Multiple Linear Regression Viewpoints: An Index of Abstracts from 1986-1988

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Volume 15, No. 1

Ward, J. H., & Sorenson, R. C. (1986). Catalytic variables for improving personnel classification and assignment. Viewpoints, 15(1), 1-36.

The authors contend that there is no interaction between people characteristics and jobs in the prediction of job performance, then it makes no different in overall system performance which people are assigned to which jobs. To increase interaction (and, therefore, differential assignment potential), it is usually necessary to add new variables to the operational variables in the prediction system. The addition of new variables can be costly, time consuming, and frequently controversial. The approach described herein suggests adding predictor variables in a noninteractive way to the operational (interacting) predictors to increase the possibility of more interaction between people and jobs. If these additional noninteractive variables can increase interaction, they are called catalytic variables. Catalytic variables (which enter the prediction system in an additive way) are not required for use in the assignment of people to jobs to maximize overall system performance.

Thayer, J. D. (1986). Testing different model building procedures using multiple regression. Viewpoints, 15(1), 37-52.

The author indicates that one of the most appealing aspects of multiple regression to beginning multiple regression students is the amazing feat performed by a stepwise regression computer program. The process of selecting the "best" combinations of predictors so effortlessly and efficiently creates an overwhelming urge to use this procedure and the computer program that accomplishes it for a multitude of tasks for which it is ill suited. The author identifies the strengths, dangers, and limitations of this process.

Morris, J. D. (1986). Microcomputer selection of a predictor weighting algorithm. Viewpoints, 15(1), 53-68.

An empirical method (PRESS) for examining and contrasting the cross-validated prediction accuracies of some popular algorithms for weighting predictor variables was advanced and examined. The weighting methods that were considered were ordinary least squares, ridge regression, regression on principal components, and regression on an equally weighted composite. PRESS was executed on several data sets having varied characteristics, with each of the weighting techniques obtaining the greatest accuracy under some conditions. The degree of advantage or disadvantage offered by these alternate weighting algorithms relative to ordinary least squares was considered. As it was not possible to determine a priori which weighting technique would be most accurate for a particular data set from theoretical knowledge or from simple sample data characteristics, the sample specific PRESS method was proffered as possibly most appropriate when the researcher wishes to select from among the several alternate predictor weighting algorithms in order to achieve maximum cross-validated prediction accuracy. The feasibility of the use of a microcomputer for the computation intensive PRESS algorithm was also considered.

Rogers, B. G. (1986). Discussion of AERA 1986 Session 21.25 applications of multiple linear regression. Viewpoints, 15(1), 69-74.

The author presents his critique of the session 21.25 AERA conference presentations by Joe Ward, Jerome Thayer, and John Morris on multiple linear regression applications.

Smith, G., McNeil, K., & Mitchell, N. (1986). Regression and model c for evaluation. Viewpoints, 15(1), 75-89.

This paper presents an overview of the symposium on regression and Model C for evaluation. The objectives of this symposium are to:

1. Provide a rationale for using regression analysis (specifically Model C) to evaluate educational programs.
2. Provide one example of an extensive Model C evaluation report.
3. Discuss assumptions of Model C and ways to deal with those assumptions.
4. Share examples of disseminating Model C results to decision makers.
5. Identify and resolve additional technical issues that evaluators need to be concerned about when implementing Model C.

Thayer, J. D. (1986). Using multiple regression with dichotomous dependent variables. Viewpoints, 15(1), 9-98.

This paper concludes that tests of significance are identical whether the dichotomous variable is an independent variable or a dependent variable. It appears, therefore, that if the critics of using multiple regression with a dichotomous dependent variable are to be taken serious, they must also deal with all significance testing with t tests, analysis of variance, analysis of covariance, discriminant analysis, and any use of dummy variables in multiple regression. There may be other statistics reported in a multiple regression analysis, such as the standard error of estimate or predicted values for which the interpretations may not be appropriate when dichotomous dependent variables are used, but this paper did not deal with these issues.

