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ANALYSIS WITH INCOMPLETE DATA: A MONTE CARLO EVALUATION OF INTERVAL ESTIMATES UNDER SPECIFIED CONDITIONS OF SELECTION

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ANALYSIS WITH INCOMPLETE DATA:
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UNDER SPECIFIED CONDITIONS OF SELECTION

by

PHILIPPA PERRY

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Abstract

ANALYSES WITH INCOMPLETE DATA:

A MONTE CARLO EVALUATION OF INTERVAL ESTIMATES

UNDER SPECIFIED CONDITIONS OF SELECTION

by

Philippa Perry

Adviser: Professor Alan L. Gross

The present research examines estimates of the relationship between two variables derived from samples where selection has taken place. Paired information is present only for certain selected subjects and, from such incomplete samples, inference is to be made for the relationship in the total group of applicants. We explore the extent to which selection conditions and violations in the underlying assumptions for the data structure affect the value of the estimates derived.

In particular, a vector of test scores (Xt) is available for Nt subjects. Through a selection process, criterion scores (Y) are available for Ns selected subjects, Ns < Nt. For Nt - Ns cases, however, Y scores are missing. We want to estimate the XY relationship in the full applicant group, the total sample.
Estimates for the XY relationship in the total sample are derived from a probability distribution of the missing Y

scores. These estimates for regression coefficients, residual variance, and difference coefficient, have been derived under restrictive conditions for the sampling distributions and selection modes. This research evaluates the accuracy and sensitivity of these estimates when the underlying assumptions are violated.

A 4 x 3 factorial design is created setting 4 distributional types against 3 selection modes. At least 100 simulated samples are computer generated for each distribution-selection condition and expected values are computed for each estimate.

Cell (1,1) investigates the accuracy of the proposed interval estimates when the assumptions of the model are met; the remaining 11 cells explore and compare the effects of separate, as well as simultaneous, violations of distribution assumptions under each specified selection mode. An estimate for the total sample correlation is computed and evaluated as well.

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INTRODUCTION

There are a variety of reasons why researchers may want to do statistical analyses of incomplete data. Attrition during an experiment may account for missing observations and even missing cells in some design structures. In questionnaire type data a frequently encountered problem is the reduction of the data set through nonresponse. In situations where selection is based on a certain set of test scores, missing data is involved in the test validation procedures since criterion measures are available for the selected sample only. For whatever reason data become missing, whether through transcription errors, random loss, nonresponse, selection procedures or experimental design, it is important to pursue statistical models that may shed light on when we can reasonably ignore missing data and when we can justify the derivation of information from samples with missing data.

Hocking and Speed (1978) have reviewed a series of commonly used procedures in Analysis of Variance with unbalanced data, that is, when observations as well as cells are missing in factorial designs. Their work calls attention to the distortions that occur in hypothesis testing when data are unbalanced. Freund (1980) has evaluated the results of analyses with missing cells in

ANOVA using two distinct computer routines. His work illustrates that it is extremely unclear exactly what is being tested under certain configurations of the available data. If analyses are to be useful, it is important that conditions for the available data, the missing data, and assumptions about their relationship be precisely defined. The research of Robert and Janet Elashoff (1966-1969) and of Rubin (1973) distinguishes between data that are missing at random and those for which specific conditions may be defined. There exists an extensive literature on procedures for parameter estimation in cases of randomly missing data; the area of nonrandomly missing data is relatively unexplored.

The concern of the present research is the situation where selection in admissions for college, special project or personnel recruitment, is based on a set of test scores (X). Validating the test with criterion measures like grade point average or job performance assessment, involves missing data since criterion scores (Y) are available for the selected sample only. Questions of practical concern are: How good a predictor is the test? What would be the correlation of X and Y scores if everyone were admitted? What are the effects of certain selection procedures on the validity estimates of the test? What difference in criterion scores might we expect between the selected and unselected groups? How sensitive to variations in assumptions are the estimators that might provide answers to the above questions?

A review of attempts to address these questions reveals four principal areas of research:

1. Reconstruction of the total sample from an incomplete subsample to provide estimates of total sample statistics. This is not the same as parameter estimation, where the emphasis is to infer characteristics of the population on the basis of samples. Here we are interested in the XY relationship in the total group that might have existed if selection had not taken place.

2. Examination of selection procedures to understand their precise effect on estimators. Gulliksen (1950) has provided numerous formulae that relate parameters in cases of explicit or incidental selection on one or more variables. He cautions that the actual selection facts of a given situation determine the choice of the formula that is appropriate. The problem then is to correctly identify the basis of selection. It is not always apparent which variable actually determines selection ; we may need to assess the "actual" versus the "intended" role of X as a predictor of Y. Further, selector variables may be unavailable, or difficult to measure; there is need, therefore, for procedures that might accomodate a wider range of selection models.

3. Investigation of the robustness of estimators.

The linear model provides the theoretical framework for estimators that have been produced in this area of study. The usefulness of these estimators becomes questionable when the strong distributional assumptions of the model are not satisfied by the actual data. In particular, preliminary investigation suggests that linearity is most frequently violated under selection conditions. Monte Carlo methods are especially suitable for assessing the effects of model violations on the proposed estimators.

4. Exploration of interval estimates for the statistics of interest. Point estimates for the population XY correlation, ρ , have been investigated for their properties under varying sample sizes, selection ratios, and parent population characteristics. Findings are that these estimators over- or under-estimate the parameter when model assumptions are violated, when selection is extreme, and when correlations are low. There is an obvious limitation when a single value is produced as an estimate; it provides a single dimension of information: greater than, less than or equal to the quantity of interest. Confidence intervals as estimates enhance the location information with a level of assurance. We see interval estimates, therefore, as more informative devices than the typical point estimates.

The particular concern of this investigation emerges from the issues outlined above. Reconstruction of the total sample was achieved by the construction of a predictive probability distribution for the missing criterion scores. This led to the derivation of interval estimates of the XY relationship in terms of the constructed distribution. This dissertation provides a comprehensive evaluation of 1) the accuracy of the interval estimates and 2) the robustness of the estimates under various distributional assumptions and selection modes.

By means of a 4 x 3 factorial structure and simulated samples the effects of nonlinearity, heteroscedasticity, and their simultaneous occurrence, could be explored under selection conditions that are typically encountered in practice. In addition to selection explicitly on the predictor variable, we explore Compensatory selection: selection on a composite of X and Z, which does not mandate a minimum score on either variable, and where, in effect, Z might compensate for X. The third selection mode, Multiple Cut-off selection, sets minimum scores on both X and Z and guarantees the involvement of the variable of interest in the selection process.

The investigation involved the generation of over 4 million random numbers in more than 10,000 bivariate and trivariate distributions. This was done on a microcomputer and the programs written in Basic are readily adaptable to other systems.

In this research we were able to illustrate convincingly that the interval estimates of the XY relationship in the total sample are reliable, consistent, and possess a reasonable precision for use in practical applications when the conditions of the model are met. In addition, the estimates are shown to retain useful properties even when the distribution conditions are violated provided that the predictor variable has specific involvement in the selection.

The problem of missing data is a recurrent one in educational research. An understanding of the sensitivity of estimates to violations in the underlying model benefits future applications where real data are involved.

CHAPTER I

REVIEW OF THE LITERATURE

1. Overview

Gleason and Staelin (1975) identify two major threads in the literature on missing data analyses:

1) The statistical approach which relies on classical estimation methods like least squares and maximum likelihood, has the advantage that the underlying model has tractable characteristics that allow for analytic evaluation. However, the analytic nicety of this approach necessitates strong distributional assumptions that might restrict its applicability in a large class of actual research data.

2) The heuristic approach, more pragmatic methods geared less to the data generation process,emphasizes instead maximum usefulness of the available data. This is illustrated in methods where information from the incomplete sample is used to refine initial estimates obtained from the complete portion of the sample (Hocking and Smith, 1968), and in the considerable multivariate literature where estimates for missing entries reconstruct the total sample. The evaluation process in the heuristic category relies on comparative judgement of efficacy among the different methods; this is generally achieved through Monte Carlo studies.

Another important consideration is the distinction between studies where data may be assumed to be missing at random, and those which involve nonrandomly missing data. Although estimation methods in both types of circumstances might exhibit parallels, the conditions and assumptions concerning the missing data feature in the formulation of an appropriate model. When the processes that caused the missing values cannot be ignored, as in selection or censoring, models must deal with the nonrandom missing values as well as the given data configuration.

Where explicit selection on X, say, has produced the missing data, the problem of inferring the total XY relationship is often referred to as the problem of "restriction of range". Studies in this area are directed at parameter estimation from the information in the selected group where the "range", in terms of variance, is restricted. The major problems in restriction of range derive from the failure of real data to satisfy the linearity and homoscedasticity assumptions of the underlying model, and the confusion about the actual basis of selection.

Again, it may well be that models underlying the selected and unselected samples differ radically. A linear model may not hold for the total sample whose characteristics we want to infer, even though we may be able to analyze the selected sample data under a linear model.

For these reasons, more flexible estimation methods than the traditional statistical approaches are sought.

We will examine the problem of this dissertation within the context of previous research involving missing data. In section 2 we will briefly discuss the statistical estimation methods that have been applied to this area of study, emphasizing how missing entries were handled, what the goals of the estimation process were stated to be, and, finally, the types of distributional assumptions that were necessary.

Section 3 will deal more extensively with the issues in nonrandomly missing data analyses. Here we will examine the theoretical framework of the problem and discuss research related to selection models, point estimators and confidence intervals. Bayesian methods from which the estimators evaluated are derived will also be reviewed.

The final section of the literature review, Section 4, will treat the heuristic approach which characterizes the current trend in missing data analyses. Although research here is primarily related to data missing at random, there are interesting illustrations of maximally accomodating available data in refining estimates. Studies from bivariate and multivariate analyses are examined for their impact on the design of the current study.

2. Statistical Estimation Methods

The preferred statistical procedure in the research reviewed has been maximum likelihood estimation. This is because maximum likelihood estimators possess the desirable properties of sufficiency, efficiency and in most cases consistency.

In maximum likelihood estimation we want to compute the sample statistic that maximizes the likelihood function, i.e. we want to obtain an estimate of the ppopulation parameter that makes the observed sample most likely. Maximum likelihood estimators are sufficient: they utilize all of the information on the parameter that the sample contains, and are, in effect, the most likely representative of the parameter that the sample produces. Maximum likelihood estimators are efficient: based on the minimum variance principle the more efficient estimator will have smaller sampling variance; maximum likelihood does well against other methods. If the observations come from identical dsitributions, maximum likelihood estimators are consistent: as sample size increases the maximum likelihood estimate tends to the true parameter value. The sampling distribution of a maximum likelihood estimator is asymptotically normally distributed.

The major disadvantage in maximum likelihood is that there is bias in many cases. With large sample sizes there is no problem because of the consistency property; when N is small, the issue of bias and its precise effect must be resolved.

Analyses of a variety of missing data patterns have been conducted by Lord (1955), Anderson (1957) and Nicholson (1957) using maximum likelihood. The underlying structure in each case was a multivariate normal model and the equations for the likelihood functions were quite complicated sometimes. In fact, Anderson's work was offered as a simplification for estimating means, variances and correlations by the maximum likelihood method.

Another statistical alternative, the method of least squares, provides the best unbiased estimators for the linear model. This was the method used by earlier researchers, in classical as well as modified forms, to estimate means and regression weights. Afifi and Elashoff (1966) have done an extensive review of this literature and what emerges is the heavy reliance on normality assumptions and the minimal use made of incomplete data. In effect, estimates depend only on the complete sample; partial data in the variables with missing entries are discarded. It follows, then, that when the number of complete cases is small relative to the total sample, least squares estimators may not perform as well as other methods. The work of Lin (1971) in estimating difference of means in samples with missing data from a bivariate normal population, demonstrates that maximum likelihood is more efficient than least squares when there is a moderate number of complete pairs of observations.

When the structure underlying the data is of known distributional form, the statistical methods when applied will exhibit predictable properties. Least squares estimators may sometimes coincide with maximum likelihood when populations have a normal distribution. When the underlying distribution is blatantly not normal, as in limited range questionnaire response data, both estimation methods for missing data may be useless. Since most practical research produces irregular probability functions, there arises the need to weigh the attractiveness of analytic methods against the severity of model violations. The search for estimation techniques that utilize the information collected, and, at the same time, rely less heavily on the assumptions of the multinormal model continues.

Pragmatic alternatives to the statistical approach have as their main feature the estimation of missing entries. Earlier research, except for Wilks (1932), showed little interest in value substitution for missing data points. Heuristic methods are documented for multivariate analyses reviewed in a later section.

3. Issues in Nonrandomly Missing Data Analyses

3.1 Estimating the XY relationship

In considering the problem, it is valuable to note the theoretical relationship between parameters of a selected (selection based on X), and a total population where no selection has occurred. This is illustrated in the equation:

$$\rho_{xy} = \left[1 + \frac{\sigma^2_{x^*}}{\sigma^2_x} \left(\frac{1}{\rho^2_{xy^*}} - 1 \right) \right]^{-.5} \qquad 1.1$$

* refers to the selected population

σ^2, ρ denote variance and correlation respectively

The assumptions of equation 1.1 are: (Lord and Novick (1968) p.142)

1) the true regression function of Y on X is a linear function throughout the domain of X:

$$E(Y \mid X) = \alpha + \beta X \qquad 1.2$$

2) the conditional variance of Y, given X, does not depend on X

$$\sigma^2 (Y \mid X) = \sigma^2 (Y \mid X') \text{ for all } X, X' \qquad 1.3$$

This says, in effect, that the minimum mean square error regression function is not affected by explicit selection on X; the same regression line holds throughout. Equation 1.1 is not an estimate, but rather yields the exact relationship between the parameters of a full population and a population selected on X.

In problems where one must estimate the population correlation between X and Y (ρxy) using an incomplete XY data set, the same basic assumptions of linearity and homoscedasticity underlie the estimate. In particular, under the assumption that the sample is drawn from a bivariate normal population, selection is based on X, and Y measured for only the selected cases, Cohen (1955) derived the maximum likelihood estimator of the population XY correlation:

$$\hat{\rho}xy = \left[1 + \frac{sx^2}{\hat{\sigma}_x^2}\left(\frac{1}{r^2} - 1\right) \right]^{-.5} \qquad 1.4$$

$$sx^2 = \sum_{i=1}^{Ns} (x_i - \bar{x}_s)^2/Ns,$$ variance of X in the selected group

r = correlation between X and Y in the selected group

$\hat{\sigma}_x^2$ = the maximum likelihood estimator of the population variance of X, its representation depending on the conditions of selection.

Equation 1.4 with the maximum likelihood estimates substituted for the parameters, is identical to 1.1.

Whereas equations 1.1 and 1.4 consider the population correlation (ρxy), one might be interested in the correlation between X and Y in the total applicant group (Rxyt). Using the same format as for the parameter estimator $\hat{\rho}xy$, one might consider R a likely estimate of Rxyt:

$$R = \left[1 + \frac{sx^2}{Sx^2} \left(\frac{1}{r^2} - 1 \right) \right]^{-.5} \qquad 1.5$$

Sx^2 = variance in the total group for X

One would then need to examine the accuracy of this point estimate in the same way that studies concerned with estimating ρxy have investigated bias and mean squared error. One would expect to deal with the issues of point estimators raised in Section 3.3.

3.2 Conditions of Selection

The assumptions that govern the choice and ultimate usefulness of estimators in missing data analyses are related to the processes that cause the data to be missing. Where data are missing at random, researchers may choose to abandon consideration of the data generation process and concentrate on the resulting pattern of observed data. In nonrandomly missing data analyses the applicable model is determined by the selection process that gives rise to the unobserved data.

As we have noted in the preceding section, estimates for ρxy depend on the conditions of selection. This means essentially that the estimates depend on the information in the available data. Cohen (1955) explains the distinction between censored samples and truncated samples. Discussion of these and other issues in selection follow.

Censored samples

In this category the size of the total sample Nt is known. X scores are available for Nt subjects, while Y scores are only present for Ns, Ns < Nt. Here, where there is a measure x_i for each subject in the total sample, the variance in the total sample is computed:

S_x^2 = variance in the total sample

$$= \sum_{i=1}^{Ns} (x_i - \bar{x}_t)/Nt$$

and this value is substituted for $\hat{\sigma}^2_x$ in Equation 1.4 The equation is useful regardless of the manner of selection on X.

Truncated Samples

In truncated samples the number of unmeasured cases is unknown. Here X and Y scores are observed for Ns cases and each x_i satisfies the restriction $x_i > x'$ or $x_i < x'$, left or right truncation on a specified cut score x'. Neither X nor Y is measured for Nt - Ns unselected cases and the size of the unselected sample is unknown. For this reason we need a different computation for the estimate of population variance from the one used in censored samples. In the left truncated sample, for $x > x'$, $\hat{\sigma}^2$ in Equation 1.4 is replaced by:

$$s_x^2 + \hat{\theta}\,(\,\bar{x}_s - x'\,)$$

where $\hat{\theta}$ can be obtained from a table compiled by Cohen (1961).

Modified Restrictions in Samples

Modifications of censored and truncated sample estimators of validity will apply in 1) doubly restricted samples, where the selected sample consists of subjects whose X scores fall in some specified range: $x' < x < x''$, where x' and x'' denote fixed boundary scores, or 2) samples where a proportion of subjects are selected for measures on

Y, the proportion and manner of selection determined by certain criteria, e.g. 10% of subjects above x', and 30% below x' form the selected sample.

Exact use of the formula in Equation 1.1 requires the population standard deviation on one of the variables, typically X. For the case of selection on X where the selection ratio is known, e.g. top 10%, but the standard deviation of X in the applicant population is unknown, Sands et al. (1978) provide a table of estimates of the correlation between X and Y corrected for restriction in range. These estimates depend on the selection ratio and represent a modification of the censored sample case.

$$\hat{\rho}_{xy} = \frac{\rho_{xy^*}}{\sqrt{(1 - \rho^2_{xy^*})\left[1 + \frac{Z\gamma}{\Phi} - \left(\frac{\gamma}{\Phi}\right)^2\right] + \rho^2_{xy^*}}} \qquad 2.1$$

* refers to the selected population

Φ = the selection ratio

Z = the standard normal deviate corresponding to Φ

γ = the ordinate on the standard normal curve that corresponds to Z

In this case the variance ratio, selected to total, is replaced by a quantity representing selection ratio, and use is made of the properties of the normal curve:

$$\frac{s_x^2}{S_x^2} = 1 + \frac{Z\gamma}{\Phi} - \left(\frac{\gamma}{\Phi}\right)^2 \qquad 2.2$$

The normality assumption is clearly a central feature of this formula and it allows for corrected validity coefficients as a function of the selected group features and selection ratio.

Cohen (1955) notes in his censored data studies that "the process to select X may differ from the process to select which X's have Y measured." This indicates the complexity of modelling selection processes and illustrates again that the issue is not simply truncation or restriction in range in many cases, though these form subsets of nonrandomly missing data analyses.

In practice it is true that other variables besides test scores affect selection; some are readily quantifiable and may be weighted to perform as a univariate selector. Variables like interviews, letters of recommendation, sex, may be recorded formally and used in some consistent way in the selection process. However, because of the difficulty in assigning quantitative relationships among such variables, these need not be included in the analysis.

One may assume that the probability models underlying the distribution of Y scores in selected and unselected groups are identical if one of the following conditions holds:

1) selection is solely on X.

2) selection is based on X together with a set of Z-variables, (Z1, Z2, ...Zk) where Y and Z are conditionally independent given X.

For example, if X is an admission test score, Y is freshman grade point average, and the Z variables are sex and geographic location, it may be plausible to assume condition 2. This, however, is seldom the case when other measured variables are present.

Linn (1968) explored the problem of using an available measured variable as if it were the explicit selector. He examined ρxy in Equation 1.1 to see what effects there would be if selection were based, not on X, but on some other variable Z. Fixing the correlations between the predictors X, Z and criterion Y respectively at .6, and varying the correlation of X wih Z and the selection ratio, he computed the corrected XY correlation. Compared with the given .6 value, the calculated ρxy overestimated for $\rho xz < .3$ and underestimated for $\rho xz \geqslant .3$. The over- or under-estimation varied directly as the selection ratio.

Cohen (1957) provided maximum likelihood estimates for ρxy when selection is in terms of a third variable, Z, say. Assuming that the joint distribution of X, Y and Z is trivariate normal in the applicant population, the estimate has the following form:

$$\hat{\rho}xy(z) = \frac{r_{xy^*} + k\, r_{xz^*}\, r_{yz^*}}{\left[\left(1 + k\, r^2_{xz^*} \right) \left(1 + k\, r^2_{yz^*} \right) \right]^{.5}} \qquad 2.3$$

$$k = \frac{\hat{\sigma}^2_z}{s^2_{z^*}}$$

* refers to the statistics of the selected group

$\hat{\sigma}^2_z$ = the maximum likelihood estimate of variance

$$= \sum_{i=1}^{Nt} (z_i - \bar{z}_t)^2 / Nt \text{ for censored samples.}$$

For selection on a third variable Z, $\hat{\rho}_{xy(z)}$ typically yields a value greater than the computed XY correlation in the selected group. This is consistent with the idea of reduced variance in the selected group, so that the ratios of variance, selected to total, are less than 1. Levin (1972) has illustrated that it is possible for the correlation in the selected sample to exceed the maximum likelihood estimate. If a third variable Z has extreme correlations with X or Y, (close to 1 or 0), then it is possible for rxy (the correlation of X with Y in the selected group) to exceed $\hat{\rho}_{xy(z)}$.

It appears then, that relationships among measured variables that are included in the selection process need to be carefully assessed. It is important also to identify the actual basis of selection. Roe (1979) suggests a strategy for differentiating "intended" from "actual" selection. His method may be viewed as an effort to reduce a multivariate selection to an essentially univariate one, but it also represents a means of including available measured variables, Z1, Z2, ...Zk, in an approximation of the explicit selector. Roe constructs a selector variable based on the role of each variable in the selection that actually took place. Using S = 1, 0, selected or unselected, a regression equation is constructed using the Z-variables as the predictors. The predicted S value is given as :

$$\hat{S} = bo + b1Z1 + \ldots bkZk$$

If the point biserial correlation between $\hat{S}$ and S is high, we treat S as the explicit selector variable, that is, equate X with $\hat{S}$.

It is noted that the Roe method because of its use of regression weights in constructing a selector variable, involves additional sampling variance in the maximum likelihood estimates. On the other hand, this method does provide a preliminary means of examining data vis a vis the assumptions that govern the estimators that we may use. For example, it would be inaccurate to use a correction formula that assumes selection explicitly on X when the correlation of X with S is low.

In summary, equations are available to correct for the results of selection; in order to choose the most appropriate one for a particular situation we need to fit the data generation process to an appropriate selection model.

3.3 Evaluating Point Estimators

The properties of the maximum likelihood estimator of validity in censored samples, Equation 1.4, have been investigated in several empirical studies, (Lord and Novick, 1968). Since its sampling distribution is unknown, conditions that determine bias, consistency and efficiency are the subject of study. Under certain conditions $\hat{\rho}xy$ has been shown to perform better than the uncorrected correlation estimate from the complete, or selected sample.

