals, and chemicals. To a similar but probably lesser degree, because of the fundamental nature of food, agriculture must compete with other economic sectors for the consumer's discretionary spending. Professor **Penson**

is correct in stating that the usefulness and reliability of models of agriculture are limited by their failure to reflect their linkages in their structure. His solution is the obvious one of including in models of the overall economy a more fully specified agricultural sector, thereby permitting the reflection of the simultaneous feedback between the agricultural sector and other economic sectors to which it has a linkage. This a direction in the development of models that is desired and to be encouraged.

However, Professor **Penson's** solution has the equally obvious disadvantage of requiring larger and more complex models which are costly to develop and maintain and cumbersome to use. Advances in computer technology have over time enhanced the ability to effectively manage large-scale models, and I suspect that such advances will continue to be made in the future, so this may not be a serious limitation.

A more serious limitation may be the availability of the appropriate data to permit the identification and quantification of the relevant linkages. Unfortunately, most of our economic data-gathering system was not designed with models in mind. As a result, model builders must make do with the data that happens to be available. Caution does need to be exercised that the specification of models does not outpace the capability of the available data to support them. Theoretically, elegant models based upon inadequate data can be just as misleading as a model that is not specified in sufficient detail. There is risk of discrediting a useful analytical approach by claiming more for a model than can be reasonably delivered. Professor **Penson** does, however, provide some evidence that does suggest that significant improvement in the quality of forecasts can be achieved by fuller specification of the agricultural sector within a model of the general economy, to more fully reflect the feedback among the sectors.

In discussing the modeling of investment behavior, Professor **Penson** points out the potential bias introduced into the model by employing the commonly used assumption that capital wears out in a geometric decay fashion. His example illustrates the care that must be taken in the uses of simplifying assumptions. In our own efforts to forecast farm machinery demand, we have had limited success in trying to relate current equipment purchases to the stock of equipment on farms, or with efforts to estimate a replacement cycle. We have had consistently better results by relating current

purchases to measures which reflect current economic conditions surrounding agriculture, with appropriate lags to conditions in preceding periods. We find the investment behavior of farmers with respect to machinery purchases to be more a function of current economic condition than of the stock of machines on farms. Farmers tend to be quite flexible in their machinery replacement patterns in an agricultural market that is as mature and highly mechanized as that of the United States. Farmers can readily defer their equipment purchases, when economic conditions are difficult, as they are at the present time, in the face of weak income, declining commodity price, and extremely high interest rates.

You might be interested in a brief description of our approach to the use of models in our efforts to forecast the near-term demand for farm equipment. We do make use of a fairly extensive model of the U.S. agricultural sector to develop a forecast of economic conditions expected to prevail over a two-year period into the future. The model is quarterly. A macroeconomic model, also quarterly, is used to establish a forecast of the relevant general economic variables required to produce the agricultural forecast.

The model of the agricultural sector does not include relationships that model the farm equipment demand. The farm equipment demand models are instead simple, single equation models that are solved separate from the agricultural model but are based upon output from the agricultural as well as the macroeconomics model. The forecasts are updated each quarter. It has also been our practice to re-estimate our machinery demand models each quarter to take maximum advantage of the latest available information on actual retail sales of machinery and the relevant economic variables. We also find this practice advisable as a means of monitoring the stability of our forecasting models.

Our approach may not appeal to the model purist because the whole complex is not neatly brought together into a single model. There is of course room for improvement, and we are continually making refinements as we learn more about the behavior of our markets. However, the point is that the approach we have taken, while not without problems, has tended to serve our needs quite well. In reviewing past forecasts to determine where we went astray, we have generally found that our principal source of error has been the failure to anticipate sudden and unexpected events such as the imposition of a grain embargo, a massive drought, or the spread of

the southern corn blight throughout **a major portion of the Corn Belt.**