Blumenfeld, G. J., Newman, I., Johnson, A., & Taylor, T. (1986). Relationship of student characteristics and achievement in a self-paced CMI application. Viewpoints, 15(1), 99-107.

Learner control of CBE applications has been an enticing topic of research. Reviews by Steinberg (1977) and Taylor (1976) indicate that effects upon achievement are equivocal when learner control has been compared with program or instructor control. The mixed results suggest the possibility of an interaction between certain aspects of instruction and characteristic of the learner, when the learner is permitted to control the program.

When trying to identify the relevant learning characteristics in a natural setting, the potential interactions and the types of relationships between variables are enormous. What may be needed to map out many of these possible relationships, develop a matrix, and systematically develop studies to investigate the relationship between these variables and learning. One may take a particular model such as suggested by McGuire (1960) and Whiteside (1964) which takes the position that when one is trying to account for complex behavior, one has to look at at least three classifications of behavior. One is the person variables which include things such as personality, intelligence, sex roles, learning characteristics, etc. The second is the characteristic of what is to be learned. Suppes (1966) and Gagne (1965) have given excellent examples of how to delineate the component of what is to be learned through a task or job analysis. The third is the environmental of context variables. These would include such things as the structure as well as the environment of the learning situation, interactions with peers, expectations produced by the environment (significant other within the environment). This three dimensional matrix may

facilitate the identification and systematic investigation of the variables which may influence and/or "cause" the differential effectiveness of "learning" as reported in the literature.

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Searls, D. T. (1987). Using diagnostics for identification of biased test items. Viewpoints, 15(2), 1-28.

This paper demonstrates how recent developments in the analysis of regression models may prove useful in the identification of atypical and potentially biased test items. Regression diagnostics studied are based on analysis of the sensitivity of leverage points, studentized residuals, and ratios of covariances due to the sequential deletion of each test item from the analysis. These procedures appear to offer a substantial refinement over existing approaches.

Williams, J. D. (1987). The use of nonsense coding the ANOVA situations. Viewpoints, 15(2), 29-39.

Nonsense coding systems can be constructed that retain outcomes regarding R^2 values, F values, and multiple comparison tests. Nonsense coding highlights the flexibility of coding ANOVA problems to be analyzed by multiple linear regression procedures; however, no additional analytic power appears to be gained from their use.

Strube, M. J. (1987). A general model for estimating and correcting the effects of nonindependence in meta-analysis. Viewpoints, 15(2), 40-47.

This paper describes a general meta-analysis model that can be used to represent the four types of meta-analysis commonly conducted. The model explicitly allows for nonindependence among study outcomes, providing exact statistical solution when the nonindependence can be estimated. Alto discussed are the directional biases that result if nonindopondence is ignored.

Houston, S. R. (1987). The use of judgment analysis and a modified canonical JAN in evaluation methodology. Viewpoints, 15(2), 48-84.

Judgment Analysis is presented as a technique for capturing and clustering unidimensional policies among a group of judges or evaluators. JAN utilizes a multiple linear regression model to represent each policy and then cluster evaluators together who

are expressing similar policies. JAN is extended to a multid mensional situation in which a modified and simplified canon- ical JAN (C-JAN) procedure for capturing policies on more tha two criteria is described. Both unidimensional and multidime sional JAN procedures should be of general interest o the evaluation methodologist.

Fraas, J. W., & Drushal, M. E. (1987). The use of MLR models to analyze partial interaction: An educational applicatior Viewpoints, 15(2), 85-96.

Certain research questions found in educational studies requir partial interaction effects to be tested. This paper presents an application of the method of using MLR models to test a partial interaction hypothesis.

Schonfeld, I. S., & Erickson, C. (1987). Conducting an 86- variable factor an analysis on a small computer and pre- serving the mean substitution option. Viewpoints, 15(2), 97-105.