Kagan (1977) investigated bias and mean squared error of $\hat{\rho}xy$ as an estimate of the population parameter and found that it was consistent as a point estimator only when the selection ratio was moderate, sample size greater than or equal to 40, and correlation in the population greater than or equal to .5.

Lord and Novick (1968) note the tendency for test score data to violate linearity and homoscedasticity, (the two assumptions of the ρxy formula), at the extremes of the distribution. The sigmoid shaped distribution, flattening at the tails of the line, has been proposed as more representative of actual selection data. Greener and Osburn (1980) examined $\hat{\rho}xy$ under varying degrees of linearity and homoscedasticity violation in simulated samples. They considered mild and extreme cases of three distribution types graphically expressed as sigmoid, fan-shaped and football, and set these against the normal linear case. For each of the seven cases they simulated 9 bivariate distributions each with 4000 observations for correlation values .1 through .9. They were able to report that the corrected correlation $\hat{\rho}xy$ was better than the uncorrected for moderate selection (40% or less screened out), and that extreme violations yielded poor estimates.

There are some indications that linearity and homoscedasticity violations may compensate for each other; however, the Greener and Osburn study investigated these as isolated conditions and did not examine simultaneous violation. In addition, since they simulated entire distributions with such a large set of observations, the applicability of their findings to samples typically encountered in practice is still uncertain.

Sample size, selection ratio, and the size of the observed correlation between X and Y are factors that affect $\hat{\rho}xy$, causing an over or under estimate of the validity of X as a predictor of Y. It is the interdependency of these factors that prevents precise analytic definition of the behavior of the estimator with respect to bias, and makes continued investigation necessary. For this, confidence intervals rather than the typical point estimates promise greater usefulness for the practicioner.

3.4 *Confidence Intervals*

Monte Carlo studies by Forsyth (1971) and Gullickson and Hopkins (1976) tested their confidence interval estimates for ρxy. In order to clarify the inferential properties of his estimate Forsyth used Fisher's log transformation:

$$Zr = .5 \text{ LOGe } [\ (1 + r)(1 - r) \ ]$$

with standard error $1/\sqrt{N - 3}$

and generated 24 sampling distributions, each with 1000 points, for three sample sizes (25, 50, 100), four selection ratios (10, 25, 50 and 75%) and two population correlation values (.8 and .5). His work showed that for the traditional standard error data:

1) for a given correlation value and selection ratio, the standard error of estimate is independent of N

2) the stringency of selection increases the variance of the estimate

3) as the correlation increases the estimate improves.

Forsyth found that with the same population correlation his empirical solution for a given N agreed with the Pearson value for a smaller N, and that this was consistent. He then proposed a technique of "scaling" for sample size in the standard error formula, arriving pretty much by trial and error at a formula that improved results. Gullickson and Hopkins (1976) argue that although Forsyth's adjustment could be shown to increase the proportion of confidence intervals enclosing the population correlation value, he had not solved the interval estimation problem. Forsyth showed that the standard confidence intervals can be quite inaccurate for selected samples. Gullickson and Hopkins used a modified estimator of ρxy rather than the maximum likelihood estimator, and though they could not extract a simple formula they provided a series of nomograms that could yield confidence intervals once their estimator had been calculated.

Useful information about the conditions that determine precision of the interval estimates has been provided by these studies, e.g. the greater the selectivity the wider the interval, and precision is recovered, interval width reduced if N is increased or the estimated correlation value increased. In addition, Gullikson and Hopkin's work provided a test for the hypothesis: $\rho = 0$. Investigation of confidence intervals based on the maximum likelihood estimator still remain to be done, and these for statistics of the total sample are undertaken here.

3.5 Bayesian Methods

Rubin (1977) proposes a technique that allows quantification of the similarities and dissimilarities in missing data samples. This involves constructing a prior distribution for the parameters of the incomplete sample given the complete sample parameters. Using the observed data, a conditional probability interval is derived for those statistics that would have been calculated if data had not been missing. Rubin's research concerns questionnaire response data where conjectures about the nonrespondents are formalized in the construction of prior distributions. He assumes that the same statistical model underlies the complete and the incomplete samples and relates differences in parameter values, slope, intercept and variance to other processes.

Earlier work by Gross and Perry (1983) explored an extension of Rubin's method considering cases where the underlying models are assumed to be 1) equal and 2) unequal in parameter values; later research produced the interval estimators described in Chapter II and Appendix 1. On an actual data set, applied to a selection problem for N = 152, encouraging results were obtained for the total sample statistics for which interval estimates have been derived.

The fundamental features of the Bayesian interval estimate strategy are:

1) Constructing a prior distribution for the parameters which underlie the incomplete or unselected sample, given

the selected sample parameters. If θs and θu denote the parameters of the selected and unselected samples respectively, $P'(\theta u \mid \theta s)$ formalizes prior assumptions concerning the similarities or differences in the sample models.

2) Using the X,Y data of the selected sample, a set of sufficient statistics, Ds, is computed. For our case, these are the regression weights and residual variance. The posterior distribution of θs given Ds is computed for the complete sample using Bayes Theorem:

$$P''(\theta s|Ds) \propto P'(\theta s)\, L(Ds|\theta s) \qquad 5.1$$

where $P(\theta s)$ is the marginal prior for the selected sample parameters and $L(Ds|\theta s)$ is the likelihood function.

3) The posterior distribution of θu given Ds is computed as:

$$P''(\theta u|Ds) = \int P''(\theta s|Ds)\, P'(\theta u|\theta s)\, d\theta s \qquad 5.2$$

4) The predictive distribution of the missing Y scores given the X data in the unselected sample and the selected sample information may be obtained as follows:

$$Pred(Yu|Xu, Ds) = \int P''(\theta u|Ds)\, L(Du|\theta u)\, d\theta u \qquad 5.3$$

where Du represents sufficient statistics from the unselected sample, from its X data.

5) If the predictive distribution of the missing Y scores is known, probability distributions for the statistics of interest may be obtained and interval estimates constructed.

The Bayesian method allows for subjective analyses to be quantified in the specification of the prior distribution. In the case where there is vague prior information and a uniform distribution is assumed, estimates resulting from the posterior distribution are identical with classical maximum likelihood, depending entirely on the observed data.

For selection explicitly on X, or on X and a set of other variables assumed to be conditionally independent of Y, given X, the models underlying the selected and unselected samples are assumed to have equal parameter values, $\theta u = \theta s$. Estimates for regression coefficients and residual variance in the total sample can then be centered about the corresponding values in the selected sample. The interval estimates evaluated in this study have been derived by this method.

4. Heuristic Methods

When X1, X2, ... Xn variables are involved, analyses that take into account only complete n-tuples sacrifice a great deal of information. Hocking and Smith (1968) aimed for a more general method than the patterned cases of missing data that occupied earlier practicioners. They developed the procedure by grouping variables into two sets, one for which all variates were observed and the other for which there was some subset of observations. This may be viewed as a meta-analysis of our problem. Starting with parameter estimates from the complete set, they produced modifications by optimally adjoining sufficient statistics from the incomplete set. Monte Carlo studies were done on two examples using 1000 data sets to investigate small sample properties of the estimators. Considering a "nested" and "non-nested" example with total sample size 50 and 55 respectively, they illustrated by comparing the cases 1) when the incomplete information is ignored, 2) when only one group is adjoined, and 3) when all data is used, that their technique was consistent and efficient. For the nested case they were able to establish equivalence with maximum likelihood estimators. The model for this work was a multivariate normal distribution.

In the general multivariate literature the major concern is the estimation of the variance-covariance matrix or the correlation matrix, so that factor analysis or other multivariate techniques may be efficiently employed. Though some researchers set out to predict correlation matrices directly by regression or extensions of regression methods, others are involved with sample reconstruction, actual estimation of the missing data points.

Timm (1970) extended the ideas of Wilks (1932) for reconstructing the data matrix Y, a random sample of N p-variate observations with missing data from a multivariate distribution. Using Monte Carlo analysis he compared three methods with respect to their ability to predict either the variance-covariance or correlation matrix. In one case the mean of all nonmissing values for a variable was used to estimate missing values, in another, the regression equation estimated missing entries, and in the third, the principal components solution of the known submatrix estimated the unknown elements. No uniformly best procedure emerged from this study; many conditions were varying: sample size, number of variables, percentage of missing data, and average intercorrelations. The methods were assessed against the complete matrix. Timm's work, though not definitive because of the diffuse scale of his undertaking, inspired much of the later research in the multivariate domain.

Gleason and Staelin (1975) acknowledged the strong influence of Timm's work in their own research, comparing estimation methods for missing data in multivariate analyses. They reviewed a regression equation method where nonmissing entries are treated as independent variables and the regression equation, derived from complete submatrices, estimates missing entries. They note the equivalence of the solution produced by this technique and maximum likelihood estimates, but propose a principal components solution that is both computationally simpler and faster than regression.

Finkbeiner (1979) compared a maximum likelihood method of estimating parameters of the multiple factor model with five heuristic methods that included mean replacement for missing data, regression replacement and principal components estimates. He chose a sample size of 64, a borderline size between large and small samples that he documents, and with 50 replications for each pattern ran a Monte Carlo study. The mean replacement method was shown to bias variance-covariance estimates downward, but it was good with respect to mean squared error and cheap in terms of computer time. Maximum likelihood though possessing good analytic properties was a very expensive method.

In multivariate regression Glasser (1964) showed that estimates for regression coefficients are consistent when all pairs of observations for each pair of variables are used in the computation. The efficiency of his approach depended on the correlation among the independent variables and the proportion of observations missing, but no assumptions were made about the distribution of the X variables. The only assumptions were that the data were missing at random and that the conditional distribution of Y, given X, was normal.

The literature illustrates the variety of heuristic methods aimed at reconstructing the situation when the data are complete. Although there is disagreement about the precise application of incomplete data, there is, nontheless, strong committment to defining its involvement in data analyses. Evaluations of heuristic methods rely not only on the classical concepts of efficiency and consistency, but include the speed and cost of running the algorithm.

CHAPTER II

EMPIRICAL INVESTIGATION

1. Objectives of the Investigation

The principal objective is to provide a comprehensive evaluation of the interval estimates proposed for inferring the XY relationship in the total sample. Interval estimates have been derived for B0 and B1, the regression weights for the total sample of applicants, for the residual variance S2e, and for the difference between criterion means in the selected and unselected samples, $D = \bar{Y}s - \bar{Y}u$, (Gross & Perry, 1983). A summary of the general method is given in Appendix 1. These estimates have been derived under restrictive conditions; there is need to evaluate their significance and accuracy when the assumptions are violated. In particular, the present research assesses:

1) the accuracy of the estimates of the 4 total sample statistics when the linearity and homoscedasticity assumptions of the underlying model are met.

2) the robustness of the estimates under selected conditions of linearity and homoscedastic violations, and under particular choices of selection modes.

3) the usefulness of R, a derivative of the Pearson correction formula, as an estimate of the XY correlation in the total sample.

2. Definition of Estimates and Procedures

2.1 Statistics for the Total Sample

A vector of test scores (Xt) is available for Nt subjects. Through a selection process criterion scores (Y) are present for Ns selected subjects, Ns < Nt. For Nt - Ns cases, Y scores are missing. A schematic illustration is given in Figure 1.

The problem might occur when candidates are admitted to an institution or training program, and the statistical concern is to infer the XY relationship in the total applicant group. On the basis of such information one might conceivably justify admission, or denial of admission, of a given candidate.

The population of interest here is a finite group of applicants; we are concerned with the inference of total sample statistics from incomplete data as distinct from parameter estimation for an infinite population. In particular, the goal is to reconstruct the missing Y scores of the unselected cases. The predictive probability approach yields a distribution for the missing Y scores from which estimates of total sample statistics are derived. The following statistics for the total group are of interest:

1) Rxyt the correlation between X and Y in the total applicant group

2) B0 and B1 the least squares weights for predicting Y from X in the total applicant group, Y = B0 + B1X + e

3) S2e the residual variance

4) $D = \bar{Y}s - \bar{Y}u$, the difference between the average Y scores in the selected and unselected groups.

Figure 1

Missing Data Diagram

	X	Y
	x1	y1
	x2	y2
	.	.
Selected Sample	.	.
	.	.
	xs	ys
	xs+1	M
	.	i
Unselected Sample	.	s
	.	s
	xt	i
		n
		g

2.2 Equations for Interval Estimates

Regression weights in the total sample:

1) $B0 = bo \pm Ao$

2) $B1 = b1 \pm A1$

$$Ao = \left[\left(\frac{SSe_*}{Ns - 2}\right)\left(\frac{SSx_* + Ns\,\bar{X}_*^2}{Ns\ SSx_*} - \frac{SSx + Nt\,\bar{X}^2}{Nt\ SSx}\right)\right]^{.5} t_{.975}(Ns - 2)$$

$$A1 = \left[\left(\frac{SSe_*}{Ns - 2}\right)\left(\frac{1}{SSx_*} - \frac{1}{SSx}\right)\right]^{.5} t_{.975}(Ns - 2)$$

* refers to the selected group

bo,b1 = regression constant and slope in the selected sample

SSe = residual sum of squares

SSx = sum of squares for X

$t_{.975}(Ns - 2)$ = .975 percentile point on a t-distribution with Ns - 2 degrees of freedom

95% confidence interval for the residual variance in predicting Y from X in the total sample is given:

3) $G1/(Nt - 2) \leq S2e \leq G2/(Nt - 2)$

$$G1 = \left[\frac{SSe_*}{Ns - 2}\right] [\, F'(Nu, Ns - 2)(Nu) + Ns - 2\,]$$

$$G2 = \left[\frac{SSe_s}{Ns - 2}\right] [F''(Nu, Ns - 2)(Nu) + Ns - 2]$$

Nu = Nt − Ns, the size of the unselected sample

F'(Nu,Ns − 2), F"(Nu,Ns − 2) are two points on an F distribution with degrees of freedom (Nu,Ns − 2).

95% interval for the difference in Y means in the selected and unselected samples is given:

4) $D = (\bar{Y}s - \bar{Y}u) \pm Ad$

$\bar{Y}u$ = average predicted Y score for the unselected cases, obtained by using the least squares weights bo and b1 for the selected cases and the X scores for the unselected cases.

$$Ad = \left[\frac{SSe_s}{Ns - 2}\left(\frac{1}{Ns} + \frac{1}{Nu} + (\bar{X}_s - \bar{X}u)^2 / SSx_s\right)\right]^{.5} t_{.975}(Ns - 2)$$

Estimate of the XY correlation in the total sample:

5) $$R = \left[1 + \frac{sx^2}{Sx^2}\left(\frac{1}{r^2} - 1\right) \right]^{-.5}$$

sx^2 = variance of X in the selected group

r = Correlation between X and Y in the selected group

Sx^2 = variance of X in the total group.

2.3 Experimental Design

The accuracy and robustness of the estimates are examined in a 4 x 3 factorial design, where the independent variables are distributional assumptions and selection models (Figure 2). The basis of the estimates is the normal linear model, but a more typical situation for real data is that 1) the same regression line does not apply to the tails as to the center of the distribution and 2) the variance in the tails is often less than at the center of the distribution, (Lord & Novick, 1968). In addition, there is some evidence that the effects of linearity and homoscedasticity violation may compensate for each other, (Gross, 1982).

These considerations determine the choice of the 4 distributional types that are matched with 3 selection models.

Distributional types: (Figure 3)

1) Bivariate normal, linear and homoscedastic

2) Sigmoid: S-shaped, flattening at the extremes; nonlinear and homoscedastic

3) Football shaped: concentration of variance in the center of the distribution; linear and heteroscedastic

4) Simultaneous nonlinear and heteroscedastic

Selection models:

1) Selection explicitly on X. Scores are ranked on X, and this single variable is the basis of selected XY samples

corresponding to 80, 50, and 30 percent of the total sample drawn.

2) Compensatory selection: selection on a composite of X and Z.

In this trivariate situation with two possible selector variables, scores are ranked on the sum of X and Z, (X and Z on the same scale), and selected samples of 80, 50, and 30 percent are drawn. Here the XY samples selected represent selection on the basis of X, or Z, or both; the variables may compensate for each other in attaining the critical cut scores.

3) Multiple cut-off selection: selection on both X and Z. The process here consists essentially of ranking for selection first on X, then on the basis of Z. For this we use a system advanced by Gross (1982) that is summarized as follows:

If the probability of a subject being rejected, P(R), is defined to be 1) the probability of rejection on the basis of X, P(Rx), or 2) the probability of having been selected on X, Sx, then rejected on the basis of Z, Rz, we have:

$$P(R) = P(Rx) + (1 - P(Rx)) (P(Rz|Sx))$$

Defining k to be the relative importance of the two conditions of rejection:

$$k = P(Rx) / [(1 - P(Rx)) (P(Rz|Sx))]$$

yields

$$P(Rx) = [k/(k + 1)] \cdot P(R)$$

For the ratio $k/(k + 1) = 0$ selection is based entirely on Z, and for $k/(k + 1) = 1$, subjects scoring highest on X alone, are selected. Values of the ratio between 0 and 1 reflect selection procedures based on both variables.

Here $k/(k + 1)$ was set at .5 and selected samples corresponding to 80, 50 and 30 percent of the total sample were drawn.

Cell (1,1) of the basic design in Figure 2, reflects the assumptions under which the estimates were derived: linear homoscedastic with selection explicitly on X. For this reason, evaluation of the accuracy and precision of the estimates is based on entries here; the remaining 11 cells address robustness through comparison with Cell(1,1).

Sample sizes, correlations, selection ratios

Large sample sizes of 1000 and 10000 that are featured in reviewed Monte Carlo studies allowed researchers to ignore sampling errors but, at the same time, limited the applicability of their findings in more typically encountered cases. Here we consider sample sizes of 50, 100 and 200.

XY samples, and XYZ samples are randomly generated with population correlations corresponding approximately to high, medium and low: .7, .5, .3. Although the estimates were derived with a fixed X model, we are interested in producing conditions where the model might apply and where we can also manipulate conditions effectively.

Total sample statistics (B0, B1, S2e, D, Rxyt) are computed in each case, and the estimates for these statistics when selection ratios correspond approximately to high, medium and low: .8, .5, .3. Additional selection ratios are computed for Cell(1,1) in order to illustrate relationships demonstrated in the analysis. A selection ratio of 1 yields the statistics for the total sample; the estimates from the incomplete samples are assessed in relation to these.

Figure 2

Basic Experimental Design

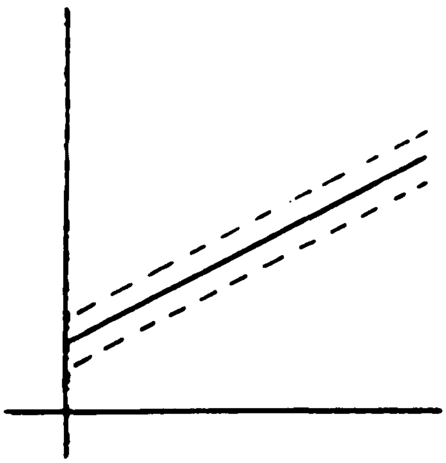
Distribution Type	Selection Method: on X	on X + Z	MC: X and Z
Linear Homoscedastic	Cell(1,1)	Cell(1,2)	Cell(1,3)
Non-linear Homoscedastic	Cell(2,1)	Cell(2,2)	Cell(2,3)
Linear Heteroscedastic	Cell(3,1)	Cell(3,2)	Cell(3,3)
Nonlinear Heteroscedastic	Cell(4,1)	Cell(4,2)	Cell(4,3)

Within each of the 12 cells above, there are 9 subcells, corresponding to variations in sample size and correlations. For each subcell, a Monte Carlo run with 100 replications yields empirical distributions for 20 statistics: B0, B1, S2e, D, Rxyt on 4 selection ratios (100%, 80%, 50%, 30%).

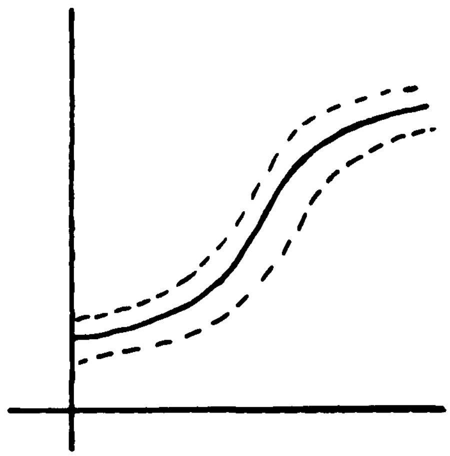
Figure 3

Distributional Types

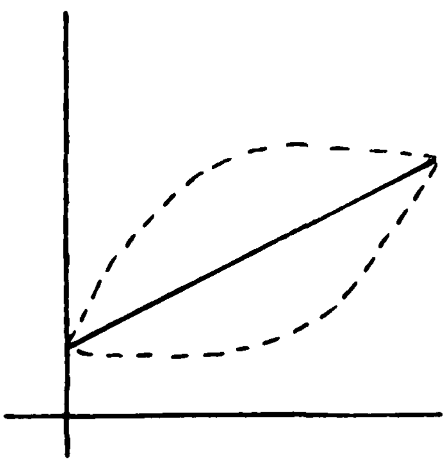
1. Linear
homoscedastic



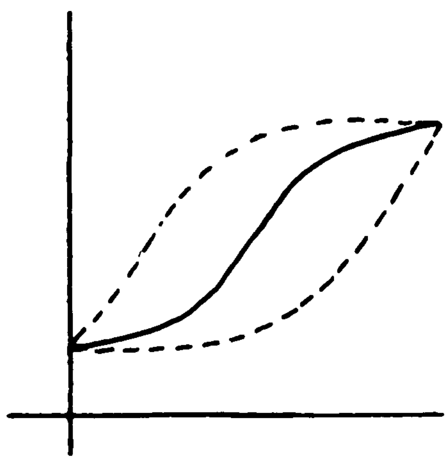
2. Sigmoid
nonlinear
homoscedastic



1. Football
linear
heteroscedastic



2. Simultaneous
nonlinear
heteroscedastic



——— regression of Y on X

- - - - conditional variance of Y given X

2.4 Simulation Procedures

Computer programs were written to provide simulated samples of the distribution types. Programs were written in Basic for the Apple II Plus microcomputer.

1) Linear homoscedastic

For the bivariate normal distribution, N(X,Y) pairs were obtained. First, values for the normal random variate X were obtained, then Y was generated with mean X, and standard deviation $(1 - \rho^2)^{.5}$.

For both X and Y mean was set at 0 and standard deviation 1.

Scores were ranked on X, and values of the statistics were computed for the total sample and selection ratios of .8, .5, .3. This process was repeated for the set of population correlation values, ρ = .3, .5, .7 and sample sizes, N = 50, 100, 200.

For each of the 9 distinct total samples, 100 replications were generated, thus the results in Table 1 are the expected values of estimates of statistics and parameters derived from 100 samples.

