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EVALUATION OF RESEARCH EXPENDITURES IN CALIFORNIA AGRICULTURE

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Evaluation of Research Expenditures in California Agriculture

By

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B.Sc. (University of Nottingham, England) 1967
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DISSERTATION

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Abstract

The evaluation of research expenditures in California agriculture presupposes two types of allocation decisions. These are (1) the division of national product among consumption and the major kinds of investment, including agricultural research - usually one of the functions of government, and (2) allocation of the given research budgets among competing projects - the job of the director of research.

This study attempts to suggest answers to both, (1) by computing a return to the agricultural research investment which can be compared with returns from other public investments, and (2) by comparing returns from different kinds of agricultural research. The internal rate of return is used as the main summary statistic, despite its theoretical handicaps. Its calculation requires information on both the value of research, and the distribution of research benefits over time. Total or long run (zero interest rate) returns are also calculated.

The output from research activity is new information. It has value to society when it is disseminated and those able to use it respond by changing technique. The users are not necessarily the beneficiaries. Depending on institutional conditions this technical change may appear as consumer surplus or producer surplus or both. But these distributional aspects which are important policy issues are ignored here. In this study output and input were measured as price weighted indexes, which permitted the calculation of an "unexplained residual" over time. This residual is actual output less expected output using current

input quantities and base-period level technology.

Most of this study centers on the Cobb-Douglas production function, although the constant elasticity of substitution (CES) function is briefly explored. Previous work has sought to estimate technical change as a function of time. This is also done here, and additionally knowing the underlying research expenditures, can be expressed as a return to the research investment.

The major emphasis, though, was to assume that the "unexplained residual" arose as a result of previous research expenditures. Therefore, lagged research expenditures were introduced into the production function as a formerly omitted variable. The forms of lag investigated were the family of first and second order rational distributed lags developed by Jorgenson. Special interest centered on the second order lag models. They are the simplest schemes which have sufficient flexibility to permit the data to specify a lag having the desired theoretical shape, that is, to peak after some unspecified period.

Use of this lag form produced an equation which was non-linear in the parameters and was estimated by a non-linear least squares algorithm. An alternative approach was to impose prior estimates of the labor and capital elasticities on the function, which rendered it capable of estimation by ordinary least squares.

Data for the period 1949-69 were gathered for California agricultural outputs and inputs, and classified into four groups: fruits and nuts, vegetable crops, field crops, and livestock products. Research expenditures for the California Agricultural Experiment Station for the same period were classed into these groups where possible, and the remainder allocated in the manner of overhead costs. Data on private agricultural research were unavailable.

Results indicated that research conducted on the first two groups of commodities yielded low returns. Some of the point estimates implied negative returns to research, which is theoretically unacceptable, but these were generally insignificant. Returns to research on field crops and livestock products were high.

The variability of the results pointed to the dangers of misspecification and suggested that the data available were insufficiently discriminating for a very flexible lag form to be used. Rather, we need prior information or a better developed theory on the form of the lag between research expenditures and their influence on output. At present, this knowledge is not available, and is only likely to become so through closer study of research projects whose impacts are highly visible and quantifiable.

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