CAPITAL BUDGETING ANALYSIS OF UNCERTAINTY IN IRRIGATION INVESTMENTS: DISCUSSION

by

Marvin T Batte *

Musser's paper addresses some of the issues raised by Boggess (1984) and in the discussion of that paper by Young. These authors observed that, although the irrigation decision is made to either increase profitability or to decrease business risk, there are other sources of risk created by the investment. Although Young cites several such sources arising from institutional or political sources, Musser focuses on increased financial risk arising from the changed structure of the firm's balance sheet as result of the irrigation investment.

Musser identifies the purpose of his paper to be "to evaluate the potential of capital budgeting methods to evaluate some of the uncertainty issues associated with irrigation." In particular, he suggests that current financial stress among these producers may be a result of expectations about the irrigation investment that have not been realized; that is, ex post NPV is substantially less that ex ante NPV. This, coupled with the greater financial risk created by the irrigation investment, may have increased the financial difficulties of these farmers. He further suggests that the model developed in the paper may be a useful and simple tool for use in a regional or national investigation of irrigated producers.

Musser's paper is organized into three sections:

1. Trends in irrigated crop production,
2. Capital budgeting model development, and
3. Applications of the capital budgeting model.

My comments will be organized to address each of these sections.

Trends in Irrigated Crop Production

Musser provides substantial data from the U.S. Census of Agriculture to demonstrate that irrigated acreage is rising, both in arid and non-arid regions of the U.S. For instance, there has been an average 170 percent increase in irrigated acreage since 1974 in the East North Central Region. However, Musser does not provide indication of the degree to which this increased irrigation has been for high valued crops such as fruits and vegetables versus for corn, soybeans and wheat, the more traditional crops of this region. Also, in many states, the base from which the percentage

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Marvin T. Batte is an Associate Professor, Department of Agricultural Economics, The Ohio State University.

change is calculated is relatively small. Although the percentage change indicated may be large, the absolute number of irrigated acres is still relatively small in the majority of these states.

Musser also devotes substantial space to the discussion of incentives for the irrigation investment. Essentially, a host of factors have changed which likely have increased the marginal value productivity of irrigation and/or increased the economic incentive for input substitution in the production process through changing relative factor prices. His arguments seem very plausible, especially as they relate to the new labor saving irrigation technologies which allow reduced variable costs of irrigation and more frequent irrigation scheduling than did previous irrigation technologies. Also important has been the historically high commodity prices of the decade of the 1970's, at least to the degree that decision makers treated these as expectations of future price levels.

Musser, however, does not complete the discussion of incentives for the irrigation investment. He implies that the primary incentive for expansion of irrigated acreage was to increase profitability. Clearly, yield risk reduction still may be a motivation. Not only are risk neutral decision makers convinced to invest, but similarly, an expanded range of risk averse farmers may have made the investment. Because NPV is higher with new irrigation technologies and high commodity price expectations, the cost of this method of yield "insurance" is reduced. Hence the risk-return trade-off is made less severe and a larger number of risk averse decision makers may have demanded the investment even though expected NPV may have been negative.

Capital Budgeting Model

As a methodology useful to study the impacts of irrigation investments on firm financial risks, Musser chooses capital budgeting, "partially based on its consistency with the issues of long term risk" raised in McCarl and Musser. Furthermore, it is simple enough to facilitate coordinated regional research and, due to the small number of parameters, is easily subjected to sensitivity analyses.

The model as formulated by Musser recognizes income tax features of the investment, and in particular, the change in tax liabilities resulting from the investment. Risk is incorporated by use of a risk adjusted discount rate model. Because equity capital is the residual claimant of income, a risk premium will be included as a reward for this entrepreneural activity. This cost of equity is disaggregated into components of a risk free rate (r), a business risk premium (BRP), and a financial risk premium (FRP).

To support the argument that irrigation investments have increased the likelihood of financial stress, Musser considers the effect of the investment on the cost of equity. If leverage is held constant, that is the investment is equity financed, then the

financial risk premium will be constant prior to and following the investment. To the extent that business risks are reduced by irrigation, the business risk premium, and hence the cost of equity, will be diminished. However, with an increase in leverage position to finance the investment, there will be an accompanying rise in the financial risk premium, and hence, a partial offset of the reduction in the cost of equity. Hence, the idea of risk balancing is introduced.

An additional item given little discussion concerns the estimation of the components of the interest rate, especially r, the risk free rate. Presumably, a standard risk free rate will be employed for all producers. The risk free rate can then be identified as a parameter for which sensitivity analyses can be performed.

Towards Application

Musser suggests that the capital budgeting model as formulated has two complimentary or alternative uses.

1. Source of hypotheses on sources of uncertainty
2. Model for empirical evaluation of uncertainty for a particular investments.

He demonstrates the first of these uses by hypothesizing relationships between the ex ante or expected parameters in the model and the ex post or realized parameters. It is difficult to argue with Musser's hypothesized changes of parameter values. Each of the parameters likely were altered from the expected in such a way as to diminish NPV. Hence, Musser's conclusion that ex post NPV is less than ex ante NPV seems reasonable.

In terms of the second use, Musser points out the difficulty in estimating some of the required model parameters. The change in leverage position and tax effects will be difficult to measure as will be the components of the discount rate. However, as Musser earlier observed, there are few such parameters in the model and sensitivity analyses could usefully provide insight into these interactions.

Although Musser does not discuss such a use, a third application of the model may be attractive. The model may be useful as an aid in investment decision making for producers. With beginning balance sheet and a few easily accessible numbers on investment cost and profitability, a broad range of outcomes could be simulated using alternative assumptions about prices, discount rates and salvage values.

In conclusion, Musser has provided useful elaboration on the interaction of the irrigation investment with firm financial risk. The capital budgeting model that he suggests seems valid as a method to understand the interaction of risk, tax features and net cash flows from the investment.

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