2) Nonlinear distributions: sigmoid

The sigmoid distribution form was chosen since it appeared to approximate the type of data encountered in educational research. Lord and Novick (1968) have argued in favor of a regression model such as the sigmoid form.

For the N(X,Y) pairs of the sigmoid distribution, the random normal variate X was first obtained, then Y was generated with mean: $kX + mX^3$,

where $k = \rho + .15$ and $m = -.05$

and standard deviation: $(1 - \rho^2)^{.5}$

This function produces bivariate distributions that are flat at the extremes. Figure 4 illustrates the distribution. This function was used as the more extreme case of nonlinear sigmoid distribution by Greener and Osburn (1980) and all 45 distributions (5 replications for each of 9 population correlation values, using N = 4000) that they generated were significantly nonlinear.

The constants are chosen so that the expected value of the slope of the curvilinear regression line in this case equals the preset population correlation ρ. It should be noted also, that increasing the value of k and adjusting m correspondingly, in an effort to increase nonlinearity, distorts the flattened ends of the curve into hooks as is indicated in the scaled plot of Figure 8.

For the nonlinear distributions 100 replications of each of the 9 sample types yielded the expected values tabled.

3) Heteroscedastic distributions: football

Here the distribution was divided into 10% intervals on X. The standard deviation was computed for each interval, and that value multiplied by a fractional constant. Values chosen were: .8, .9, 1, 1.1, 1.2, 1.2, 1.1, 1, .9, .8 as multipliers for each decile of the bivariate normal distribution.

4) Trivariate normal distributions

Where an additional selector variable is present we require N(X,Y,Z) triples. The relationships that are necessary so that X, Y, and Z are distributed normally each with a mean of 0 and standard deviation of 1, are detailed in Appendix 3. We investigated samples where $\rho xy = \rho xz = \rho yz$ = .3, .5, .7 and replicated each sample type 100 times for each of the N values.

The simulation process employed provides independent samples for each sample type considered. However, in order to enhance comparability across the distribution types and selection models, we held the seed for the random generation of X constant for any given ρ-N combination. For example, for N = 50, ρ = .3, the seed was 13 for generating X in all cells.

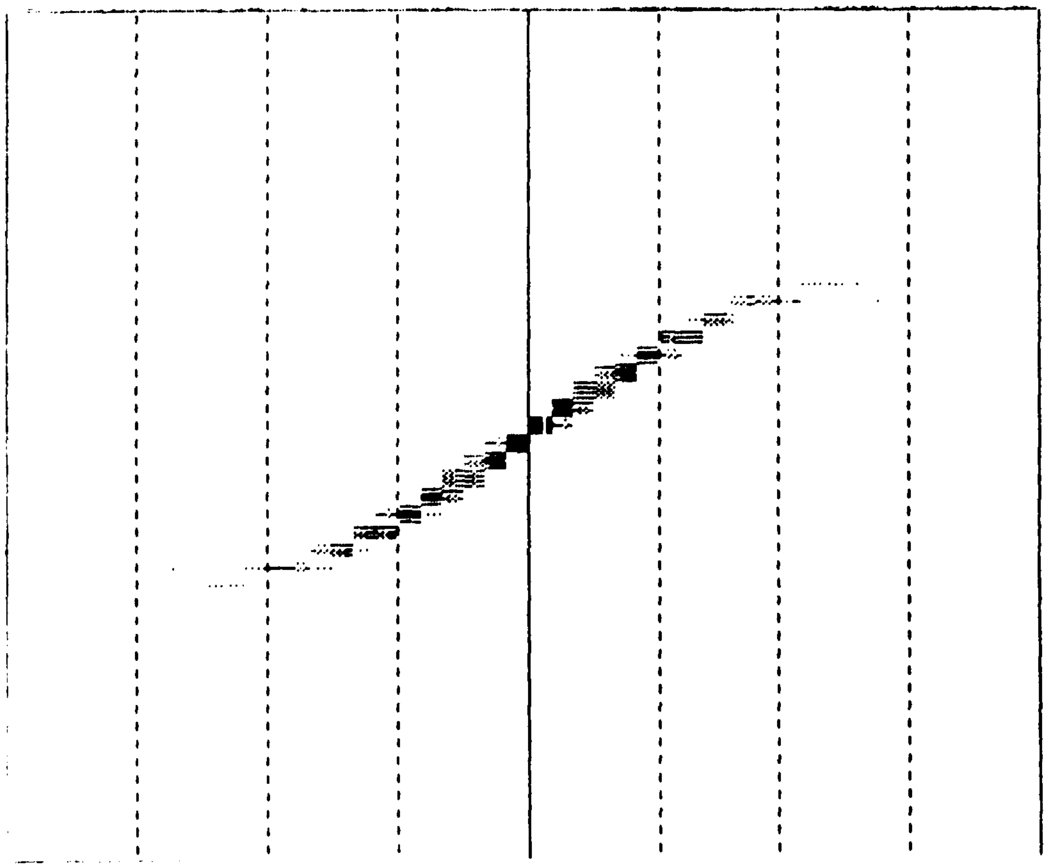
The simulation process was checked for accuracy, stability and randomness. In order to validate the stability of the estimates for each sample type, replications were made using different random number seeds. An example of this is presented in Appendix 4, page 96. Here, for N = 50, ρ = .5, under conditions of linear homoscedasticity and selection on X, estimates were computed using 10 different random number seeds. Inspection of the values in the table confirm that there is little variability in the estimates of interest.

Intermediate caculations were hand checked, partial and full iteration results were computed and compared, and plots of the distribution of X attested to the precision of the random number generator.

Additional tables in Appendix 4 provide computed values of the mean, standard deviation and correlation estimate. These serve as validity checks for the sample type that is generated in each case.

Figure 4

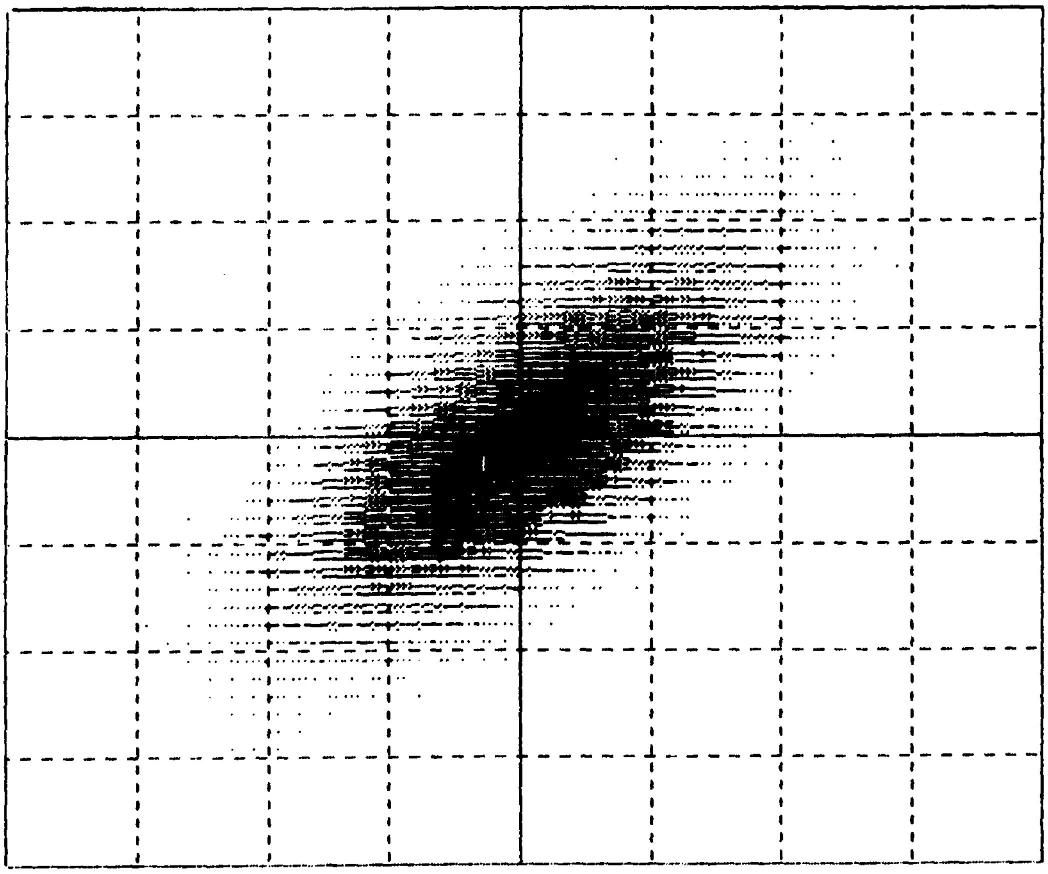
Plot of Nonlinear Distribution



Broken lines mark standard deviations from the mean. Scaling by setting variance at 0, produces definitive sigmoid shape.

Figure 5

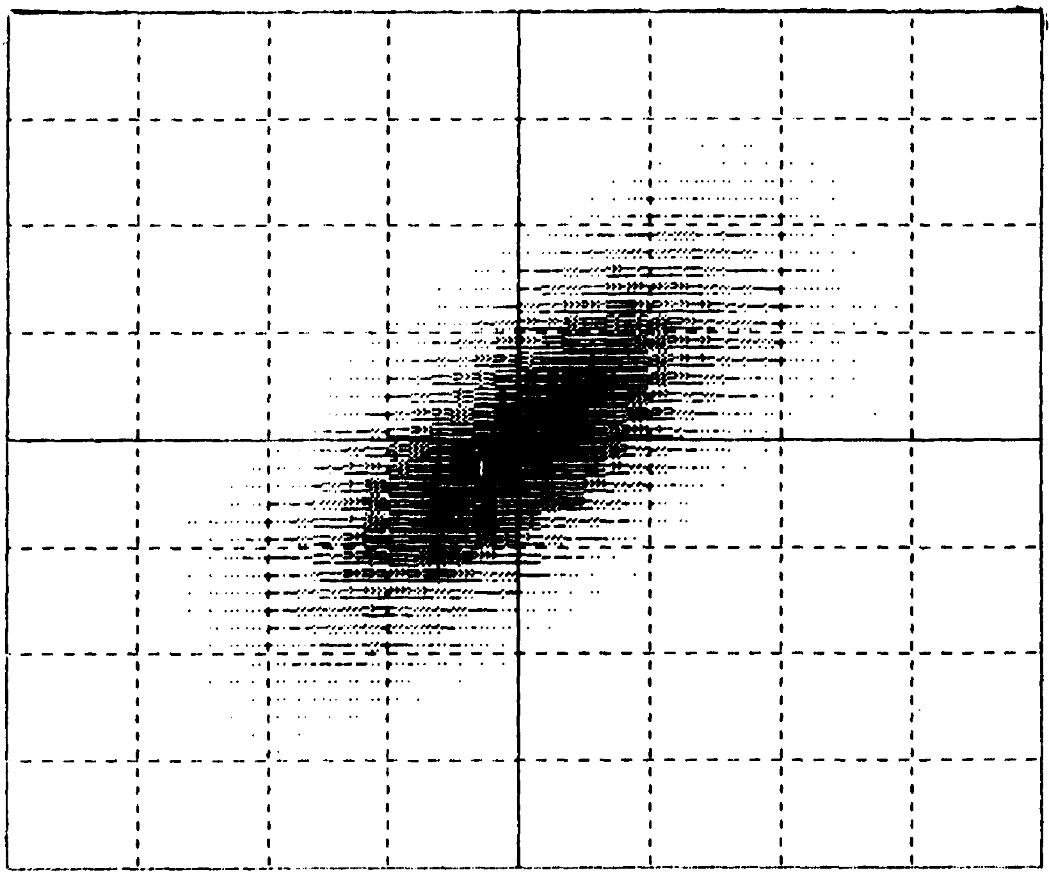
Scatter Plot of Bivariate Normal Distribution



Scatter plot of 75,000 random pairs in a bivariate normal distribution.

Figure 6

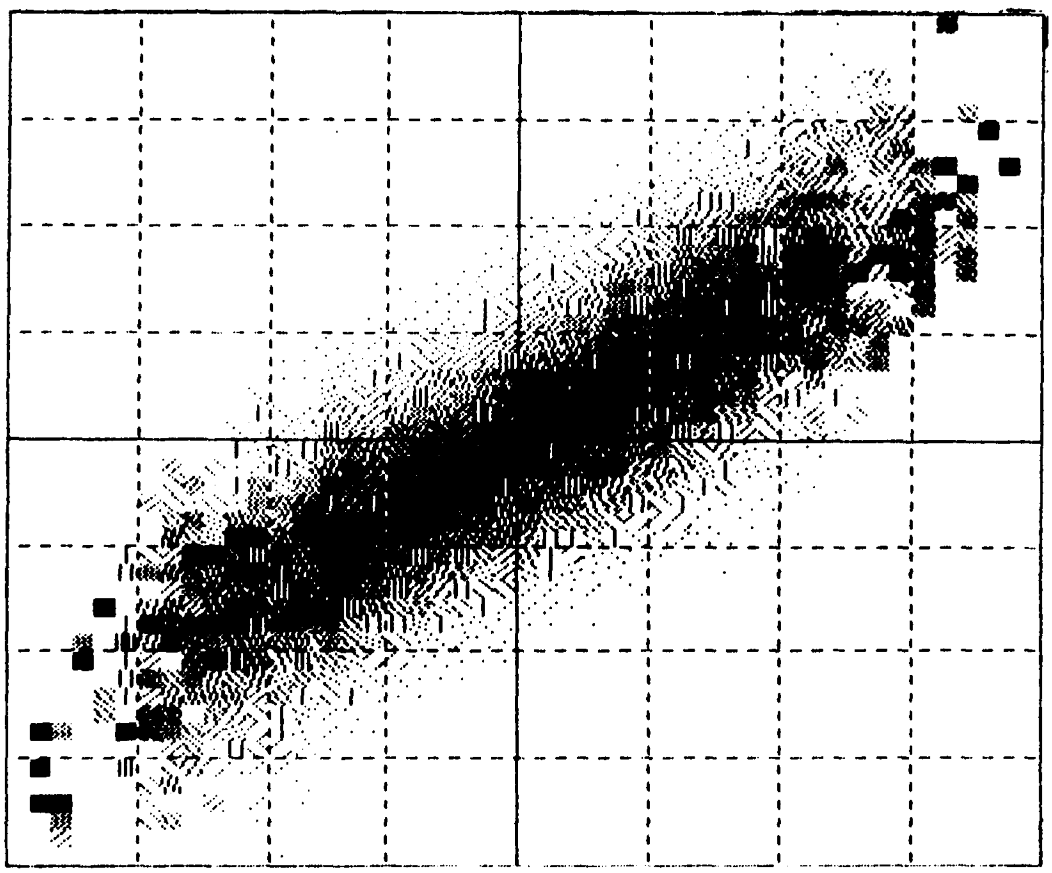
Scatter Plot of Nonlinear Bivariate Distribution



Scatter plot of 75,000 random pairs in a nonlinear bivariate distribution, correlation=.7. Here is an example of how the distribution of X is sometimes more important than the XY relationship.

Figure 7

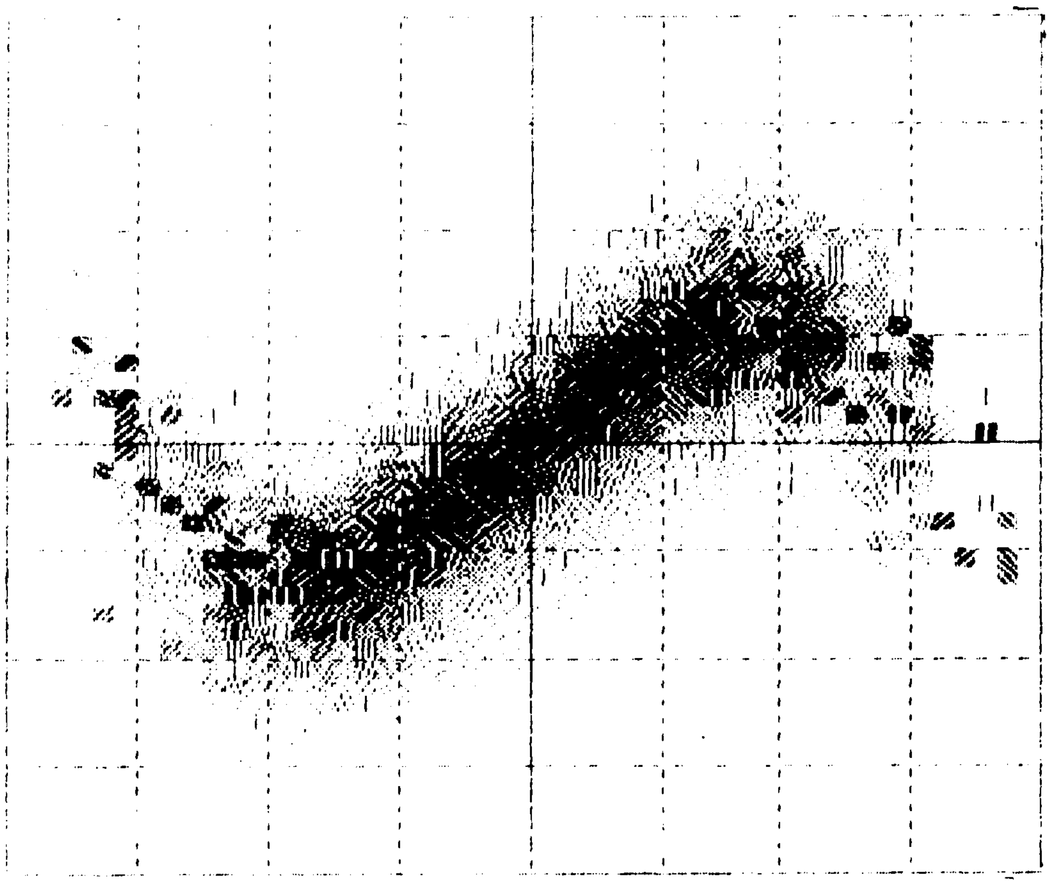
Scaled Plot of Bivariate Normal Distribution



Scaled scatter plot of 75,000 random pairs in linear bivariate normal distribution for correlation =.7. Scaling provides equal density of points over the distribution on the horizontal axis and more clearly illustrates linearity.

Figure 8

Scaled Plot of Nonlinear Distribution



Scaled scatter plot of nonlinear distribution for correlation =.7. The function:

$$y = kX + mX^3 \quad (k = \rho + .3,\ m = -.1)$$

illustrates the distortion of the flattened ends of the sigmoid into hooks.

3. Results

The accompanying tables, Table 1 - Table 12, summarize the main results of the investigation. Each table represents a cell of the basic 4 x 3 design in Figure 2. Table 1 reports for Cell(1,1), Table 2 for Cell(2,1) and so on reading down the columns. Each table is composed of 3 subtables presenting computations for N = 50, 100, 200 respectively over the correlation values .3, .5, .7. The entries in each table are means, expected values produced from the 100 samples generated for each of the 9 sample types, or ρ-N combinations.

The evaluative variables considered are :

1) E(W), expected width of the interval for each interval estimate.

2) P(I), probability of inclusion (given in percent) of the estimated statistic in the interval.

3) B(r) and B(R), the expected tendency of r and R to over or under estimate the XY correlation in the total sample. These are essentially estimates of bias:

B(r) = E(r - Rxyt), where r is the correlation of X with Y in the selected sample and Rxyt refers to the XY correlation in the total sample.

B(R) = E(R - Rxyt), where R is the estimate of total sample XY correlation defined in Section 2.2, equation 5.

Tables that list the total sample values, means and standard deviations, as well as other statistics of interest in these samples may be found in Appendix 4.

Starting with Table 5 the distributions are trivariate, thus column 1 which gives the correlation refers to the population correlation for each pair of variables, for example: correlation = .3 means $\rho_{xy} = \rho_{xz} = \rho_{yz} = .3$.