The paper shows how we overcame limitations imposed on us by the memory capacity of the relatively small mainframe we used in conducting a factor analysis in which means are substitute for missing values. Insufficient memory did not permit us to employ SPSSX, with its mean substitution feature, in conductin a factor analysis of 86 variables reflecting ways in which parents cope with the hospitalization of their children. Instead, we employed a two-step solution: (1) we ran SPSSX Condescriptive to create z-score equivalents of the 86 vari- ables and recoded the z variable's system missing values to zeros; (2) the output of the Condescriptive run constituted th input of a BMDP P4M factor analysis run.

Blumenfeld, G. J. (1987). The use of multiple regression in evaluating alternative methods of scoring multiple choice tests. Viewpoints, 15(2), 106-133.

In this study, an attempt was made to develop a multi-variable approach for improving item validities via multiple regression procedures.

Colliver, J. A., Verhulst, S. J., & Kolm, S. J. (1987). A simple multiple linear regression test for differential effects of a given independent variable on several dependent measures. Viewpoints, 15(2), 134-141.

Multiple linear regression may be used to determine whether an independent variable of interest has a differential effect on two or more dependent variables. The initial step involves the separate standardization of each dependent variable. The values of the standardized dependent variables are pooled and treated for purposes of the analysis as constituting a single dependent variable. A within subjects independent variable is created and the levels of the variable are used to denote the different dependent variables. The data are analyzed with a split-plot analysis of variance for which the independent variables of interest is the between groups factor and the independent variables which distinguishes the dependent variables is the within subjects factor. The test of the interaction of these two factors provides a statistical determination of whether the independent variable of interest ha a differential effect on the two or more dependent variables.

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Bush, A. J. (1988). A perspective on applications of maximum likelihood and weighted least squares procedures in the context of categorical data analysis. Viewpoints, 16(1), 1-35.

The author presents a case for embracing both the ML and GSK technologies and for appreciating that both are fundamentally regression based strategies. Further, he hopes that the point has been adequately made that to argue which is better is, at best, a contextually bound issue which begs the question for a universal answer.

Presley, R. J., & Huberty, C. (1988). Predicting statistics achievement: A prototypical regression analysis. Viewpoints, 16(1), 36-77.

The purposes of the current study are: (a) to demonstrate a viable approach to the conduct of a multiple regression/correlation analysis; and (b) to illustrate the approach in the context of predicting achievement in an introductory statistical methods course. The analysis is proposed as being appropriate if the basic intent of a study is that of prediction as opposed to that of explanation. That is, the intent is to arrive at a model for predicting a criterion in as efficient a manner as the data on hand will allow. No model, causal or otherwise, is being posited or verified.

Morris, D., & Huberty, C. (1988). Some parallels between predictive discriminant analysis and multiple regression. Viewpoints, 16(1), 78-90.

The purpose of this paper is to outline some important similarities in, and differences between, predictive discriminant analysis (DA) and multiple regression (MR). The areas covered are estimates of model accuracy, hypothesis testing, and non-least squares models. Some of the parallels are well know, some are less well known, and some appear to have not yet been considered at all.

Williams, J. D., Williams, J. A., & Roman, S. J. (1988). A ten-year study of salary differential by sex through a regression methodology. Viewpoints, 16(1), 91-107.

A ten-year study of salary differential by sex was completed, using a multiple regression methodology, with rank, discipline, degree, years in department, years in current rank, and sex as predictors, focusing on the change in the value of the sex variable. The sex variable evidenced lower salaries for women when controlling for the other variables throughout the study period for both proposed and actual salaries from $341 in 1978-79 (proposed salary) to $1675 for 1981-82 (actual salary) to $504 for 1986-87 (proposed salary). This apparent drop in discrimination by sex in salary at each rank was accompanied by increasing differences in pay. The change is in the direction of "market adjustments," i.e., paying lower salaries to those in disciplines with higher proportions of women.