TABLE 1

CELL 1-1 SELECTION ON X
LINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.37	93	.59	93	.38	96	1.90	93	-.09	-.03
	.5	1.16	95	1.22	95	.82	93	2.36	95	-.19	-.02
	.3	2.64	94	2.16	92	1.67	94	3.81	94	-.20	.09
.5	.8	.36	95	.54	95	.32	98	1.74	95	-.09	.00
	.5	1.10	96	1.13	97	.68	95	2.16	96	-.16	.02
	.3	2.52	98	2.02	98	1.45	96	3.55	98	-.19	.03
.7	.8	.30	97	.45	98	.23	98	1.46	97	-.10	.00
	.5	.92	95	.94	94	.50	97	1.81	95	-.21	-.03
	.3	2.09	96	1.66	98	1.04	96	2.94	96	-.27	-.03

SAMPLE SIZE = 100

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.27	96	.40	95	.27	96	1.35	96	-.07	-.01
	.5	.82	99	.82	97	.57	99	1.65	99	-.12	-.01
	.3	1.80	94	1.40	96	.96	93	2.57	94	-.16	.03
.5	.8	.24	96	.36	96	.22	98	1.21	96	-.10	.00
	.5	.74	96	.74	96	.46	95	1.47	96	-.19	-.04
	.3	1.61	95	1.26	96	.76	95	2.29	95	-.24	-.04
.7	.8	.21	94	.31	93	.15	97	1.02	93	-.11	.00
	.5	.62	94	.63	97	.32	96	1.25	94	-.19	.00
	.3	1.36	94	1.08	96	.52	93	1.94	94	-.24	.00

SAMPLE SIZE = 200

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.19	96	.28	95	.19	95	.95	95	-.06	.00
	.5	.57	92	.57	93	.39	97	1.14	92	-.12	.00
	.3	1.22	93	.95	95	.61	100	1.74	93	-.14	.01
.5	.8	.17	92	.26	93	.16	97	.86	92	-.10	.00
	.5	.52	94	.53	96	.32	97	1.05	94	-.17	.00
	.3	1.12	92	.89	92	.50	97	1.60	92	-.20	.02
.7	.8	.14	95	.21	96	.11	100	.71	95	-.11	-.01
	.5	.42	95	.43	95	.22	97	.85	95	-.21	-.02
	.3	.90	93	.71	93	.34	95	1.29	94	-.26	-.02

TABLE 2

CELL 2-1 SELECTION ON X
NONLINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

CORR- ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.38	93	.59	94	.38	95	1.91	93	-.07	.00
	.5	1.17	89	1.23	94	.83	94	2.36	90	-.23	-.04
	.3	2.65	93	2.16	90	1.68	94	3.82	92	-.29	.05
.5	.8	.36	95	.54	97	.32	98	1.75	95	-.09	.00
	.5	1.11	91	1.13	95	.69	95	2.17	91	-.21	-.03
	.3	2.53	98	2.03	98	1.46	97	3.56	98	-.30	-.03
.7	.8	.30	97	.45	95	.23	97	1.47	96	-.09	.00
	.5	.93	93	.95	95	.51	96	1.83	93	-.25	-.07
	.3	2.10	93	1.67	93	1.05	98	2.95	93	-.36	-.12

SAMPLE SIZE = 100

CORR- ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.27	95	.40	96	.27	98	1.35	95	-.06	.00
	.5	.83	94	.83	96	.57	99	1.65	94	-.18	-.07
	.3	1.81	93	1.41	93	.96	94	2.58	93	-.27	-.05
.5	.8	.25	96	.36	96	.22	97	1.22	95	-.09	.00
	.5	.74	86	.74	90	.46	95	1.48	86	-.24	-.11
	.3	1.61	85	1.26	89	.76	95	2.30	85	-.35	-.14
.7	.8	.21	93	.31	93	.15	94	1.03	93	-.10	.00
	.5	.63	90	.64	94	.32	94	1.25	90	-.23	-.04
	.3	1.37	93	1.08	91	.52	92	1.95	93	-.34	-.11

SAMPLE SIZE = 200

CORR- ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.19	98	.28	96	.19	94	.95	98	-.05	.02
	.5	.57	83	.57	86	.39	98	1.15	83	-.17	-.06
	.3	1.22	89	.95	90	.61	100	1.75	89	-.25	-.07
.5	.8	.17	94	.26	90	.16	95	.86	94	-.08	.01
	.5	.52	89	.53	89	.32	98	1.05	89	-.22	-.06
	.3	1.13	91	.89	89	.50	96	1.61	91	-.30	-.11
.7	.8	.14	96	.21	96	.11	97	.71	96	-.10	.00
	.5	.43	78	.43	82	.22	97	.86	78	-.25	-.07
	.3	.91	77	.71	72	.35	97	1.30	77	-.37	-.16

TABLE 3

CELL 3-1 SELECTION ON X
LINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxvt B(r)	Rxvt B(R)
.3	.8	.37	92	.59	91	.38	96	1.91	92	-.10	-.03
	.5	1.16	95	1.22	95	.82	94	2.36	95	-.19	-.03
	.3	2.61	94	2.14	93	1.63	95	3.77	94	-.19	.07
.5	.8	.36	95	.54	96	.33	95	1.76	95	-.11	-.02
	.5	1.09	92	1.12	96	.67	94	2.15	92	-.15	.03
	.3	2.43	97	1.96	99	1.35	98	3.43	97	-.17	.06
.7	.8	.31	100	.46	100	.24	93	1.50	100	-.11	-.01
	.5	.90	96	.93	96	.49	94	1.79	95	-.17	.00
	.3	1.85	93	1.48	96	.83	98	2.62	93	-.18	.04

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxvt B(r)	Rxvt B(R)
.3	.8	.27	96	.40	96	.27	97	1.35	96	-.09	-.02
	.5	.82	99	.82	98	.57	99	1.64	99	-.12	.00
	.3	1.78	96	1.39	97	.94	93	2.55	96	-.16	.04
.5	.8	.25	96	.36	97	.22	97	1.22	96	-.11	-.02
	.5	.74	95	.74	97	.45	96	1.47	95	-.18	.00
	.3	1.55	96	1.22	95	.71	92	2.21	96	-.20	.01
.7	.8	.21	97	.32	96	.16	89	1.05	97	-.12	-.03
	.5	.62	91	.63	94	.32	96	1.24	91	-.16	.02
	.3	1.21	91	.96	93	.41	85	1.73	91	-.15	.08

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxvt B(r)	Rxvt B(R)
.3	.8	.19	94	.28	94	.19	95	.95	95	-.08	.00
	.5	.57	92	.57	95	.39	97	1.14	92	-.12	.01
	.3	1.20	94	.94	93	.59	97	1.73	94	-.13	.03
.5	.8	.17	92	.26	91	.16	92	.87	92	-.11	-.02
	.5	.52	94	.53	96	.32	97	1.04	94	-.16	.03
	.3	1.08	89	.85	89	.46	94	1.54	89	-.17	.08
.7	.8	.15	97	.22	95	.11	70	.73	97	-.12	-.03
	.5	.42	93	.42	94	.22	95	.84	93	-.17	.01
	.3	.81	89	.63	91	.27	84	1.16	90	-.17	.06

TABLE 4

CELL 4-1 SELECTION ON X
NONLINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.38	94	.59	93	.38	94	1.92	93	-.09	-.01
	.5	1.17	94	1.23	94	.83	95	2.36	94	-.23	-.05
	.3	2.62	92	2.14	91	1.64	94	3.78	92	-.28	.03
.5	.8	.36	95	.54	96	.33	98	1.76	95	-.10	.00
	.5	1.10	95	1.13	96	.68	96	2.16	95	-.19	-.02
	.3	2.44	98	1.96	99	1.37	98	3.44	98	-.26	-.03
.7	.8	.31	98	.46	99	.24	93	1.50	99	-.10	.00
	.5	.91	95	.93	96	.50	94	1.80	95	-.21	-.02
	.3	1.86	95	1.49	96	.84	97	2.63	95	-.26	-.03

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.27	95	.40	96	.27	99	1.35	95	-.07	.00
	.5	.82	97	.82	97	.57	99	1.65	97	-.17	-.06
	.3	1.79	94	1.39	94	.94	94	2.55	94	-.26	-.06
.5	.8	.25	98	.36	96	.22	99	1.23	98	-.10	.00
	.5	.74	89	.74	92	.46	96	1.47	90	-.22	-.06
	.3	1.56	91	1.22	90	.71	93	2.22	91	-.31	-.10
.7	.8	.21	96	.32	94	.16	90	1.05	96	-.11	-.02
	.5	.62	94	.63	94	.32	95	1.24	94	-.19	.00
	.3	1.22	94	.97	94	.42	84	1.74	94	-.24	.00

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.19	96	.28	95	.19	95	.95	97	-.07	.00
	.5	.57	85	.57	88	.39	98	1.14	85	-.17	-.05
	.3	1.21	88	.94	90	.60	99	1.73	89	-.24	-.08
.5	.8	.17	95	.26	92	.16	93	.87	94	-.10	.00
	.5	.52	92	.53	91	.32	97	1.04	92	-.20	-.02
	.3	1.09	94	.86	93	.46	96	1.55	94	-.27	-.05
.7	.8	.15	94	.22	96	.11	81	.73	94	-.11	-.02
	.5	.42	91	.42	91	.22	96	.85	91	-.21	-.02
	.3	.82	90	.64	88	.28	85	1.17	90	-.27	-.03

TABLE 5

CELL 1-2 COMPENSATORY SELECTION
LINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.32	82	.45	85	.37	94	1.64	82	-.11	-.07
	.5	.84	85	.88	88	.82	94	1.71	83	-.21	-.11
	.3	1.62	84	1.42	88	1.64	100	2.35	84	-.26	-.04
.5	.8	.32	86	.45	88	.32	95	1.57	86	-.12	-.07
	.5	.85	87	.86	92	.67	96	1.67	88	-.19	-.08
	.3	1.70	86	1.42	93	1.38	94	2.39	85	-.26	-.08
.7	.8	.28	85	.40	90	.22	98	1.35	87	-.13	-.05
	.5	.76	80	.78	85	.47	97	1.50	80	-.23	-.09
	.3	1.59	87	1.31	93	.99	99	2.25	87	-.33	-.14

SAMPLE SIZE = 100

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.24	80	.32	87	.27	95	1.18	81	-.10	-.07
	.5	.59	77	.60	90	.56	99	1.19	78	-.16	-.10
	.3	1.10	85	.92	90	.91	92	1.57	83	-.19	-.06
.5	.8	.22	70	.30	82	.22	95	1.09	69	-.12	-.06
	.5	.57	64	.57	76	.44	97	1.15	65	-.23	-.14
	.3	1.13	63	.92	79	.72	93	1.61	65	-.32	-.19
.7	.8	.19	65	.28	75	.15	97	.95	64	-.12	-.04
	.5	.53	69	.54	80	.31	94	1.06	69	-.23	-.09
	.3	1.07	79	.87	88	.50	94	1.52	80	-.29	-.11

SAMPLE SIZE = 200

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.16	57	.22	77	.19	98	.82	56	-.09	-.06
	.5	.41	58	.42	75	.39	99	.83	59	-.16	-.10
	.3	.76	65	.63	83	.58	98	1.09	66	-.19	-.10
.5	.8	.15	60	.22	76	.15	95	.77	60	-.11	-.05
	.5	.41	52	.41	72	.31	92	.82	53	-.21	-.11
	.3	.76	56	.63	71	.47	94	1.09	56	-.27	-.17
.7	.8	.13	42	.19	56	.10	96	.66	43	-.12	-.04
	.5	.36	39	.36	56	.21	94	.72	40	-.24	-.10
	.3	.70	51	.56	68	.32	94	1.00	51	-.32	-.15

TABLE 6

CELL 2-2 COMPENSATORY SELECTION
NONLINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.33	83	.45	89	.38	97	1.64	85	-.09	-.05
	.5	.85	80	.88	88	.82	95	1.71	78	-.21	-.11
	.3	1.63	82	1.42	87	1.65	98	2.35	82	-.30	-.04
.5	.8	.32	86	.45	92	.32	97	1.57	86	-.11	-.05
	.5	.85	79	.87	92	.68	95	1.67	79	-.21	-.10
	.3	1.70	82	1.42	85	1.38	95	2.39	81	-.33	-.11
.7	.8	.27	87	.41	89	.23	98	1.38	87	-.10	-.02
	.5	.78	70	.81	81	.50	96	1.57	68	-.26	-.12
	.3	1.60	73	1.34	79	1.02	96	2.31	74	-.38	-.18

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.24	84	.32	91	.27	93	1.18	85	-.09	-.05
	.5	.60	69	.60	87	.56	99	1.19	72	-.18	-.12
	.3	1.10	73	.93	82	.92	92	1.58	72	-.25	-.08
.5	.8	.22	70	.30	87	.22	95	1.09	72	-.10	-.04
	.5	.57	50	.57	72	.44	97	1.15	48	-.25	-.17
	.3	1.12	47	.91	63	.72	93	1.60	48	-.40	-.25
.7	.8	.19	72	.28	84	.15	94	.95	72	-.11	-.03
	.5	.53	53	.54	68	.31	93	1.05	55	-.25	-.11
	.3	1.06	60	.86	66	.49	95	1.52	60	-.37	-.20

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.16	63	.22	83	.19	96	.82	62	-.08	-.04
	.5	.41	45	.42	72	.39	99	.83	44	-.17	-.12
	.3	.76	46	.63	65	.59	97	1.09	47	-.25	-.14
.5	.8	.15	61	.22	82	.15	92	.77	63	-.10	-.03
	.5	.41	35	.41	62	.31	92	.81	36	-.23	-.13
	.3	.76	32	.63	50	.47	95	1.08	31	-.34	-.25
.7	.8	.13	43	.19	66	.11	95	.66	47	-.11	-.03
	.5	.36	16	.36	37	.21	94	.72	16	-.27	-.13
	.3	.70	15	.56	21	.32	93	1.00	15	-.41	-.26

TABLE 7

CELL 3-2 COMPENSATORY SELECTION
LINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0		B1		S2e		D		Rxyt	
		E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.32	80	.45	82	.37	95	1.64	83	-.11	-.07
	.5	.84	84	.88	88	.81	94	1.71	83	-.21	-.12
	.3	1.61	83	1.41	88	1.62	100	2.34	85	-.26	-.07
.5	.8	.32	86	.46	88	.32	94	1.58	86	-.13	-.07
	.5	.85	88	.86	95	.67	96	1.66	88	-.19	-.07
	.3	1.66	87	1.39	93	1.33	94	2.34	86	-.24	-.09
.7	.8	.28	86	.41	90	.23	99	1.38	85	-.13	-.05
	.5	.75	81	.77	87	.46	96	1.49	81	-.20	-.06
	.3	1.46	92	1.21	94	.86	100	2.07	92	-.25	-.08

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0		B1		S2e		D		Rxyt	
		E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.24	80	.32	86	.27	95	1.18	81	-.11	-.07
	.5	.59	77	.60	90	.56	99	1.19	80	-.17	-.11
	.3	1.09	87	.92	93	.90	92	1.56	85	-.18	-.08
.5	.8	.22	71	.30	81	.22	97	1.09	69	-.12	-.06
	.5	.57	69	.57	80	.44	95	1.14	71	-.22	-.12
	.3	1.10	67	.90	83	.69	93	1.57	69	-.29	-.17
.7	.8	.20	73	.28	80	.16	93	.97	72	-.13	-.05
	.5	.53	71	.54	81	.31	96	1.06	71	-.21	-.07
	.3	.98	79	.80	87	.42	84	1.39	79	-.21	-.03

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0		B1		S2e		D		Rxyt	
		E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.16	58	.22	76	.19	98	.82	55	-.10	-.06
	.5	.41	60	.42	75	.39	99	.83	61	-.16	-.10
	.3	.75	67	.63	84	.58	98	1.08	67	-.19	-.11
.5	.8	.15	58	.22	73	.15	98	.77	60	-.12	-.05
	.5	.41	55	.41	76	.31	93	.82	56	-.21	-.09
	.3	.75	60	.62	73	.45	94	1.07	60	-.25	-.12
.7	.8	.13	40	.19	50	.11	86	.67	41	-.12	-.05
	.5	.36	47	.36	65	.21	93	.72	48	-.22	-.07
	.3	.65	59	.52	79	.28	82	.93	58	-.24	-.06

TABLE 8

CELL 4-2 COMPENSATORY SELECTION
NONLINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.37	84	.45	90	.38	97	1.64	85	-.10	-.05
	.5	.84	80	.88	89	.82	95	1.71	79	-.22	-.12
	.3	1.62	81	1.41	87	1.62	99	2.34	82	-.30	-.07
.5	.8	.32	87	.46	90	.32	97	1.58	85	-.12	-.05
	.5	.85	79	.86	93	.67	95	1.66	79	-.21	-.09
	.3	1.66	81	1.39	87	1.32	95	2.34	81	-.31	-.13
.7	.8	.28	88	.41	90	.23	98	1.38	87	-.11	-.04
	.5	.75	73	.77	81	.45	95	1.48	72	-.22	-.08
	.3	1.45	75	1.20	84	.85	100	2.06	76	-.31	-.14

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.24	83	.32	91	.27	95	1.18	83	-.09	-.05
	.5	.59	70	.60	88	.56	99	1.19	73	-.18	-.12
	.3	1.10	75	.92	85	.91	93	1.57	73	-.24	-.11
.5	.8	.22	71	.30	87	.22	97	1.09	70	-.11	-.04
	.5	.57	51	.57	72	.44	96	1.14	51	-.24	-.14
	.3	1.10	49	.89	65	.69	92	1.56	50	-.37	-.24
.7	.8	.19	74	.28	88	.16	94	.97	75	-.11	-.04
	.5	.52	59	.53	70	.31	91	1.05	58	-.23	-.08
	.3	.97	61	.79	69	.41	80	1.38	61	-.28	-.09

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.16	60	.22	80	.19	96	.82	62	-.08	-.05
	.5	.41	47	.42	73	.39	99	.83	46	-.17	-.12
	.3	.75	47	.63	70	.58	97	1.08	49	-.25	-.16
.5	.8	.15	60	.22	78	.15	96	.77	61	-.10	-.04
	.5	.41	43	.41	65	.31	93	.81	43	-.22	-.11
	.3	.74	37	.61	58	.45	94	1.06	36	-.32	-.20
.7	.8	.13	45	.19	64	.11	89	.67	44	-.11	-.04
	.5	.36	19	.36	45	.21	94	.72	19	-.24	-.10
	.3	.64	23	.52	33	.27	78	.92	23	-.32	-.14

TABLE 9

CELL 1-3 MULTIPLE CUTOFF
LINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.33	89	.50	92	.37	95	1.65	89	-.08	-.04
	.5	.92	89	1.06	93	.82	95	1.86	88	-.18	-.05
	.3	2.10	90	1.90	90	1.65	97	3.04	90	-.21	.11
.5	.8	.32	96	.47	96	.32	96	1.56	96	-.08	-.01
	.5	.93	93	.99	93	.67	96	1.83	93	-.15	-.01
	.3	2.20	97	1.83	96	1.38	95	3.10	96	-.20	.03
.7	.8	.28	91	.41	95	.22	98	1.37	91	-.11	-.02
	.5	.85	92	.87	92	.47	95	1.67	92	-.22	-.05
	.3	1.92	94	1.55	97	.97	98	2.70	94	-.28	-.07

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.23	87	.34	91	.27	100	1.17	86	-.08	-.04
	.5	.65	95	.71	98	.56	97	1.30	95	-.11	-.03
	.3	1.41	99	1.21	99	.94	95	2.01	99	-.14	.01
.5	.8	.22	83	.32	91	.21	94	1.09	83	-.09	-.02
	.5	.64	90	.66	92	.45	97	1.28	90	-.18	-.05
	.3	1.40	92	1.14	95	.72	96	2.00	92	-.24	-.07
.7	.8	.19	90	.29	95	.15	98	.96	92	-.10	-.02
	.5	.58	92	.60	95	.31	95	1.16	92	-.20	-.03
	.3	1.29	95	1.03	96	.50	96	1.83	95	-.25	-.02

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.16	78	.24	90	.19	95	.81	78	-.06	-.02
	.5	.45	86	.49	91	.38	97	.91	86	-.12	-.03
	.3	.97	93	.83	96	.59	98	1.38	93	-.14	.00
.5	.8	.16	83	.23	92	.15	92	.78	83	-.09	-.02
	.5	.45	89	.47	97	.31	98	.90	89	-.17	-.02
	.3	.96	90	.79	92	.47	94	1.37	91	-.19	.00
.7	.8	.13	68	.20	84	.10	96	.67	66	-.11	-.02
	.5	.40	84	.40	89	.21	95	.79	84	-.21	-.04
	.3	.85	92	.67	94	.33	94	1.21	92	-.27	-.04

TABLE 10

CELL 2-3 MULTIPLE CUTOFF
NONLINEAR HOMOSCEDASTIC

SAMPLE SIZE = 50

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.33	89	.51	95	.38	98	1.67	88	-.06	.00
	.5	.93	83	1.06	92	.82	95	1.87	83	-.20	-.06
	.3	2.11	88	1.91	91	1.66	96	3.05	88	-.27	.09
.5	.8	.32	95	.47	95	.32	98	1.56	94	-.07	.00
	.5	.94	88	1.00	90	.67	95	1.84	89	-.19	-.05
	.3	2.21	94	1.84	96	1.39	95	3.11	94	-.30	-.04
.7	.8	.28	92	.42	96	.22	97	1.38	91	-.09	.00
	.5	.85	88	.88	90	.48	96	1.68	88	-.25	-.08
	.3	1.93	87	1.56	90	.98	99	2.72	87	-.38	-.16

SAMPLE SIZE = 100

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.23	91	.34	93	.27	97	1.17	90	-.06	-.01
	.5	.65	90	.71	96	.57	99	1.31	90	-.15	-.06
	.3	1.42	92	1.22	95	.96	96	2.02	90	-.22	-.06
.5	.8	.22	84	.32	95	.22	96	1.10	86	-.08	.00
	.5	.65	81	.67	88	.46	98	1.28	81	-.22	-.10
	.3	1.40	80	1.14	84	.73	96	2.00	77	-.34	-.15
.7	.8	.19	90	.29	93	.15	93	.97	90	-.09	.00
	.5	.58	81	.60	88	.32	94	1.17	82	-.24	-.06
	.3	1.29	81	1.03	85	.51	93	1.84	81	-.34	-.13

SAMPLE SIZE = 200

CORR-ELATION	SELECTION RATIO	B0 E(W)	B0 P(I)	B1 E(W)	B1 P(I)	S2e E(W)	S2e P(I)	D E(W)	D P(I)	Rxyt B(r)	Rxyt B(R)
.3	.8	.16	81	.24	90	.19	95	.82	82	-.04	.00
	.5	.45	72	.49	85	.39	98	.91	73	-.15	-.06
	.3	.97	82	.83	91	.59	98	1.39	81	-.22	-.09
.5	.8	.16	86	.23	94	.15	90	.78	86	-.07	.00
	.5	.45	70	.47	92	.31	99	.90	70	-.20	-.06
	.3	.96	76	.79	82	.47	93	1.37	76	-.29	-.12
.7	.8	.13	65	.20	89	.11	96	.67	64	-.10	-.01
	.5	.40	49	.40	64	.22	96	.79	48	-.25	-.08
	.3	.85	61	.67	65	.34	95	1.22	60	-.38	-.17

TABLE 11

CEL 3-3 MULTIPLE CUTOFF
LINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

		B0		B1		S2e		D		Rxyt	
CORR- ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.33	87	.50	92	.38	95	1.66	88	-.09	-.04
	.5	.92	89	1.06	93	.82	95	1.87	88	-.19	-.06
	.3	2.09	89	1.89	91	1.62	97	3.02	90	-.21	.08
.5	.8	.32	95	.48	97	.32	96	1.57	94	-.10	-.03
	.5	.93	92	1.00	95	.67	94	1.84	94	-.15	.00
	.3	2.13	96	1.78	96	1.30	95	3.01	97	-.17	.04
.7	.8	.29	92	.42	95	.23	98	1.40	91	-.11	-.03
	.5	.83	94	.86	96	.47	96	1.65	94	-.18	-.02
	.3	1.71	95	1.39	96	.80	98	2.43	95	-.19	.01

SAMPLE SIZE = 100

		B0		B1		S2e		D		Rxyt	
CORR- ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.23	84	.34	91	.27	100	1.17	84	-.09	-.04
	.5	.65	95	.71	98	.56	97	1.30	95	-.12	-.02
	.3	1.40	98	1.20	98	.93	95	2.00	98	-.13	.02
.5	.8	.22	82	.32	90	.22	98	1.10	82	-.10	-.03
	.5	.64	92	.66	96	.45	95	1.28	92	-.18	-.03
	.3	1.36	94	1.11	94	.68	93	1.94	94	-.21	.00
.7	.8	.20	89	.29	95	.16	96	.99	90	-.12	-.03
	.5	.58	96	.60	96	.31	94	1.16	96	-.17	.00
	.3	1.15	96	.92	95	.40	84	1.64	96	-.16	.06

SAMPLE SIZE = 200

		B0		B1		S2e		D		Rxyt	
CORR- ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.16	77	.24	87	.19	96	.81	77	-.07	-.03
	.5	.45	86	.49	92	.38	97	.91	86	-.12	-.03
	.3	.96	95	.82	95	.58	98	1.37	95	-.13	.02
.5	.8	.16	79	.23	91	.16	94	.78	79	-.10	-.03
	.5	.45	93	.47	97	.31	99	.90	93	-.16	.00
	.3	.93	94	.77	94	.44	86	1.33	93	-.16	.06
.7	.8	.14	64	.20	73	.11	89	.68	63	-.12	-.03
	.5	.39	91	.40	94	.21	89	.79	91	-.18	-.01
	.3	.76	94	.60	96	.27	76	1.09	94	-.17	.05

TABLE 12

CELL 4-3 MULTIPLE CUTOFF
NONLINEAR HETEROSCEDASTIC

SAMPLE SIZE = 50

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.33	89	.51	95	.38	97	1.67	89	-.07	-.01
	.5	.93	84	1.06	92	.82	95	1.87	83	-.20	-.07
	.3	2.10	88	1.90	91	1.64	97	3.03	88	-.27	.05
.5	.8	.32	95	.48	95	.32	99	1.57	95	-.09	-.01
	.5	.94	90	1.00	92	.67	95	1.84	91	-.18	-.04
	.3	2.14	95	1.79	94	1.31	96	3.02	95	-.26	-.03
.7	.8	.29	91	.42	98	.23	98	1.40	91	-.10	-.02
	.5	.84	89	.86	92	.47	96	1.65	89	-.21	-.04
	.3	1.72	85	1.40	92	.81	98	2.44	86	-.28	-.07

SAMPLE SIZE = 100

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.23	90	.34	93	.27	98	1.17	90	-.07	-.02
	.5	.65	93	.71	96	.57	98	1.30	93	-.15	-.06
	.3	1.41	93	1.21	95	.95	96	2.01	93	-.22	-.07
.5	.8	.22	82	.32	95	.22	98	1.10	83	-.09	-.02
	.5	.64	82	.67	90	.45	98	1.28	82	-.21	-.07
	.3	1.36	85	1.11	87	.68	94	1.94	85	-.30	-.12
.7	.8	.20	90	.29	97	.16	94	.99	90	-.11	-.02
	.5	.58	89	.60	91	.31	93	1.16	89	-.20	-.03
	.3	1.16	90	.93	92	.41	83	1.65	91	-.24	.00

SAMPLE SIZE = 200

		B0		B1		S2e		D		Rxyt	
CORR-ELATION	SELECTION RATIO	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
.3	.8	.16	80	.24	92	.19	96	.82	81	-.05	.00
	.5	.45	75	.49	84	.39	98	.91	75	-.15	-.06
	.3	.96	83	.82	95	.59	98	1.38	83	-.22	-.09
.5	.8	.16	83	.23	95	.16	94	.78	84	-.09	.00
	.5	.45	79	.47	92	.31	99	.90	79	-.19	-.04
	.3	.93	83	.77	87	.45	86	1.33	84	-.26	-.06
.7	.8	.14	58	.20	80	.11	92	.68	58	-.11	-.02
	.5	.39	68	.40	74	.21	91	.79	68	-.22	-.05
	.3	.77	84	.61	85	.28	77	1.10	84	-.27	-.04

CHAPTER III

SUMMARY AND DISCUSSION

1. Overview

Tables 1 - 12 demonstrate the following consistencies for the interval estimates of B0, B1, S2e, D :

1) Interval width decreases as ρ increases.

2) Interval width decreases as N increases.

3) Interval width decreases as selection ratio increases.

These consistencies may be observed in each of the 12 tables when one examines E(W). The probability of inclusion in the interval, P(I), is not as well behaved. In Table 1, which presents values for Cell(1,1) when the conditions of the model are met, P(I) values are reasonable (close to .95). In the other 11 cells, though interval widths remain close to the values established for the corresponding estimates of Cell(1,1), the probability of inclusion is seriously affected.

It may be observed also that E(W) values for corresponding cases across all 12 tables, vary within a narrow range. For example, N = 50, ρ = .3, selection ratio = .8, E(W) estimates for B0 range from .324 to .376 for the 12 cells; similar illustrations apply to the other estimates. An explanation for this is the fact that the distribution of X is held constant for each sample type (ρ-N combination), so variance in E(W) is restricted to the effect of the Y distribution in computations. In addition, especially for high correlation values, nonlinearity is not as evident in the E(W) variable. Since X is distributed normally, data points are concentrated in the center of the distribution so that distortions confined to the tails of the distribution do not seem to have significant effect.

It follows, then, that although relationships may be determined from the use of both evaluative variables, E(W) is a more effective measure of within cell relationships, while P(I) more adequately describes differences across the cells in the basic design.

The logical relationship between E(W) and P(I) has not been overlooked. In particular, it is plausible to expect that if the interval is wide enough it would more likely contain the estimated statistic. We explored additional selection ratios for the estimates and found, for example, when 10% of the sample is selected, interval widths balloon but the inclusion proportions are not specifically affected. It is not unreasonable, therefore, to discuss E(W) and P(I) as independent measures in the analysis.

2. Evaluation of the Accuracy of the Interval Estimates

Table 1, the results of Cell (1,1) in the basic design, demonstrates the performance of the estimates when the conditions of the model are met: linear, homoscedastic distribution with selection explicitly on X.

The following general conclusions may be made:

1) Estimates of B0, B1, S2e, D for the total sample are consistent in terms of E(W) with respect to sample size, selection ratio and correlation. The intervals are narrower, thus better, the higher the values of N, selection ratio and population correlation.

2) The estimates are reliable. The median value of P(I) for each estimate in Cell(1,1) = 95. There is an expected 95% inclusion rate for the cases considered.

3) The estimates are potentially useful since the widths of the intervals may be explained or predicted, relative to sample size, selection ratio and correlation. The values in Table 1 are reasonable numerically when compared with E(W) values for selection ratios of .2 or .1, as seen in Table 13. Because of the observed consistency we may expect interval width to be less than 1 standard deviation if N = 50 and the selection ratio .8, or if N = 100 and ratio .5, or N = 200 and ratio as low as .3. All estimates except D conform, and those for S2e rate even better.

Tables 13 - 15 use some of the information from Table 1 and Appendix 4, page 97, to highlight the following relationships that occur in Cell(1,1):

1) Decrease in E(W) values across the rows in Table 13 illustrates consistency with total sample size.

2) Increase in E(W) values for each estimate down the columns illustrates that the estimates worsen as the selected sample size is smaller, as the selection ratio decreases.

3) Tables 14 and 15 hold selected sample size constant and examine E(W) values for the applicable ratios of various N. By this means we illustrate that E(W) is a function of the selection ratio, rather than the absolute number of selected cases. For example, if complete information is available for 80 subjects, it matters that they are drawn from a total sample of 100 as opposed to 200 subjects: the expected width of the regression constant estimate is .27 rather than .81, (Table 15).

4) Decrease in E(W) values across the rows of Table 14 and Table 15 illustrate consistency with the correlation of the X and Y variables.

In summary, the results of the analysis of Cell(1,1) attest to the accuracy and consistency of the interval estimates. Small standard deviations for the expected values computed, and checks in the simulation also confirm the stability of these estimates. When the conditions of the model are met, critical values for the effective use of the estimates may be established in terms of sample size, selection ratio and correlation. When estimates are derived from too little complete data, i.e. when selection ratios are low, the intervals may be too wide to be of practical use. The intervals seem much less affected by the correlation values for X and Y and are reasonable even for small sample sizes.

When the conditions of the model are not met, either through distributional variations or alternate selection conditions, use of the estimates requires caution. An examination of the robustness of the estimates is presented by Tables 2 - 12 and summarized below.

TABLE 13

CONSISTENCY OF INTERVAL ESTIMATES

	Ratio Selected	E(W) N=50	E(W) N=100	E(W) N=200
	.8	.36	.24	.17
	.5	1.10	.74	.52
B0	.4	1.64	1.06	.75
	.3	2.52	1.61	1.12
	.2	4.39	2.68	1.85
	.1	12.88	6.82	4.10
	.8	.54	.36	.26
	.5	1.13	.74	.53
B1	.4	1.49	.94	.67
	.3	2.02	1.26	.89
	.2	3.10	1.82	1.27
	.1	3.88	2.34	1.81
	.8	.32	.22	.16
	.5	.68	.46	.32
S2e	.4	.90	.56	.39
	.3	1.45	.76	.50
	.2	2.08	1.06	.60
	.1	8.28	2.37	1.17
	.8	1.74	1.21	.86
	.5	2.16	1.47	1.05
D	.4	2.69	1.76	1.25
	.3	3.55	2.29	1.60
	.2	5.45	3.34	2.31
	.1	14.27	7.56	4.56

Note: Correlation = .5.
Expected width of intervals, E(W), decreases as N increases and increases as smaller ratios of the total sample are selected.

TABLE 14

Expected Width as a Function of Selection Ratio

	Ratio Selected	N	E(W) Rho=.3	Rho=.5	Rho=.7
	.8	50	.37	.36	.30
B0	.4	100	1.20	1.06	.89
	.2	200	2.02	1.85	1.48
	.8	50	.59	.54	.45
B1	.4	100	1.06	.94	.82
	.2	200	1.36	1.27	1.00
	.8	50	.38	.32	.23
S2e	.4	100	.72	.56	.39
	.2	200	.73	.60	.41
	.8	50	1.90	1.74	1.46
D	.4	100	2.00	1.76	1.48
	.2	200	2.53	2.31	1.84

Note: Selected sample size was held constant for all of the above entries (N'=40).

TABLE 15

Effects of Selected Sample Size, Selection Ratio and Correlation on E(W)

E(W) values for B0

Selected Sample Size	Ratio Selected	N	E(W) Rho=.3	E(W) Rho=.5	E(W) Rho=.7
80	.8	100	.27	.24	.21
	.4	200	.81	.75	.61
40	.8	50	.37	.36	.30
	.4	100	1.20	1.06	.89
	.2	200	2.0	1.85	1.48
20	.4	50	1.70	1.64	1.34
	.2	100	3.05	2.68	2.39
	.1	200	4.37	4.10	3.26
10	.2	50	4.87	4.39	3.93
	.1	100	7.31	6.82	6.06

3. Evaluation of the Robustness of the Interval Estimates

As previously noted, the E(W) values in Tables 2 - 12 reflect similar consistencies as Table 1. In effect, this establishes an internal validity for the system. As we measure changes across the cells in the design, however, expected width is secondary to the probability of including the estimated statistic in the interval. It really would not matter how narrow the interval was, if, in fact, it was unlikely to contain the estimated value. For this reason, P(I) is the chosen variable for assessing robustness.

An examination of P(I) values computed showed no uniformity of behavior with respect to sample size, selection ratio or correlation. There was a tendency for the inclusion percentages to worsen significantly for N = 200: the extremely poor P(I) values 15, 19, 21, 27 occur for N = 200, correlation = .7, and selection ratios of .3 or .5. These poor values occur in Table 6, under nonlinear homoscedastic distribution type with Compensatory selection, and also in Table 8, nonlinear heteroscedastic with Compensatory selection.

Tables 16 and 17 allow us to organize and, therefore, assess the effects of distribution and selection variations on P(I).

In Table 16 we return to the basic 4 x 3 design (Figure 2), and present within each cell the median P(I) value for each estimate. There are 27 P(I) values for each estimate in each cell: one for each of 3 sample sizes with

3 correlation values over 3 selection ratios. By reading across the rows we may summarize the effect of selection, and down the columns the effect of distribution.

Table 16 illustrates the following general conclusions:

1) The estimates are reliable when the conditions of the model are met. In Cell(1,1) the median expected probability of inclusion, P(I) = 95% for each of the 4 estimates.

2) When selection is explicitly on X, the estimates remain reasonably reliable despite distributional variations. The median P(I) values in the column for explicit selection on X, are good, 93 - 96%.

3) Multiple cut-off selection effects are not as detrimental to the estimates as Compensatory selection effects. Comparing the entries in the respective columns we find median P(I) values for Multiple cut-off appreciably better than those for Compensatory selection: a range of 85 - 96% as against 68 - 95%. This appears a reasonable result based on the dynamics of the two selection modes. The role of X in selection is clear in Multiple cut-off: scores are ranked and a certain percentage selected on the basis of X, then, subsequently, selection based on Z from this group yields the desired selected sample.This interprets also as having a minimum or cut score for X and Z. In Compensatory selection no such minimum is set and either one of the variables, X or Z, could influence selection almost entirely. In any event, the wide fluctuation in inclusion percentages for both selection types here indicate that the

estimates are not reliable for alternative selection modes.
4) Non-linearity in the distribution distorts the P(I) values. This is not as clear-cut an observation due to possible interaction effects in Table 16. It is difficult to separate out the selection effects as we read across rows, However, worst P(I) values overall tend to occur in the rows of Table 16 that correspond to non-linear distributions, and in the Compensatory selection column.

Table 17 again utilizes the basic 4 x 3 design of Figure 2 and presents the median P(I) values broken down by statistic estimated. The range in P(I) values for each cell is also indicated. This organization of the results allows a clear analysis of the behavior of the estimates. The following conclusions may be made from Table 17:

1) Under all conditions studied the estimates of S2e are reliable. The median P(I) values are 95% or better.
2) For selection explicitly on X, all 4 estimates are reasonable. Column 1 values of each subtable are good.
3) Worst values for each estimate occur in column 2, under Compensatory selection. In this column the reliability of of the estimates for B0 and D is particularly affected, as the range of P(I) values for these estimates illustrates. Worst values also tend to occur in row 2 or row 4 which correspond to non-linear distributions.
4) Except for the Compensatory selection column 2, estimates of the regression coefficients B0 and B1 are reasonably

reliable. This, taken together with the general reliability of the estimate of residual variance S2e, makes a solid case for the robustness of the interval estimates for regression, provided the selection mode assuredly involves the variable of interest. In effect, as is true for the Multiple cut-off selection model investigated here, if the selection is based to some extent on X, then the interval estimates of the XY relationship will be reasonable despite distributional variations.

TABLE 16

Inclusion Percentages for the Estimates

(Median P(I) values for the estimates)

		Explicit Selection on X	Compen-satory on X + Z	Multiple Cutoff on X and Z
Linear	B0	95	70	90
Homo-	B1	95	83	93
scedastic	S2e	95	95	96
	D	95	69	92
Non-	B0	93	70	86
Linear	B1	93	82	91
Homo-	S2e	96	95	96
scedastic	D	93	68	86
Linear	B0	94	73	92
Hetero-	B1	95	83	95
scedastic	S2e	95	95	95
	D	95	72	93
Non-	B0	94	70	85
Linear	B1	94	81	92
Hetero-	S2e	95	95	96
scedastic	D	94	70	86

TABLE 17

Reliability of the Estimates

Median inclusion values P(I), (range given in parentheses).

B0

95 (92- 98)	70 (39- 86)	90 (68- 99)
93 (77- 98)	70 (15- 87)	86 (49- 95)
94 (89-100)	73 (40- 88)	92 (64- 98)
94 (85- 98)	70 (19- 88)	85 (58- 93)

B1

95 (92- 98)	83 (56- 93)	93 (84- 98)
93 (72- 98)	82 (21- 92)	91 (64- 96)
95 (89-100)	83 (50- 90)	95 (73- 98)
94 (88- 99)	81 (33- 88)	92 (74- 98)

S2e

95 (93-100)	95 (92-100)	96 (92-100)
96 (92- 98)	95 (92- 99)	96 (90- 98)
95 (70- 98)	95 (82-100)	95 (76-100)
95 (81- 99)	95 (78-100)	96 (77- 98)

D

95 (92- 98)	69 (40- 88)	92 (66- 99)
93 (77- 98)	68 (15- 87)	86 (48- 94)
95 (89-100)	72 (41- 88)	93 (63- 96)
94 (85- 99)	70 (19- 87)	86 (51- 93)

Note: Each 4 x 3 grid above reflects the basic design of Figure 2; rows are distribution types and columns selection models.

4. Evaluation of a point estimate of Rxyt

Tables 1 - 12 examine bias associated with r, correlation in the selected sample, and R (Equation 5, Section 2.2) as estimates of the XY correlation in the total sample.

R is a "correction" of r, to adjust for the effects of selection. Here R is estimating the correlation in the finite total sample for each case we consider, and not the population correlation value ρ, as is generally the case when this formula is applied. The analysis here is localized and discrete since every sample type produces its particular sample correlation value Rxyt. The expected value of each Rxyt, however, is approximately ρ and the more detailed results in the tables of Appendix 4 confirm this.

The following general conclusions may be made from Tables 1 - 12:

1) Under conditions of explicit selection on X and linear distribution type, R overestimates when the selected sample is small. When 30% of the sample is selected, the correction tends to overcompensate: in 15 out of the 18 cases of Tables 1 and 3, $B(R) \geqslant 0$.

Under Multiple cut-off selection, the same tendency is observed in the linear cases of Tables 9 and 11: for selection ratio of .3, $B(R) \geqslant 0$ for 14 out of 18 cases.

2) In the non-linear cases, Tables 2, 6, 10 and to a slightly lesser extent in Tables 4, 8, and 12, extreme

negative bias is observed in r for medium and low selection ratios. The tendency of R to overcompensate raises the correlation estimate in the selected sample to an acceptable level e.g., in Table 2, N = 100, correlation = .7 : for selection ratio .5, the expected negative bias in r of .23 is reduced to .04.

3) Under Compensatory selection, Tables 5 - 8, negative bias is reported throughout. B(r) values are negative in all tables; however, under explicit selection on X and Multiple cut-off, the correction has adjusted correlation so that some cases of nonnegative B(R) values result. Not so for Compensatory selection.

4) For the conditions investigated here, the estimate R tends to underestimate the correlation in the total sample; rationales for predicting its specific behavior are difficult to summarize because of the interaction of the conditions involved.

5. Further Considerations

In the quest for greater variation in the nonlinear form of the bivariate distribution, we examined families of sigmoid-shaped distributions where a larger portion of the distribution may be flattened. In particular, we explored the Logistic Function model, (Lord and Novick (1968), pp. 398-400).

Starting with X distributed normally with a mean of 0 and standard deviation of 1, Y was generated so that :

$$E(Y \mid X) = [\ 1 + e^{Dax}]^{-1}$$

Setting D = 1.7 and varying values for a, $1 \leqslant a \leqslant 3$, we obtain the regression functions displayed in Figure 9. Comparing the graphs we note that the logistic function for a = 1 allows a more substantial portion of the distribution to be flattened than in the polynomial or sigmoid case of our analysis. For a = 3 the logistic function is essentially a bivalued step function and clearly represents a rather strong violation in the assumption of linear regression.

Using the regression functions of Figure 9, the accuracy of the estimates was examined for the case where N = 50, ρ= .5. The results are given in Table 18. No firm conclusions can be drawn with respect to either the E(W) or P(I) criterion. The values for E(W) are marginally affected by varying the "a" values; the most accurate P(I) values occur for a = 1. With a = 1, however, values were not very different from the nonlinear case of Table 2. It may be that the normality of X, and the consequent concentration of data points in the center of the distribution, diffuses the effect of nonlinearity defined by the sigmoid shape. Except for very low selection ratios when the selected sample is in the lower tail of the distribution, the nonlinearity condition does not disturb interval widths to any serious extent.

Future research might attempt to ascertain whether these estimates can withstand further distortions in underlying assumptions that may be of theoretical significance.

In conclusion, the findings of this research indicate that the estimates of the XY relationship are better able to withstand distributional violations than constraints in the selection process. Results in Table 16 illustrate that the reliability of the estimates holds up remarkably except for Compensatory Selection, and Table 17 emphasizes, moreover, that the residual variance is a most robust statistic.

As previously noted, there is a basic limitation to the concept of nonlinear regression as defined in the present study. Even in the examples given by the sigmoid function, the bulk of the observations fall in a range where the regression is nearly linear. None the less, our results are still of practical value, since this pattern of nonlinearity will probably occur in real life settings. In support of this statement, Lord & Novick (1968) have argued in favor of the sigmoid model as a realistic one for test validation studies.

Figure 9

Graphs of the Logistic Function for a=1, 2, 3 compared with Sigmoid and Linear Functions

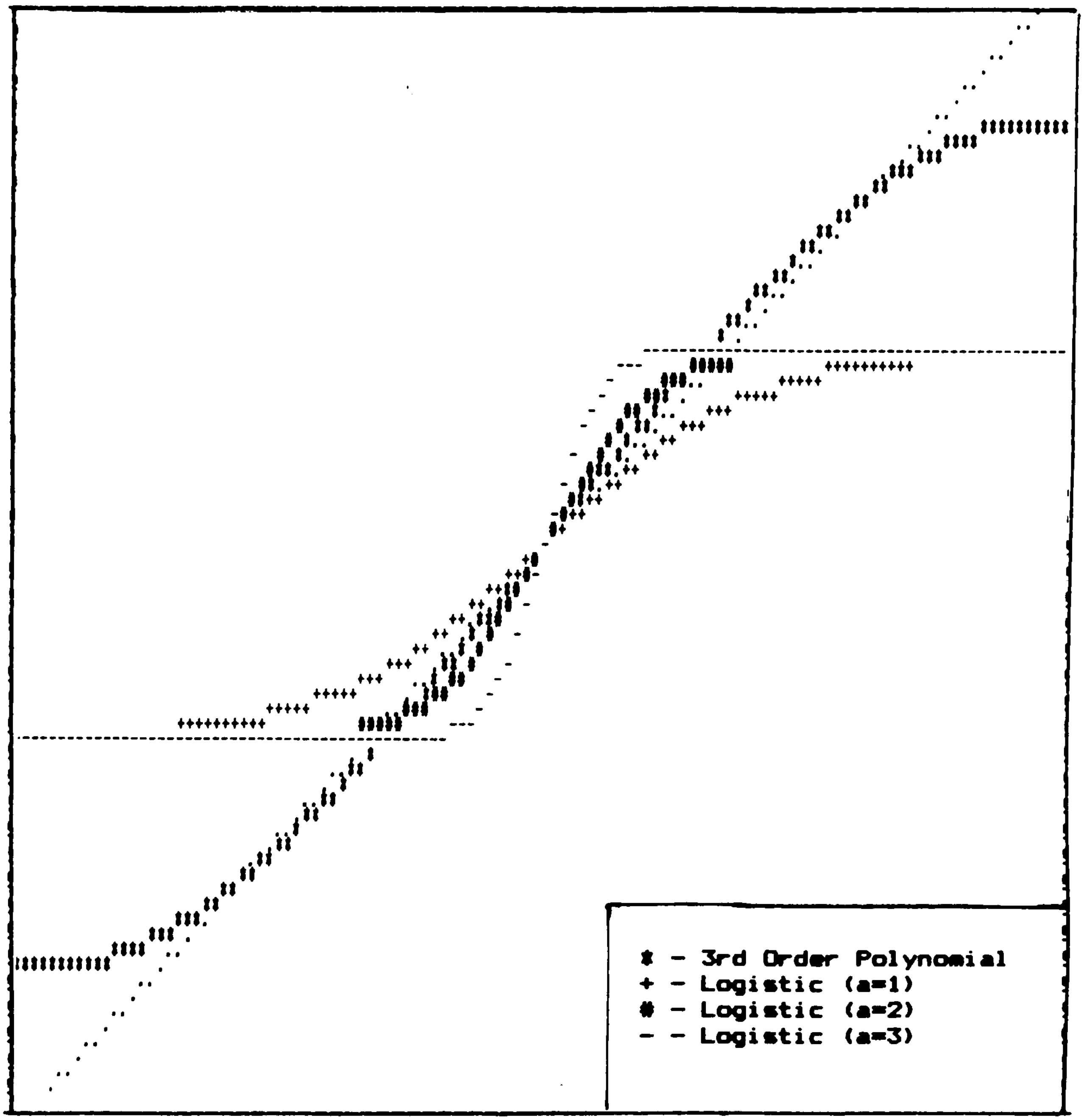


TABLE 18

LOGISTIC FUNCTION WITH VARYING EXPONENTIAL CONSTANTS
(CORRELATION = .5)

SAMPLE SIZE = 50

CONSTANT	SELECTION RATIO	B0		B1		S2e		D		Rxyt	
		E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	E(W)	P(I)	B(r)	B(R)
A=1	.8	.36	94	.54	97	.32	97	1.75	94	-.05	.03
	.5	1.10	89	1.13	93	.68	95	2.17	88	-.18	.02
	.3	2.52	98	2.03	98	1.45	97	3.55	98	-.26	.05
A=2	.8	.36	94	.54	94	.32	97	1.75	94	-.05	.04
	.5	1.10	89	1.13	91	.69	95	2.17	89	-.21	.00
	.3	2.52	98	2.03	96	1.45	97	3.55	97	-.30	.02
A=3	.8	.36	92	.55	91	.33	96	1.77	91	-.04	.04
	.5	1.11	85	1.13	85	.69	92	2.18	85	-.25	-.03
	.3	2.52	95	2.03	95	1.45	97	3.55	95	-.34	-.01

Note: E(W) values are marginally affected by varying "a" values. Best P(I) values occur for a = 1. Overall values are not significantly different from the comparable ones in Table 2.