Huberty, C. J., & Morris, J. D. (1988). Multivariate analysis versus multiple univariate analyses. Viewpoints, 16(1), 108-127.

The argument for preceding multiple ANOVAs with a MANOVA to control for Type I error is challenged. Several situations are discussed in which multiple ANOVAs might be conducted. Three reasons for considering a multivariate analysis are discussed: to identify outcome variable system constructs, to select variable subsets, and to determine variable relative worth.

Thompson, B., & Melancon, J. G. (1988). Developmental trends in androgyny: Implications for measurement. Viewpoints, 16(1), 128-148.

The present study was conducted to investigate differences in item performance, reliability, and scale means of the Bem Sex-Role Inventory when comparisons are made across developmentally different groups. Analyses were conducted comparing results for adolescents with results for adults, and further analyses were conducted comparing results for the adolescents across various adolescent gender and age groups. The results tend to support the conclusion that the BSRI has reasonable measurement integrity when used with adolescents, and thus indicates that the measure may be useful in exploring developmental changes in sex-role perceptions as they occur during adolescence.

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McNeil, K. (1988). "Notes" covariance as the basis for all research questions and tests of significance. Viewpoints, 16(2), 2-9.

The author contends that the covariance straitjacket makes us think of certain limited possibilities regarding: (a) the order to tests of significance, (b) all adjustments based on rectilinear lines of best fit, (c) the number of covariates-one, (d) the covariate being a continuous variable, (e) R^2, and (f) "the big picture."

Sidhu Pittenger, K. K., & Fraas, J. W. (1988). The use of LISREL VI to test a management model. Viewpoints, 16(2), 10-32.

LISREL VI is used to test a relatively complex model of management which suggests a relationship between Leader-Member Exchange, Job Scope, and career outcomes of a young professional. The model if modified to improve the goodness of fit of the original model. The need to validate the reconstructed model has been acknowledged. Also, caution is urged in the use of path analysis as assessment of fit alone may not indicate misspecifications related to the model. The article demonstrates the use of LISREL in building and testing models in management theory.

Byrne, B. M. (1988). Testing the factorial validity and invariance of a measuring instrument using LISREL confirmatory factor analyses: A reexamination and application. Viewpoints, 16(2), 33-80.

The paper identifies and addresses four methodological weaknesses common to most previous studies that have used LISREL confirmatory factor analysis to test for the factorial validity and invariance of a single measuring instrument. Specifically, the paper demonstrates the steps involved in (a) conducting sensitivity analyses to determine a statistically best-fitting, yet substantively most meaningful baseline model; (b) testing for partial measurement invariance; (c) testing for the invariance of factor variances and covariances, given partial measurement invariance; and (d) testing of the invariance of

test item and subscale reliabilities. These procedures are illustrated with item response data from normal and gifted children in grades 5 and 8, based on the Perceived Competence Scale for Children.

Hu, M., Fisher, S. A., & Fisher, D. M. (1988). Effect of sample size on the MLE and WLS approaches to solving logit models: An empirical example. Viewpoints, 16(2), 81-92.

Logit is frequently used in education, business, and economics to model qualitative choice situations. Maximum likelihood estimation (MLE) and weighted least squares (WLS) are alternative approaches to solving logit models. WLS has been touted as computationally simpler and easier to interpret than MLE. Using economic data, this study compares the relative variability in parameter estimates between the MLE and WLS procedures as sample size changes. The results indicated that with reductions in sample size there are increasing differences in the coefficients provided by the alternative procedures. Additionally, both MLE and WLS exhibit instability at the smallest sample sample sizes.

Levine, D. U., & Stephenson, R. S. (1988). Differing policy implications of alternate multiple regressions using the same set of student background variables to predict academic achievement. Viewpoints, 16(2), 94-104.

The purpose of this paper is to utilize actual data sets in illustrating how substantially and sometimes radically different conclusions and implications can be drawn from alternate multiple regressions predicting academic achievement from the same set of variables measuring student background.