Appendix 1

Derivation of Interval Estimates

The construction of the predictive probability distribution for the missing Y-scores follows the general method outlined in Chapter 2, Section 3.5.

Assuming that the underlying model for the total sample Nt Y-scores is normal with expectation $Xt\beta$ and dispersion $\sigma^2 It$, the models for Y in the selected sample (Ys) and unselected sample (Yu) are:

$$P(Ys\ Xs, \beta, \sigma) = N(Xs, \beta, \sigma\ Is)$$

$$P(Yu\ Xu, \beta, \sigma) = N(Xs, \beta, \sigma\ Iu)$$

In short, under the selection conditions 1) solely on X, or 2) on a set of conditionally independent variables, the models for Y in the selected and unselected samples are assumed normally distributed with expectation and dispersion derived by partitioning the total sample. Xs and Xu are the design matrices for the selected and unselected groups and Is and Iu are identity matrices of order Ns and Nu respectively. The predictive probability distribution of the unobserved Y-scores is expressed as:

$$Pred(Yu|Xu,Xs,Ys) \propto \int\int P'(\beta, \sigma^2) P(Ys|Xs,\beta, \sigma^2) P(Yu|Xu,\beta,\sigma^2)$$

where $P'(\beta, \sigma^2)$ represents the joint distribution of β and

Assuming a non-informative prior this distribution is known to have a multivariate t-distribution with Ns-2 degrees of freedom. Interval estimates for the least squares regression weights, B = (B0,B1), for the total applicant group Nt derive from the relationship:

$$B = c + L\,Yu$$

where $c = (Xt'Xt)^{-1} Xs'Ys$ and $L = (Xt'Xt)^{-1} Xu'$.

Since Yu is distributed multivariate t, the distribution of B, a linear function of the missing Yu scores, will also be multivariate t. This distribution yields 95% credibility intervals for B0 and B1 as given in Chapter 2, Section 2.2.

$$P(bo - Ao \leq B0 \leq bo + Ao) = .95$$

$$P(b1 - A1 \leq B1 \leq b1 + A1) = .95$$

For D, ($D = \bar{Y}s - \bar{Y}u$), the difference in average Y-score between the selected and unselected groups, estimates are derived in terms of the multivariate t distribution for Yu. From the relationship:

$$D = \bar{Y}s - 1'Yu/Nu$$

and using as an estimate of $\bar{Y}u$, the average predicted Y-score in the unselected group,

$$\hat{\bar{Y}}u = 1'Xu\,b\,/\,Nu$$

calculated from the regression weights in the selected group, a 95% credibility interval for D is given:

$$P(\bar{Y}s - \hat{\bar{Y}}u - Ad \leq D \leq \bar{Y}s - \hat{\bar{Y}}u + Ad) = .95$$

For the estimate of residual variance in the total sample:

$S2e = SSe / (Nt-2)$

the predictive unconditional distribution for SSe was obtained:

$$Pred(SSe \mid SSe_*, Nt, Ns) = B[(Nt - Ns)/2, (Ns-2)/2]^{-1} (SSe_*)^{b} (SSe - SSe_*)^{a-1} (SSe)^{-a-b}$$

where B[a,b] refers to a beta function with arguments a,b.

It is then shown that the random variable:

$$F = [(SSe - SSe_*)(Ns - 2)] / [SSe_*(Nt - Ns)]$$

has an F distribution with degrees of freedom Nt-Ns, Nt-2. From this the 95% credibility interval for the residual variance S2e is derived.

Further details of this method for deriving interval estimates may be found in the paper by Gross and Perry (1983).

Appendix 2

Multiple Cut-off Selection

If the probability of a subject being rejected, P(R) is efined to be 1) the probability of rejection on the basis of X, P(Rx) or 2) the probability of having been selected on X, Sx, then rejected on the basis of Z, Rz, we have:

$$P(R) = P(Rx) + [1 - P(Rx)] [P(Rz \mid Sx)]$$

Defining k to be the relative importance of the two conditions of rejection:

$$k = P(Rx) / [(1 - P(Rx))(P(Rz \mid Sx)]$$

yields

$$P(Rx) = [k / (K + 1)] . P(R)$$

For k/(k+1) = 0, selection is based entirely on Z.
For k/(k+1) = 1, subjects scoring highest on X alone are selected. Values of the ratio between 0 and 1 reflect selection procedures based on both variables.
For k/(k+1) = .5 rejection percentages on X and Z are:

Selection	X	Z
.8	10	11
.5	25	33.3
.3	35	53.8

To obtain required selection ratios, subjects were rejected from the total sample first on X then on the basis of Z.

Appendix 3

Trivariate Normal Distributions

Denoting variables X, Y, Z by subscripts 1, 2, 3 respectively and specifying matrix V

$$V = \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{12} & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix}$$

Obtain C a triangular matrix

$$C = \begin{bmatrix} c11 & & \\ c21 & c22 & \\ c31 & c32 & c33 \end{bmatrix}$$

so that $X = CZ + \mu$ and $V = C \cdot C'$

we may calculate:

$c11 = 1$, $c21 = \rho 12$, $c31 = \rho 13$, $c22 = (1 - \rho^2 12)^{.5}$

$c32 = (\rho 23 - \rho 13 \rho 12) / (1 - \rho^2 12)^{.5}$

$c33 = \left[1 - \rho 13^2 - (\rho 23 - \rho 13 \rho 12)^2 / (1 - \rho^2 12)\right]^{.5}$

Thus having generated X,

$Y = \rho 12\ X + c22\ E1$

$Z = \rho 13\ X + c32\ E1 + c33\ E2$

where E1 and E2 are linearly independent random numbers.

These calculations utilize the method proposed in Naylor et. al. (1966) p. 98.

Appendix 4

Additional Tables

The tables that follow give means and standard deviations for statistics calculated from 100 iterations of each particular sample condition. They present more comprehensive information than the tables of the text and are included as reference and validation for the results and analyses presented.

Glossary

2*A0	Expected interval width (E(W)) for B0
B0 IN	Probability of inclusion (P(I)) for B0
2*A1	E(W) for B1
B1 IN	P(I) for B1
G	E(W) for S2e
SS IN	P(I) for S2e
DEL Y	Difference in Y means, D
2*AD	E(W) for D
DELY IN	P(I) for D
RHO	XY correlation in the selected sample
RXYT	Corrected correlation R
V RATIO	Variance ratio, selected to total, for X
X BAR	Mean of X
Y BAR	Mean of Y
SIGMA X	Standard deviation of X
SIGMA Y	Standard deviation of Y

STABILITY CHECK OF ESTIMATES, VARYING RANDOM SEEDS
(LINEAR HOMOSCEDASTIC SELECTION ON X N=50, CORR. =.5)

RS=RANDOM SEED VALUES

	RS=13	RS=11	RS=17	RS=31	RS=23	RS=37	RS=29	RS=43	RS=41	RS=47
B0 100%	.02361	.00754	.01904	.02472	.00676	.00281	.02798	.01724	.01918	.00324
2 * A0 80%	.33898	.35605	.36377	.34709	.34852	.36659	.35531	.34931	.34273	.34715
2 * A0 50%	1.0570	1.0993	1.1191	1.1062	1.0777	1.1144	1.0985	1.0892	1.0573	1.0807
2 * A0 30%	2.3989	2.5183	2.5311	2.5956	2.4267	2.3887	2.4448	2.4116	2.4960	2.4520
B0 IN 80%	.93	.95	.97	.96	.96	.97	.96	.96	.95	.98
B0 IN 50%	.95	.96	.95	.96	.95	.92	.91	.96	.93	.95
B0 IN 30%	.94	.98	.96	.95	.94	.92	.96	.97	.99	.94
B1 100%	.51562	.49778	.50741	.48203	.51022	.52142	.47292	.50700	.47923	.51391
2 * A1 80%	.53172	.53738	.54310	.53221	.53250	.54830	.54131	.52196	.50704	.53541
2 * A1 50%	1.1111	1.1261	1.1381	1.1444	1.1128	1.1350	1.1361	1.1034	1.0646	1.1267
2 * A1 30%	1.9597	2.0248	2.0166	2.0999	1.9522	1.9048	1.9836	1.9134	1.9716	1.9908
B1 IN 80%	.93	.95	.98	.95	.97	.94	.96	.95	.95	.97
B1 IN 50%	.95	.97	.94	.96	.93	.93	.93	.95	.93	.97
B1 IN 30%	.92	.98	.98	.95	.94	.92	.96	.94	.99	.94
SSE 100%	.71388	.72517	.75051	.72668	.73446	.75254	.72804	.76018	.71057	.76946
6 80%	.31022	.31826	.33307	.32453	.32238	.34005	.32185	.33275	.31126	.34032
6 50%	.67861	.67874	.73462	.71444	.69896	.74613	.70644	.73154	.66535	.73813
6 30%	1.3730	1.4457	1.5265	1.5124	1.4501	1.4496	1.4162	1.5293	1.4661	1.4735
SS IN 80%	.96	.98	.98	.94	.98	.94	.95	.95	.91	.91
SS IN 50%	.93	.95	.97	.97	.97	.96	.97	.91	.94	.94
SS IN 30%	.94	.96	.96	.97	.96	.97	.98	.98	.99	.97
DEL Y 80%	.92106	.84242	.84455	.86691	.87652	.89927	.80553	.88799	.83888	.88050
DEL Y 50%	.83167	.76703	.80293	.79282	.80268	.83411	.74467	.81612	.73313	.77482
DEL Y 30%	.79847	.79605	.80635	.78799	.82158	.83954	.76417	.83408	.78762	.79669
2 * AD 80%	1.7266	1.7387	1.7712	1.7587	1.7504	1.7946	1.7555	1.7506	1.6971	1.7688
2 * AD 50%	2.1417	2.1611	2.1984	2.2357	2.1655	2.1973	2.1795	2.1799	2.0985	2.1848
2 * AD 30%	3.4604	3.5495	3.5608	3.7385	3.4799	3.3737	3.4713	3.4515	3.5421	3.5338
DELY IN 80%	.93	.95	.97	.96	.96	.97	.95	.96	.95	.97
DELY IN 50%	.95	.96	.95	.96	.95	.92	.91	.96	.93	.96
DELY IN 30%	.94	.98	.96	.95	.94	.92	.96	.97	.99	.94
RHO 100%	.51876	.49564	.49815	.49037	.51183	.51578	.47704	.50193	.49572	.49619
RHO 80%	.40433	.40164	.40794	.37182	.40847	.41635	.38252	.40229	.39695	.39935
RHO 50%	.28035	.33606	.30717	.26623	.31700	.32058	.30877	.30937	.34846	.34602
RHO 30%	.24378	.30099	.26608	.19400	.26514	.31062	.29149	.26061	.29425	.34167
RXYT 80%	.49790	.49278	.49987	.46008	.49915	.51039	.46970	.48604	.48177	.48124
RXYT 50%	.44693	.51410	.47402	.43554	.48478	.47740	.47640	.47441	.51561	.50345
RXYT 30%	.48831	.52807	.50651	.46839	.51263	.53733	.53419	.49429	.52376	.57274
V RATIO 80%	.58046	.58621	.58999	.58948	.58541	.58441	.58608	.60393	.60263	.60861
V RATIO 50%	.35009	.35415	.36094	.34785	.35305	.36942	.35938	.37065	.36727	.37567
V RATIO 30%	.23696	.24706	.25066	.23326	.24413	.26877	.25097	.26927	.25338	.25837
X BAR 100%	-.0133	.01391	.01859	-.0122	-.0038	.01224	.00548	-.0002	.00433	-.0090
Y BAR 100%	.01825	.01291	.02940	.02170	.00674	.01095	.03029	.01877	.02011	.00187
SIGMA X 100%	.98446	.97663	.97756	.99181	.99276	.99139	.97595	.99435	.99755	.97837
SIGMA Y 100%	.97228	.97074	.98778	.96702	.98355	.99596	.95965	.99542	.95732	1.0010

SELECTION ON X -- LINEAR HOMOSCEDASTIC
MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02600	.01263	.00500	.00754	-.0050	.01189	.01570	.00399	.00794
2 * A0 40%	1.6960	1.1963	.81354	1.6353	1.0612	.74878	1.3400	.89024	.60545
2 * A0 20%	4.8170	3.0515	2.0160	4.3915	2.6787	1.8516	3.9320	2.3924	1.4768
2 * A0 10%	16.201	7.3101	4.3698	12.880	6.8215	4.1030	13.330	6.0568	3.2615
B0 IN 40%	.89	.98	.96	.98	.96	.91	.97	.94	.95
B0 IN 20%	.94	.97	.95	.99	.91	.96	.97	.93	.97
B0 IN 10%	.98	.98	.94	.95	.98	.97	.95	.94	.96
B1 100%	.31721	.29445	.29415	.49778	.50467	.50559	.70611	.71188	.70189
2 * A1 40%	1.5767	1.0588	.72408	1.4866	.94339	.67114	1.2121	.80153	.53727
2 * A1 20%	3.4211	2.0548	1.3636	3.0995	1.8199	1.2654	2.7265	1.6385	.99488
2 * A1 10%	9.7660	4.0878	2.4549	7.7477	3.8804	2.3362	7.8123	3.4788	1.8184
B1 IN 40%	.9	.97	.96	.98	.95	.92	.97	.94	.96
B1 IN 20%	.93	.97	.96	.99	.91	.94	.98	.93	.96
B1 IN 10%	.97	.98	.95	.94	.99	.97	.96	.94	.97
SSE 100%	.86618	.91596	.90742	.72517	.74155	.74782	.51035	.51238	.50547
G 40%	1.0583	.71828	.47126	.90473	.56221	.38627	.65566	.38842	.26405
G 20%	2.4583	1.4314	.73261	2.0794	1.0584	.59553	1.5358	.75903	.40691
G 10%	10.719	2.9702	1.4254	8.2776	2.3745	1.1689	6.7239	1.6106	.76555
SS IN 40%	.96	.96	.99	.96	.94	.94	.96	.93	.93
SS IN 20%	.9	.96	.95	.98	.95	.92	.93	.96	.89
SS IN 10%	.97	.95	.95	.94	.96	.97	.97	.96	.95
DEL Y 40%	.48560	.47438	.47106	.78528	.81802	.79926	1.1307	1.1248	1.1182
DEL Y 20%	.46496	.49462	.51014	.86361	.86089	.88211	1.1884	1.2302	1.2072
DEL Y 10%	.50923	.54889	.56821	.93954	.93074	.98528	1.2681	1.3590	1.3450
2 * AD 40%	2.8593	1.9930	1.3614	2.6853	1.7644	1.2470	2.1999	1.4806	1.0082
2 * AD 20%	6.0666	3.8073	2.5287	5.4455	3.3421	2.3136	4.8378	2.9814	1.8433
2 * AD 10%	18.221	8.0973	4.8699	14.266	7.5609	4.5573	14.503	6.7007	3.6139
DELY IN 40%	.89	.98	.96	.98	.96	.91	.97	.94	.95
DELY IN 20%	.93	.97	.95	.99	.91	.96	.97	.93	.97
DELY IN 10%	.98	.98	.94	.95	.98	.97	.95	.94	.96
RHO 100%	.32044	.29574	.29572	.49564	.50392	.50215	.69622	.70239	.70097
RHO 40%	.12410	.14871	.16745	.31201	.29428	.31978	.44081	.48572	.46774
RHO 20%	.12556	.12661	.14137	.25505	.24898	.27592	.35769	.40359	.39883
RHO 10%	.10041	.11926	.13288	.23940	.23939	.26046	.29167	.34100	.33675
RXYT 40%	.35001	.28474	.29859	.53222	.46919	.51634	.64192	.70001	.68249
RXYT 20%	.52365	.37645	.34491	.57949	.51411	.52836	.67259	.68568	.66224
RXYT 10%	.73167	.53948	.45556	.74651	.56644	.57238	.75238	.70167	.62582
V RATIO 40%	.29474	.31161	.30503	.29575	.31415	.29728	.30764	.30585	.31244
V RATIO 20%	.18420	.21388	.20391	.20430	.21077	.19755	.18974	.19388	.21703
V RATIO 10%	.12756	.15370	.15312	.15354	.14884	.14415	.12248	.13412	.15579
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02347	.01303	.00330	.01291	-.0029	.01214	.02959	.00612	.00847
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.96574	.99452	.99419	.97074	.99004	.99712	.98608	1.0029	.99406

SELECTION ON X -- LINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12749	.08346	.06944	.12824	.08513	.06471	.09053	.06646	.05240
2 # A0 40%	.48624	.22334	.09680	.51088	.19857	.08874	.33522	.16485	.07540
2 # A0 20%	2.0542	.81750	.32259	1.7956	.75270	.34404	1.5958	.76594	.28788
2 # A0 10%	11.417	3.0997	1.1997	9.5903	3.3322	1.1573	9.7069	3.1015	1.0678
B0 IN 40%	.31288	.13999	.19595	.13999	.19595	.28618	.17058	.23748	.21794
B0 IN 20%	.23748	.17058	.21794	.09949	.28618	.19595	.17058	.25514	.17058
B0 IN 10%	.13999	.13999	.23748	.21794	.13999	.17058	.21794	.23748	.19595
B1 100%	.10831	.09091	.07073	.14073	.08103	.06710	.11131	.07186	.04751
2 # A1 40%	.46337	.19467	.09826	.46038	.18055	.09184	.31327	.17918	.06962
2 # A1 20%	1.5208	.57725	.24584	1.3642	.55676	.25883	1.1342	.56013	.19747
2 # A1 10%	7.1835	1.8268	.72278	6.3149	2.1067	.72068	5.7742	1.8658	.61146
B1 IN 40%	.3	.17058	.19595	.13999	.21794	.27129	.17058	.23748	.19595
B1 IN 20%	.25514	.17058	.19595	.09949	.28618	.23748	.13999	.25514	.19595
B1 IN 10%	.17058	.13999	.21794	.23748	.09949	.17058	.19595	.23748	.17058
SSE 100%	.15026	.12290	.08655	.15489	.09386	.07588	.10227	.06161	.04595
G 40%	.34980	.14498	.07131	.31723	.12027	.05668	.21896	.08763	.04004
G 20%	1.3844	.44691	.15887	1.0208	.34252	.13866	.80531	.26607	.08939
G 10%	8.2797	1.4450	.47016	7.0023	1.1270	.36740	5.3743	.79542	.25187
SS IN 40%	.19595	.19595	.09949	.19595	.23748	.23748	.19595	.25514	.25514
SS IN 20%	.3	.19595	.21794	.13999	.21794	.27129	.25514	.19595	.31288
SS IN 10%	.17058	.21794	.21794	.23748	.19595	.17058	.17058	.19595	.21794
DEL Y 40%	.22659	.17686	.14565	.26477	.18398	.13892	.24980	.17894	.11457
DEL Y 20%	.26302	.22157	.17799	.33489	.20561	.15526	.24976	.20895	.13811
DEL Y 10%	.40444	.30283	.24556	.44687	.26294	.21441	.37010	.26853	.17857
2 # AD 40%	.74350	.29243	.14136	.75519	.28867	.13612	.49627	.25826	.10909
2 # AD 20%	2.4977	.91169	.39841	2.2184	.89346	.42619	1.8452	.92916	.33754
2 # AD 10%	12.976	3.2960	1.3323	10.767	3.5947	1.2832	9.9701	3.3689	1.1457
DELY IN 40%	.31288	.13999	.19595	.13999	.19595	.28618	.17058	.23748	.21794
DELY IN 20%	.25514	.17058	.21794	.09949	.28618	.19595	.17058	.25514	.17058
DELY IN 10%	.13999	.13999	.23748	.21794	.13999	.17058	.21794	.23748	.19595
RHO 100%	.10231	.08899	.06994	.12360	.06634	.05374	.07630	.05281	.03305
RHO 40%	.24584	.13876	.10473	.22724	.14067	.10331	.18884	.12286	.08428
RHO 20%	.33106	.21077	.15839	.30830	.22534	.14919	.30089	.20210	.13654
RHO 10%	.49018	.31707	.22236	.52633	.27107	.20573	.46598	.29328	.21407
RXYT 40%	.24777	.17679	.15336	.22681	.18974	.13987	.20575	.12532	.08361
RXYT 20%	.26393	.24122	.21088	.26897	.24248	.19813	.25461	.20507	.15446
RXYT 10%	.27058	.29453	.25139	.27828	.29159	.24940	.28684	.23137	.23989
V RATIO 40%	.09555	.07469	.05118	.10972	.07870	.05263	.10284	.07756	.04929
V RATIO 20%	.10441	.08179	.05797	.11404	.08806	.05903	.09987	.08578	.06437
V RATIO 10%	.12874	.08158	.07014	.12743	.09457	.07148	.11239	.08665	.07185
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13251	.08456	.07156	.15117	.10085	.08005	.14953	.08623	.08091
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08270	.06515	.04633	.09705	.06446	.04962	.09634	.07577	.04630

SELECTION ON X -- LINEAR HOMOSCEDASTIC
MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02600	.01263	.00500	.00754	-.0050	.01189	.01570	.00399	.00794
2 * A0 80%	.37340	.26912	.18782	.35605	.24352	.17248	.29997	.20506	.14143
2 * A0 50%	1.1643	.82206	.56822	1.0993	.73908	.52318	.92285	.62415	.42478
2 * A0 30%	2.6424	1.8030	1.2160	2.5183	1.6084	1.1228	2.0872	1.3628	.90459
B0 IN 80%	.93	.96	.96	.95	.96	.92	.97	.94	.95
B0 IN 50%	.95	.99	.92	.96	.96	.94	.95	.94	.95
B0 IN 30%	.94	.94	.93	.98	.95	.92	.96	.94	.93
B1 100%	.31721	.29445	.29415	.49778	.50467	.50559	.70611	.71188	.70189
2 * A1 80%	.58570	.39868	.28131	.53738	.36021	.25885	.44785	.30801	.21034
2 * A1 50%	1.2239	.82270	.57172	1.1261	.74031	.52968	.93854	.63450	.42581
2 * A1 30%	2.1587	1.4034	.95151	2.0248	1.2607	.88530	1.6629	1.0784	.70551
B1 IN 80%	.93	.95	.95	.95	.96	.93	.98	.93	.96
B1 IN 50%	.95	.97	.93	.97	.96	.96	.94	.97	.95
B1 IN 30%	.92	.96	.95	.98	.96	.92	.98	.96	.93
SSE 100%	.86618	.91596	.90742	.72517	.74155	.74782	.51035	.51238	.50547
G 80%	.37640	.26809	.19003	.31826	.21863	.15664	.22649	.15255	.10663
G 50%	.82338	.56930	.39023	.67874	.45665	.32022	.49954	.31951	.21876
G 30%	1.6659	.95610	.60579	1.4457	.75634	.49541	1.0380	.51674	.34104
SS IN 80%	.96	.96	.95	.98	.98	.97	.98	.97	1
SS IN 50%	.93	.99	.97	.95	.95	.97	.97	.96	.97
SS IN 30%	.94	.93	1	.96	.95	.97	.96	.93	.95
DEL Y 80%	.58261	.52850	.50818	.84242	.87753	.88251	1.1871	1.2555	1.2393
DEL Y 50%	.52154	.46739	.47429	.76703	.82619	.80812	1.1116	1.1133	1.1185
DEL Y 30%	.47079	.47583	.48202	.79605	.83430	.82421	1.1311	1.1501	1.1417
2 * AD 80%	1.9019	1.3468	.94630	1.7387	1.2103	.86090	1.4606	1.0218	.70580
2 * AD 50%	2.3591	1.6452	1.1420	2.1611	1.4728	1.0456	1.8128	1.2457	.84878
2 * AD 30%	3.8116	2.5726	1.7437	3.5495	2.2933	1.6029	2.9363	1.9412	1.2911
DELY IN 80%	.93	.96	.95	.95	.96	.92	.97	.93	.95
DELY IN 50%	.95	.99	.92	.96	.76	.94	.95	.94	.95
DELY IN 30%	.94	.94	.93	.98	.95	.92	.96	.94	.94
RHO 100%	.32044	.29574	.29572	.49564	.50392	.50215	.69622	.70239	.70097
RHO 80%	.23026	.22350	.23327	.40164	.40711	.40621	.60109	.59516	.59424
RHO 50%	.13115	.17093	.17655	.33606	.31206	.33023	.48683	.51070	.49428
RHO 30%	.12065	.13230	.15463	.30099	.26486	.30358	.42616	.46089	.43741
RXYT 80%	.29383	.28251	.29613	.49278	.49620	.50028	.69792	.69289	.69067
RXYT 50%	.29836	.28403	.29391	.51410	.46550	.50412	.66758	.69827	.68105
RXYT 30%	.40965	.32605	.30753	.52807	.46289	.52636	.66808	.70614	.67850
V RATIO 80%	.58046	.59551	.59119	.58621	.60142	.58750	.58999	.58892	.59653
V RATIO 50%	.35009	.36611	.36086	.35415	.36823	.35211	.36094	.35936	.36716
V RATIO 30%	.23696	.26202	.25433	.24706	.26376	.24605	.25066	.25125	.26325
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	-.00050
Y BAR 100%	.02347	.01303	.00330	.01291	-.0029	.01214	.02959	.00612	.00847
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.96574	.99452	.99419	.97074	.99004	.99712	.98608	1.0029	.99406

SELECTION ON X -- LINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

		COR=.3			COR=.5			COR=.7		
		N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0	100%	.12749	.08346	.06944	.12824	.08513	.06471	.09053	.06646	.05240
2 * A0	80%	.09279	.05115	.02125	.09303	.04281	.01941	.07079	.02972	.01845
2 * A0	50%	.29785	.13935	.06415	.30233	.12635	.05498	.20891	.10115	.05059
2 * A0	30%	.87145	.39787	.15701	.89519	.35297	.16281	.64950	.30692	.12907
B0 IN	80%	.25514	.19595	.19595	.21794	.19595	.27129	.17058	.23748	.21794
B0 IN	50%	.21794	.09949	.27129	.19595	.19595	.23748	.21794	.23748	.21794
B0 IN	30%	.23748	.23748	.25514	.13999	.21794	.27129	.19595	.23748	.25514
B1	100%	.10831	.09091	.07073	.14073	.08103	.06710	.11131	.07186	.04751
2 * A1	80%	.11937	.05392	.02875	.11889	.04425	.02669	.08577	.04461	.02125
2 * A1	50%	.30688	.13460	.07256	.30479	.11729	.06479	.20951	.12607	.05040
2 * A1	30%	.73895	.31431	.14191	.72522	.29556	.14338	.53564	.27657	.10505
B1 IN	80%	.25514	.21794	.21794	.21794	.19595	.25514	.13999	.25514	.19595
B1 IN	50%	.21794	.17058	.25514	.17058	.19595	.19595	.23748	.17058	.21794
B1 IN	30%	.27129	.19595	.21794	.13999	.19595	.27129	.13999	.19595	.25514
SSE	100%	.15026	.12290	.08655	.15489	.09386	.07588	.10227	.06161	.04595
G	80%	.07450	.04127	.01951	.07550	.02952	.01744	.05147	.02160	.01062
G	50%	.24279	.10317	.05128	.20149	.08856	.04137	.14425	.06012	.02842
G	30%	.68853	.23652	.10267	.57459	.19326	.09129	.41554	.13828	.05787
SS IN	80%	.19595	.19595	.21794	.13999	.13999	.17058	.13999	.17058	0
SS IN	50%	.25514	.09949	.17058	.21794	.21794	.17058	.17058	.19595	.17058
SS IN	30%	.23748	.25514	0	.19595	.21794	.17058	.19595	.25514	.21794
DEL Y	80%	.34613	.24102	.16536	.29257	.21441	.17155	.31965	.23643	.13243
DEL Y	50%	.21713	.16451	.15029	.25058	.18253	.14527	.24119	.16973	.10810
DEL Y	30%	.23077	.18761	.16319	.31706	.17872	.13318	.24206	.19037	.11171
2 * AD	80%	.24930	.12239	.06065	.24398	.09214	.05381	.18655	.08694	.04374
2 * AD	50%	.49757	.20197	.10817	.48914	.19503	.09580	.33355	.18212	.08132
2 * AD	30%	1.2017	.47846	.21015	1.1870	.46495	.22336	.85660	.41528	.16881
DELY IN	80%	.25514	.19595	.21794	.21794	.19595	.27129	.17058	.25514	.21794
DELY IN	50%	.21794	.09949	.27129	.19595	.19595	.23748	.21794	.23748	.21794
DELY IN	30%	.23748	.23748	.25514	.13999	.21794	.27129	.19595	.23748	.23748
RHO	100%	.10231	.08899	.06994	.12360	.06634	.05374	.07630	.05281	.03305
RHO	80%	.12825	.10180	.08096	.15439	.08411	.06516	.08594	.07523	.04924
RHO	50%	.18827	.11818	.10719	.20852	.12452	.07723	.15103	.10671	.07429
RHO	30%	.27093	.17596	.13161	.23156	.16661	.11727	.21268	.13554	.10376
RXYT	80%	.15312	.12472	.09840	.16434	.09252	.07070	.08347	.06945	.04487
RXYT	50%	.18934	.15643	.13970	.22571	.15597	.09882	.16122	.10301	.07293
RXYT	30%	.24905	.19744	.19395	.25440	.21836	.16620	.20744	.13683	.11137
V RATIO	80%	.08612	.05805	.04245	.08513	.05128	.04576	.08136	.06137	.04450
V RATIO	50%	.09425	.07192	.05064	.10895	.07334	.05048	.10068	.07637	.04865
V RATIO	30%	.09729	.07764	.05223	.11018	.08310	.05570	.10034	.08044	.05504
X BAR	100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR	100%	.13251	.08456	.07156	.15117	.10085	.08005	.14953	.08623	.08091
SIGMA X	100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y	100%	.08270	.06515	.04633	.09705	.06446	.04962	.09634	.07577	.04630

SELECTION ON X -- NONLINEAR HOMOSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02906	.01088	.00431	.00781	-.0072	.01236	.01620	.00378	.00645
2 * A0 80%	.37617	.27055	.18867	.35774	.24525	.17317	.30297	.20635	.14279
2 * A0 50%	1.1677	.82556	.57002	1.1055	.74284	.52464	.93026	.62767	.42796
2 * A0 30%	2.6490	1.8075	1.2185	2.5281	1.6118	1.1260	2.0997	1.3695	.91072
B0 IN 80%	.93	.95	.98	.95	.96	.94	.97	.93	.96
B0 IN 50%	.89	.94	.83	.91	.86	.89	.93	.9	.78
B0 IN 30%	.93	.93	.89	.98	.85	.91	.93	.93	.77
B1 100%	.32585	.29910	.29957	.51029	.51199	.51326	.71876	.72062	.70724
2 * A1 80%	.58919	.40066	.28258	.53975	.36256	.25982	.45181	.30986	.21229
2 * A1 50%	1.2263	.82600	.57355	1.1319	.74370	.53108	.94505	.63781	.42891
2 * A1 30%	2.1625	1.4066	.95349	2.0325	1.2630	.88775	1.6716	1.0833	.71020
B1 IN 80%	.94	.96	.96	.97	.96	.9	.95	.93	.96
B1 IN 50%	.94	.96	.86	.95	.9	.89	.95	.94	.82
B1 IN 30%	.9	.93	.9	.98	.89	.89	.93	.91	.72
SSE 100%	.87771	.92829	.91826	.73496	.75471	.75966	.52290	.52220	.51956
G 80%	.38180	.27083	.19180	.32115	.22173	.15787	.23098	.15459	.10866
G 50%	.82844	.57393	.39290	.68572	.46149	.32204	.50754	.32361	.22210
G 30%	1.6782	.96139	.60874	1.4595	.76032	.49841	1.0494	.52318	.34592
SS IN 80%	.95	.98	.94	.98	.97	.95	.97	.94	.97
SS IN 50%	.94	.99	.98	.95	.95	.98	.96	.94	.97
SS IN 30%	.94	.94	1	.97	.95	.96	.98	.92	.97
DEL Y 80%	.60333	.55478	.53499	.87804	.90966	.91305	1.2225	1.2844	1.2693
DEL Y 50%	.59970	.54645	.55577	.84893	.90775	.89209	1.1926	1.1942	1.2004
DEL Y 30%	.53399	.53439	.54403	.85789	.89435	.88899	1.1923	1.2120	1.2035
2 * AD 80%	1.9145	1.3537	.95067	1.7468	1.2187	.86424	1.4743	1.0284	.71245
2 * AD 50%	2.3642	1.6520	1.1457	2.1726	1.4800	1.0485	1.8264	1.2527	.85506
2 * AD 30%	3.8188	2.5787	1.7474	3.5633	2.2977	1.6074	2.9532	1.9506	1.2999
DELY IN 80%	.93	.95	.98	.95	.95	.94	.96	.93	.96
DELY IN 50%	.9	.94	.83	.91	.86	.89	.93	.9	.78
DELY IN 30%	.92	.93	.89	.98	.85	.91	.93	.93	.77
RHO 100%	.32454	.29724	.29861	.50157	.50528	.50435	.69857	.70363	.69879
RHO 80%	.25172	.23588	.24733	.41523	.41712	.42085	.61152	.60604	.60089
RHO 50%	.09759	.12216	.12952	.29488	.26266	.28694	.45103	.47243	.44588
RHO 30%	.03783	.03060	.05241	.20656	.15711	.20390	.33652	.36559	.32433
RXYT 80%	.31986	.29804	.31367	.50720	.50718	.51646	.70762	.70324	.69678
RXYT 50%	.28380	.23001	.23466	.47405	.39901	.44660	.63140	.66062	.63066
RXYT 30%	.37854	.25210	.22751	.46788	.36297	.39500	.57888	.59774	.54255
V RATIO 80%	.58046	.59551	.59119	.58621	.60142	.58750	.58999	.58892	.59653
V RATIO 50%	.35009	.36611	.36086	.35415	.36823	.35211	.36094	.35936	.36716
V RATIO 30%	.23696	.26202	.25433	.24706	.26376	.24605	.25066	.25125	.26325
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02590	.01154	.00261	.01301	-.0053	.01262	.02987	.00640	.00720
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.97412	1.0018	1.0008	.98051	.99943	1.0066	.99866	1.0121	1.0043

SELECTION ON X -- NONLINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12849	.08262	.07003	.12782	.08538	.06519	.09194	.06899	.05295
2 * A0 80%	.09391	.05156	.02101	.09337	.04345	.01954	.07259	.02990	.01874
2 * A0 50%	.29973	.14105	.06331	.30481	.12596	.05416	.21132	.10073	.04999
2 * A0 30%	.87356	.40216	.16020	.89814	.35244	.16103	.64653	.30637	.12704
B0 IN 80%	.25514	.21794	.13999	.21794	.19595	.23748	.17058	.25514	.19595
B0 IN 50%	.31288	.23748	.37563	.28618	.34698	.31288	.25514	.3	.41424
B0 IN 30%	.25514	.25514	.31288	.13999	.35707	.28618	.25514	.25514	.42083
B1 100%	.11831	.09573	.07187	.14375	.08868	.07255	.11524	.07527	.05122
2 * A1 80%	.11751	.05340	.02835	.11860	.04353	.02616	.08606	.04410	.02107
2 * A1 50%	.30597	.13475	.07217	.30464	.11443	.06345	.20774	.12431	.04924
2 * A1 30%	.73870	.31610	.14441	.72510	.29361	.14206	.53037	.27515	.10305
B1 IN 80%	.23748	.19595	.19595	.17058	.19595	.3	.21794	.25514	.19595
B1 IN 50%	.23748	.19595	.34698	.21794	.3	.31288	.21794	.23748	.38418
B1 IN 30%	.3	.25514	.3	.13999	.31288	.31288	.25514	.28618	.44899
SSE 100%	.15360	.12610	.08747	.15515	.09782	.07652	.10522	.06423	.04928
G 80%	.07631	.04117	.01943	.07554	.03065	.01741	.05374	.02258	.01090
G 50%	.24605	.10373	.05207	.20199	.08963	.04059	.14629	.06286	.02835
G 30%	.70672	.24356	.10834	.58481	.19612	.09129	.41260	.14567	.05790
SS IN 80%	.21794	.13999	.23748	.13999	.17058	.21794	.17058	.23748	.17058
SS IN 50%	.23748	.09949	.13999	.21794	.21794	.13999	.19595	.23748	.17058
SS IN 30%	.23748	.23748	0	.17058	.21794	.19595	.13999	.27129	.17058
DEL Y 80%	.35129	.24341	.16225	.28699	.21316	.16864	.31218	.21772	.12572
DEL Y 50%	.21521	.16629	.14934	.24893	.18166	.14525	.23544	.16101	.10707
DEL Y 30%	.23123	.18709	.16290	.31719	.17407	.13316	.23191	.18128	.11066
2 * AD 80%	.24622	.12102	.05940	.24436	.09298	.05285	.19185	.08755	.04370
2 * AD 50%	.49616	.20357	.10772	.49061	.19177	.09336	.33332	.18027	.07922
2 * AD 30%	1.2009	.48316	.21640	1.1887	.46207	.22101	.84891	.41366	.16590
DELY IN 80%	.25514	.21794	.13999	.21794	.21794	.23748	.19595	.25514	.19595
DELY IN 50%	.3	.23748	.37563	.28618	.34698	.31288	.25514	.3	.41424
DELY IN 30%	.27129	.25514	.31288	.13999	.35707	.28618	.25514	.25514	.42083
RHO 100%	.10733	.09060	.06791	.11962	.06554	.05417	.07072	.04806	.03235
RHO 80%	.12221	.10097	.07904	.15273	.08412	.06479	.08311	.06983	.05010
RHO 50%	.19196	.12112	.10831	.21553	.13036	.08673	.15114	.10609	.08048
RHO 30%	.27379	.17657	.13775	.24589	.18458	.13750	.22656	.14632	.11493
RXYT 80%	.14956	.12428	.09639	.16404	.09336	.07072	.07994	.06570	.04686
RXYT 50%	.18800	.14965	.13454	.23241	.17951	.12270	.16981	.11444	.08989
RXYT 30%	.25072	.20379	.15865	.24221	.21517	.19163	.24216	.19001	.15973
V RATIO 80%	.08612	.05805	.04245	.08513	.05128	.04576	.08136	.06137	.04450
V RATIO 50%	.09425	.07192	.05064	.10895	.07334	.05048	.10068	.07637	.04865
V RATIO 30%	.09729	.07764	.05223	.11018	.08310	.05570	.10034	.08044	.05504
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13451	.08400	.07229	.15241	.10080	.08023	.15175	.08705	.08156
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08268	.06636	.04656	.09615	.06385	.05069	.09294	.06959	.04396

SELECTION ON X -- LINEAR HETEROSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02643	.01284	.00529	.00717	-.0044	.01191	.01734	.00575	.01084
2 # A0 80%	.37419	.26966	.18829	.35980	.24564	.17414	.30670	.21115	.14530
2 # A0 50%	1.1632	.82053	.56755	1.0925	.73556	.52137	.90463	.61791	.42088
2 # A0 30%	2.6131	1.7834	1.2030	2.4280	1.5510	1.0819	1.8496	1.2106	.81068
B0 IN 80%	.92	.96	.94	.95	.96	.92	1	.97	.97
B0 IN 50%	.95	.99	.92	.92	.95	.94	.96	.91	.93
B0 IN 30%	.94	.96	.94	.97	.96	.89	.93	.91	.89
B1 100%	.36116	.33893	.33854	.56990	.57791	.57812	.80759	.81182	.80437
2 # A1 80%	.58713	.39955	.28205	.54344	.36346	.26146	.45944	.31750	.21627
2 # A1 50%	1.2233	.82144	.57112	1.1214	.73749	.52816	.92574	.62978	.42257
2 # A1 30%	2.1359	1.3885	.94145	1.9556	1.2168	.85344	1.4829	.96070	.63318
B1 IN 80%	.91	.96	.94	.96	.97	.91	1	.96	.95
B1 IN 50%	.95	.98	.95	.96	.97	.96	.96	.94	.94
B1 IN 30%	.93	.97	.93	.99	.95	.89	.96	.93	.91
SSE 100%	.86418	.91367	.90564	.72368	.73721	.74425	.50447	.50833	.49987
G 80%	.37807	.26926	.19100	.32515	.22246	.15972	.23774	.16182	.11265
G 50%	.82265	.56769	.38941	.67315	.45345	.31836	.49055	.31508	.21574
G 30%	1.6312	.93618	.59308	1.3496	.70505	.46057	.83272	.41118	.27498
SS IN 80%	.96	.97	.95	.95	.97	.92	.93	.89	.7
SS IN 50%	.94	.99	.97	.94	.96	.97	.94	.96	.95
SS IN 30%	.95	.93	.97	.98	.92	.94	.98	.85	.84
DEL Y 80%	.66563	.61311	.59331	.97639	1.0134	1.0205	1.3738	1.4442	1.4317
DEL Y 50%	.57082	.51694	.52280	.84600	.90803	.88653	1.2230	1.2205	1.2281
DEL Y 30%	.53355	.54160	.54721	.89970	.94310	.92971	1.2781	1.2960	1.2890
2 # AD 80%	1.9060	1.3497	.94873	1.7573	1.2209	.86936	1.4967	1.0524	.72545
2 # AD 50%	2.3578	1.6426	1.1407	2.1510	1.4670	1.0424	1.7866	1.2354	.84232
2 # AD 30%	3.7706	2.5452	1.7251	3.4257	2.2129	1.5449	2.6150	1.7271	1.1584
DELY IN 80%	.92	.96	.95	.95	.96	.92	1	.97	.97
DELY IN 50%	.95	.99	.92	.92	.95	.94	.95	.91	.93
DELY IN 30%	.94	.96	.94	.97	.96	.89	.93	.91	.9
RHO 100%	.36034	.33621	.33592	.54889	.55712	.55442	.74567	.74915	.74984
RHO 80%	.25675	.25094	.25941	.43837	.44568	.44124	.63679	.62748	.62868
RHO 50%	.17241	.21321	.21816	.40037	.38070	.39484	.57300	.59117	.58034
RHO 30%	.16778	.17917	.20156	.38186	.35240	.38491	.56578	.59649	.57979
RXYT 80%	.32537	.31600	.32800	.53142	.53827	.53864	.73135	.72298	.72267
RXYT 50%	.33046	.33799	.34827	.57770	.55287	.58373	.74945	.77066	.76023
RXYT 30%	.43436	.37496	.36704	.60697	.56824	.63184	.78348	.82658	.80814
V RATIO 80%	.58046	.59551	.59119	.58621	.60142	.58750	.58999	.58892	.59653
V RATIO 50%	.35009	.36611	.36086	.35415	.36823	.35211	.36094	.35936	.36716
V RATIO 30%	.23696	.26202	.25433	.24706	.26376	.24605	.25066	.25125	.26325
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02314	.01309	.00339	.01355	-.0020	.01234	.03310	.00806	.01140
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.97956	1.0075	1.0074	1.0066	1.0267	1.0334	1.0554	1.0735	1.0655

SELECTION ON X -- LINEAR HETEROSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12761	.08378	.06975	.12906	.08537	.06489	.09148	.06538	.05169
2 * A0 80%	.09294	.05122	.02128	.09397	.04327	.01951	.06997	.03045	.01860
2 * A0 50%	.29507	.13731	.06355	.29092	.12048	.05284	.17743	.09322	.04427
2 * A0 30%	.85517	.39009	.15421	.84949	.33348	.15279	.53571	.25536	.10584
B0 IN 80%	.27129	.19595	.23748	.21794	.19595	.27129	0	.17058	.17058
B0 IN 50%	.21794	.09949	.27129	.27129	.21794	.23748	.19595	.28618	.25514
B0 IN 30%	.23748	.19595	.23748	.17058	.19595	.31288	.25514	.28618	.31288
B1 100%	.10631	.08960	.06973	.13278	.07696	.06342	.09457	.06189	.04010
2 * A1 80%	.12041	.05430	.02902	.12203	.04591	.02778	.09212	.04830	.02284
2 * A1 50%	.30656	.13414	.07270	.30182	.11623	.06552	.20677	.12847	.05024
2 * A1 30%	.73017	.30978	.14047	.69852	.28591	.13796	.48280	.24835	.09358
B1 IN 80%	.28618	.19595	.23748	.19595	.17058	.28618	0	.19595	.21794
B1 IN 50%	.21794	.13999	.21794	.19595	.17058	.19595	.19595	.23748	.23748
B1 IN 30%	.25514	.17058	.25514	.09949	.21794	.31288	.19595	.25514	.28618
SSE 100%	.15027	.12294	.08617	.15741	.09471	.07643	.10188	.06734	.04694
G 80%	.07481	.04180	.01966	.07781	.03050	.01805	.05396	.02357	.01157
G 50%	.24238	.10337	.05132	.19823	.08913	.04189	.15682	.06388	.03035
G 30%	.67308	.23186	.10086	.53584	.18281	.08592	.34992	.11486	.04778
SS IN 80%	.19595	.17058	.21794	.21794	.17058	.27129	.25514	.31288	.45825
SS IN 50%	.23748	.09949	.17058	.23748	.19595	.17058	.23748	.19595	.21794
SS IN 30%	.21794	.25514	.17058	.13999	.27129	.23748	.13999	.35707	.36660
DEL Y 80%	.34624	.24025	.16561	.29014	.21247	.16935	.31036	.23688	.13098
DEL Y 50%	.22102	.16523	.15185	.25342	.18815	.14824	.24926	.18026	.11517
DEL Y 30%	.23270	.18987	.16377	.31388	.18315	.13394	.24617	.19736	.11497
2 * AD 80%	.24949	.12316	.06116	.24772	.09518	.05570	.19298	.09215	.04684
2 * AD 50%	.49527	.20002	.10804	.47726	.19057	.09543	.31526	.18151	.08112
2 * AD 30%	1.1835	.47007	.20725	1.1336	.44555	.21189	.75202	.35864	.14700
DELY IN 80%	.27129	.19595	.21794	.21794	.19595	.27129	0	.17058	.17058
DELY IN 50%	.21794	.09949	.27129	.27129	.21794	.23748	.21794	.28618	.25514
DELY IN 30%	.23748	.19595	.23748	.17058	.19595	.31288	.25514	.28618	.3
RHO 100%	.09838	.08587	.06779	.11069	.06141	.04899	.06420	.04807	.02872
RHO 80%	.12536	.09963	.07984	.14268	.08034	.06281	.07483	.07103	.04637
RHO 50%	.18425	.11546	.10540	.19084	.11706	.07024	.12949	.09717	.06304
RHO 30%	.26556	.17280	.12816	.21514	.15486	.10763	.18081	.11096	.08253
RXYT 80%	.14880	.12036	.09562	.15359	.08569	.06579	.06908	.06290	.03968
RXYT 50%	.19501	.15934	.14292	.21303	.13230	.08112	.12100	.08013	.05245
RXYT 30%	.25291	.19272	.20024	.24256	.20163	.13185	.17424	.07285	.06120
V RATIO 80%	.08612	.05805	.04245	.08513	.05128	.04576	.08136	.06137	.04450
V RATIO 50%	.09425	.07192	.05064	.10895	.07334	.05048	.10068	.07637	.04865
V RATIO 30%	.09729	.07764	.05223	.11018	.08310	.05570	.10034	.08044	.05504
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13455	.08610	.07276	.15803	.10511	.08334	.16109	.09286	.08704
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08358	.06598	.04685	.09893	.06557	.04984	.09486	.07616	.04571

SELECTION ON X -- NONLINEAR HETEROSCEDASTIC
MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02949	.01110	.00461	.00744	-.0065	.01237	.01783	.00554	.00935
2 * A0 80%	.37639	.27064	.18884	.36033	.24652	.17429	.30771	.21117	.14561
2 * A0 50%	1.1659	.82360	.56905	1.0976	.73861	.52234	.91012	.62041	.42290
2 * A0 30%	2.6203	1.7885	1.2060	2.4398	1.5558	1.0861	1.8642	1.2202	.81879
B0 IN 80%	.94	.95	.96	.95	.98	.95	.98	.96	.94
B0 IN 50%	.94	.97	.85	.95	.89	.92	.95	.94	.91
B0 IN 30%	.92	.94	.88	.98	.91	.94	.95	.94	.9
B1 100%	.36981	.34358	.34396	.58241	.58522	.58579	.82024	.82056	.80973
2 * A1 80%	.58979	.40087	.28286	.54416	.36461	.26162	.46063	.31750	.21668
2 * A1 50%	1.2250	.82429	.57265	1.1260	.74013	.52904	.93027	.63201	.42450
2 * A1 30%	2.1401	1.3922	.94379	1.9646	1.2202	.85665	1.4932	.96786	.63938
B1 IN 80%	.93	.96	.95	.96	.96	.92	.99	.94	.96
B1 IN 50%	.94	.97	.88	.96	.92	.91	.96	.94	.91
B1 IN 30%	.91	.94	.9	.99	.9	.93	.96	.94	.88
SSE 100%	.87249	.92257	.91311	.72807	.74477	.75050	.50971	.51097	.50570
G 80%	.38233	.27108	.19214	.32597	.22406	.15997	.23933	.16197	.11312
G 50%	.82665	.57166	.39165	.67835	.45726	.31953	.49577	.31792	.21781
G 30%	1.6441	.94212	.59651	1.3650	.71027	.46436	.84431	.41905	.28075
SS IN 80%	.94	.99	.95	.98	.99	.93	.93	.9	.81
SS IN 50%	.95	.99	.98	.96	.96	.97	.94	.95	.96
SS IN 30%	.94	.94	.99	.98	.93	.96	.97	.84	.85
DEL Y 80%	.68635	.63940	.62013	1.0120	1.0455	1.0510	1.4092	1.4731	1.4616
DEL Y 50%	.64897	.59600	.60429	.92791	.98959	.97051	1.3040	1.3015	1.3100
DEL Y 30%	.59675	.60016	.60922	.96154	1.0031	.99449	1.3393	1.3580	1.3508
2 * AD 80%	1.9159	1.3543	.95154	1.7598	1.2251	.87001	1.5010	1.0526	.72690
2 * AD 50%	2.3615	1.6485	1.1439	2.1601	1.4727	1.0443	1.7961	1.2402	.84624
2 * AD 30%	3.7786	2.5521	1.7296	3.4420	2.2193	1.5508	2.6347	1.7406	1.1700
DELY IN 80%	.93	.95	.97	.95	.98	.94	.99	.96	.94
DELY IN 50%	.94	.97	.85	.95	.9	.92	.95	.94	.91
DELY IN 30%	.92	.94	.89	.98	.91	.94	.95	.94	.9
RHO 100%	.36458	.33795	.33906	.55546	.55946	.55748	.74970	.75231	.75019
RHO 80%	.27804	.26334	.27348	.45229	.45614	.45602	.64832	.63951	.63708
RHO 50%	.13932	.16531	.17211	.36208	.33480	.35471	.54420	.56034	.54074
RHO 30%	.08512	.07779	.09990	.29087	.24773	.28858	.48684	.51467	.48135
RXYT 80%	.35177	.33137	.34533	.54601	.54951	.55459	.74179	.73410	.73022
RXYT 50%	.31045	.27618	.28608	.53667	.49627	.53533	.72504	.74496	.72546
RXYT 30%	.39648	.27727	.25584	.52904	.45487	.50838	.71537	.76035	.72410
V RATIO 80%	.58046	.59551	.59119	.58621	.60142	.58750	.58999	.58892	.59653
V RATIO 50%	.35009	.36611	.36086	.35415	.36823	.35211	.36094	.35936	.36716
V RATIO 30%	.23696	.26202	.25433	.24706	.26376	.24605	.25066	.25125	.26325
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02558	.01159	.00270	.01366	-.0044	.01282	.03338	.00834	.01013
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.98638	1.0131	1.0125	1.0141	1.0334	1.0404	1.0647	1.0793	1.0716

SELECTION ON X -- NONLINEAR HETEROSCEDASTIC STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12834	.08277	.07021	.12813	.08540	.06517	.09225	.06739	.05174
2 * A0 80%	.09386	.05155	.02100	.09395	.04362	.01954	.07100	.03041	.01874
2 * A0 50%	.29699	.13906	.06277	.29333	.12006	.05204	.17926	.09292	.04389
2 * A0 30%	.85744	.39443	.15742	.85200	.33276	.15093	.53182	.25472	.10355
B0 IN 80%	.23748	.21794	.19595	.21794	.13999	.21794	.13999	.19595	.23748
B0 IN 50%	.23748	.17058	.35707	.21794	.31288	.27129	.21794	.23748	.28618
B0 IN 30%	.27129	.23748	.32496	.13999	.28618	.23748	.21794	.23748	.3
B1 100%	.11575	.09400	.07056	.13505	.08376	.06837	.09731	.06343	.04367
2 * A1 80%	.11854	.05381	.02863	.12173	.04518	.02730	.09244	.04796	.02270
2 * A1 50%	.30561	.13425	.07229	.30148	.11313	.06418	.20435	.12671	.04921
2 * A1 30%	.72972	.31145	.14286	.69755	.28350	.13643	.47672	.24642	.09129
B1 IN 80%	.25514	.19595	.21794	.19595	.19595	.27129	.09949	.23748	.19595
B1 IN 50%	.23748	.17058	.32496	.19595	.27129	.28618	.19595	.23748	.28618
B1 IN 30%	.28618	.23748	.3	.09949	.3	.25514	.19595	.23748	.32496
SSE 100%	.15266	.12560	.08661	.15656	.09697	.07632	.10460	.06772	.04920
G 80%	.07624	.04153	.01947	.07733	.03109	.01787	.05550	.02410	.01172
G 50%	.24519	.10360	.05204	.19726	.08949	.04095	.15635	.06552	.03017
G 30%	.69161	.23894	.10659	.54543	.18560	.08606	.34637	.12204	.04825
SS IN 80%	.23748	.09949	.21794	.13999	.09949	.25514	.25514	.3	.39230
SS IN 50%	.21794	.09949	.13999	.19595	.19595	.17058	.23748	.21794	.19595
SS IN 30%	.23748	.23748	.09949	.13999	.25514	.19595	.17058	.36660	.35707
DEL Y 80%	.34846	.24116	.16115	.28125	.20811	.16472	.29762	.21291	.11950
DEL Y 50%	.21814	.16639	.15053	.25081	.18645	.14775	.24220	.17011	.11372
DEL Y 30%	.23150	.18832	.16269	.31200	.17607	.13256	.23236	.18582	.11249
2 * AD 80%	.24616	.12173	.05984	.24756	.09520	.05467	.19707	.09264	.04681
2 * AD 50%	.49371	.20152	.10758	.47808	.18671	.09295	.31276	.17932	.07922
2 * AD 30%	1.1826	.47469	.21340	1.1343	.44195	.20929	.74243	.35637	.14370
DELY IN 80%	.25514	.21794	.17058	.21794	.13999	.23748	.09949	.19595	.23748
DELY IN 50%	.23748	.17058	.35707	.21794	.3	.27129	.21794	.23748	.28618
DELY IN 30%	.27129	.23748	.31288	.13999	.28618	.23748	.21794	.23748	.3
RHO 100%	.10196	.08665	.06532	.10591	.05895	.04814	.05875	.04185	.02742
RHO 80%	.11807	.09801	.07723	.13988	.07824	.06084	.07037	.06342	.04532
RHO 50%	.18683	.11741	.10566	.19637	.11976	.07674	.12468	.09176	.06424
RHO 30%	.27038	.17464	.13494	.23294	.17391	.12761	.19383	.11683	.09014
RXYT 80%	.14234	.11901	.09281	.15236	.08416	.06403	.06445	.05663	.03963
RXYT 50%	.19014	.16034	.14275	.22505	.15056	.10059	.12519	.08402	.06158
RXYT 30%	.24407	.19708	.17529	.24996	.21602	.18066	.20576	.10901	.09375
V RATIO 80%	.08612	.05805	.04245	.08513	.05128	.04576	.08136	.06137	.04450
V RATIO 50%	.09425	.07192	.05064	.10895	.07334	.05048	.10068	.07637	.04865
V RATIO 30%	.09729	.07764	.05223	.11018	.08310	.05570	.10034	.08044	.05504
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13627	.08547	.07335	.15902	.10487	.08333	.16298	.09308	.08738
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08319	.06713	.04678	.09710	.06398	.05093	.08866	.06789	.04240

MULTIPLE CUTOFF -- LINEAR HOMOSCEDASTIC
MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02600	.01263	.00500	.00754	-.0050	.01189	.01570	.00399	.00794
2 * A0 80%	.32777	.23367	.16177	.31821	.22036	.15539	.28170	.19361	.13357
2 * A0 50%	.92152	.64901	.45282	.93426	.64112	.44821	.84784	.58244	.39511
2 * A0 30%	2.1042	1.4096	.96580	2.2019	1.4001	.96007	1.9161	1.2863	.84711
B0 IN 80%	.89	.87	.78	.96	.83	.83	.91	.9	.68
B0 IN 50%	.89	.95	.86	.93	.9	.89	.92	.92	.84
B0 IN 30%	.9	.99	.93	.97	.92	.9	.94	.95	.92
B1 100%	.31721	.29445	.29415	.49778	.50467	.50559	.70611	.71188	.70189
2 * A1 80%	.50238	.34223	.23949	.47281	.31846	.22911	.41247	.28596	.19584
2 * A1 50%	1.0560	.70526	.49272	.99343	.66380	.47126	.87013	.59796	.40013
2 * A1 30%	1.9019	1.2108	.82788	1.8296	1.1414	.78963	1.5497	1.0288	.66911
B1 IN 80%	.92	.91	.9	.96	.91	.92	.95	.95	.84
B1 IN 50%	.93	.98	.91	.93	.92	.97	.92	.95	.89
B1 IN 30%	.9	.99	.96	.96	.95	.92	.97	.96	.94
SSE 100%	.86618	.91596	.90742	.72517	.74155	.74782	.51035	.51238	.50547
G 80%	.37489	.26760	.18803	.31528	.21380	.15339	.21787	.14962	.10392
G 50%	.81554	.55959	.38351	.66661	.44916	.30891	.47362	.31256	.21312
G 30%	1.6456	.94346	.58990	1.3769	.72232	.47162	.97411	.50328	.33067
SS IN 80%	.95	1	.95	.96	.94	.92	.98	.98	.96
SS IN 50%	.95	.97	.97	.96	.97	.98	.95	.95	.95
SS IN 30%	.97	.95	.98	.95	.96	.94	.98	.96	.94
DEL Y 80%	.61769	.62139	.58146	.87712	.93405	.93078	1.2893	1.2909	1.2968
DEL Y 50%	.60024	.53720	.53048	.82291	.85670	.86371	1.1572	1.1601	1.1616
DEL Y 30%	.54983	.55935	.54634	.85478	.88000	.88274	1.1811	1.1744	1.1710
2 * AD 80%	1.6546	1.1679	.81364	1.5575	1.0932	.77523	1.3690	.96425	.66668
2 * AD 50%	1.8629	1.2973	.91050	1.8346	1.2766	.89527	1.6676	1.1622	.78977
2 * AD 30%	3.0359	2.0096	1.3843	3.1009	1.9972	1.3699	2.7044	1.8318	1.2089
DELY IN 80%	.89	.86	.78	.96	.83	.83	.91	.92	.66
DELY IN 50%	.88	.95	.86	.93	.9	.89	.92	.92	.84
DELY IN 30%	.9	.99	.93	.96	.92	.91	.94	.95	.92
RHO 100%	.32044	.29574	.29572	.49564	.50392	.50215	.69622	.70239	.70097
RHO 80%	.23918	.21891	.23351	.41115	.41076	.41210	.59093	.59785	.59311
RHO 50%	.13896	.18172	.17921	.34140	.32115	.33595	.48107	.50121	.48764
RHO 30%	.10900	.15795	.15865	.29529	.26421	.30801	.41240	.45425	.43481
RXYT 80%	.28474	.25999	.27726	.48141	.48044	.48627	.67661	.68411	.67893
RXYT 50%	.27265	.27030	.26722	.48355	.45023	.48209	.64748	.67661	.66072
RXYT 30%	.42823	.30736	.29294	.52832	.43720	.50406	.62726	.68641	.66517
V RATIO 80%	.67440	.68964	.68828	.66187	.67162	.65728	.62833	.62892	.63303
V RATIO 50%	.44022	.45933	.45119	.42496	.43358	.41297	.39309	.38750	.39741
V RATIO 30%	.29883	.33759	.31977	.28323	.30231	.28866	.27026	.26766	.28114
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02347	.01303	.00330	.01291	-.0029	.01214	.02959	.00612	.00847
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.96574	.99452	.99419	.97074	.99004	.99712	.98608	1.0029	.99406

MULTIPLE CUTOFF -- LINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12749	.08346	.06944	.12824	.08513	.06471	.09053	.06646	.05240
2 # A0 80%	.07618	.03949	.01704	.07534	.03810	.01667	.06524	.02792	.01704
2 # A0 50%	.23923	.11712	.04796	.25578	.11709	.05164	.18341	.09473	.04740
2 # A0 30%	.67516	.31931	.12798	.80868	.30829	.13964	.58208	.30082	.12075
B0 IN 80%	.31288	.33630	.41424	.19595	.37563	.37563	.28618	.3	.46647
B0 IN 50%	.31288	.21794	.34698	.25514	.3	.31288	.27129	.27129	.36660
B0 IN 30%	.3	.09949	.25514	.17058	.27129	.3	.23748	.21794	.27129
B1 100%	.10831	.09091	.07073	.14073	.08103	.06710	.11131	.07186	.04751
2 # A1 80%	.11094	.04879	.02675	.10822	.04391	.02497	.07764	.04114	.02035
2 # A1 50%	.25903	.11545	.06098	.26788	.11082	.06061	.19062	.11822	.04739
2 # A1 30%	.65129	.26728	.12055	.66499	.26444	.12624	.50168	.26821	.09838
B1 IN 80%	.27129	.28618	.3	.19595	.28618	.27129	.21794	.21794	.36660
B1 IN 50%	.25514	.13999	.28618	.25514	.27129	.17058	.27129	.21794	.31288
B1 IN 30%	.3	.09949	.19595	.19595	.21794	.27129	.17058	.19595	.23748
SSE 100%	.15026	.12290	.08655	.15489	.09386	.07588	.10227	.06161	.04595
6 80%	.07724	.04183	.01975	.07793	.03041	.01653	.04720	.02104	.01062
6 50%	.22256	.10888	.04527	.20132	.08392	.04334	.12171	.06036	.02793
6 30%	.62429	.23566	.09659	.55830	.18337	.09234	.37999	.13122	.05862
SS IN 80%	.21794	0	.21794	.19595	.23748	.27129	.13999	.13999	.19595
SS IN 50%	.21794	.17058	.17058	.19595	.17058	.13999	.21794	.21794	.21794
SS IN 30%	.17058	.21794	.13999	.21794	.19595	.23748	.13999	.19595	.23748
DEL Y 80%	.33657	.22015	.18408	.27298	.22880	.16412	.26119	.23660	.12328
DEL Y 50%	.24002	.18171	.15302	.25224	.17433	.14483	.22846	.16642	.10265
DEL Y 30%	.24311	.18900	.16206	.28489	.17652	.13974	.23910	.18304	.11628
2 # AD 80%	.24356	.10955	.05169	.22565	.09656	.04898	.17121	.08316	.04404
2 # AD 50%	.38970	.17001	.08302	.40842	.18133	.08734	.30071	.16913	.07849
2 # AD 30%	.91501	.37672	.16441	1.0725	.40963	.18801	.79769	.40312	.15634
DELY IN 80%	.31288	.34698	.41424	.19595	.37563	.37563	.28618	.27129	.47370
DELY IN 50%	.32496	.21794	.34698	.25514	.3	.31288	.27129	.27129	.36660
DELY IN 30%	.3	.09949	.25514	.19595	.27129	.28618	.23748	.21794	.27129
RHO 100%	.10231	.08899	.06994	.12360	.06634	.05374	.07630	.05281	.03305
RHO 80%	.11414	.10268	.07696	.14789	.08651	.06556	.09634	.07181	.04824
RHO 50%	.18270	.11878	.10175	.19054	.12777	.07858	.14648	.10436	.07043
RHO 30%	.30441	.16005	.12407	.25466	.17727	.11414	.21686	.14329	.10053
RXYT 80%	.13167	.11787	.08872	.16009	.09380	.06947	.09800	.06619	.04584
RXYT 50%	.18143	.14623	.12665	.21946	.15618	.09766	.16139	.09849	.07013
RXYT 30%	.24352	.17763	.16101	.24258	.22791	.16263	.23615	.14870	.10747
V RATIO 80%	.09267	.06370	.04618	.09207	.06321	.05403	.09214	.06556	.04905
V RATIO 50%	.11424	.08563	.06207	.12791	.08485	.05696	.11203	.07966	.05219
V RATIO 30%	.11724	.09583	.06477	.12416	.09283	.06213	.10995	.08409	.05651
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13251	.08456	.07156	.15117	.10085	.08005	.14953	.08623	.08091
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08270	.06515	.04633	.09705	.06446	.04962	.09634	.07577	.04630

MULTIPLE CUTOFF -- NONLINEAR HOMOSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02906	.01088	.00431	.00781	-.0072	.01236	.01620	.00378	.00645
2 * A0 80%	.33022	.23478	.16248	.31975	.22189	.15596	.28403	.19461	.13466
2 * A0 50%	.92532	.65301	.45430	.93926	.64538	.44975	.85391	.58452	.39756
2 * A0 30%	2.1130	1.4193	.96851	2.2103	1.4032	.96247	1.9254	1.2919	.85282
B0 IN 80%	.89	.91	.81	.95	.84	.86	.92	.9	.65
B0 IN 50%	.83	.9	.72	.88	.81	.7	.88	.81	.49
B0 IN 30%	.88	.92	.82	.94	.8	.76	.87	.81	.61
B1 100%	.32585	.29910	.29957	.51029	.51199	.51326	.71876	.72062	.70724
2 * A1 80%	.50540	.34374	.24053	.47491	.32043	.22989	.41541	.28738	.19738
2 * A1 50%	1.0592	.70924	.49436	.99815	.66775	.47274	.87522	.59994	.40253
2 * A1 30%	1.9069	1.2186	.83023	1.8366	1.1437	.79153	1.5560	1.0329	.67355
B1 IN 80%	.95	.93	.9	.95	.95	.94	.96	.93	.89
B1 IN 50%	.92	.96	.85	.9	.88	.92	.9	.88	.64
B1 IN 30%	.91	.95	.91	.96	.84	.82	.9	.85	.65
SSE 100%	.87771	.92829	.91826	.73496	.75471	.75966	.52290	.52220	.51956
G 80%	.38033	.27011	.18970	.31825	.21676	.15448	.22143	.15127	.10559
G 50%	.82296	.56623	.38625	.67394	.45524	.31097	.48005	.31535	.21580
G 30%	1.6641	.95655	.59367	1.3889	.72637	.47416	.98244	.50919	.33536
SS IN 80%	.98	.97	.95	.98	.96	.9	.97	.93	.96
SS IN 50%	.95	.99	.98	.95	.98	.99	.96	.94	.96
SS IN 30%	.96	.96	.98	.95	.96	.93	.99	.93	.95
DEL Y 80%	.60686	.61348	.57364	.88717	.94459	.93909	1.3160	1.3100	1.3173
DEL Y 50%	.65271	.56719	.58683	.88816	.92230	.93185	1.2312	1.2342	1.2363
DEL Y 30%	.60974	.61374	.60586	.91451	.93817	.94467	1.2404	1.2348	1.2313
2 * AD 80%	1.6659	1.1732	.81727	1.5648	1.1005	.77798	1.3795	.96931	.67199
2 * AD 50%	1.8694	1.3050	.91361	1.8439	1.2848	.89824	1.6783	1.1665	.79460
2 * AD 30%	3.0464	2.0231	1.3884	3.1122	2.0014	1.3733	2.7169	1.8396	1.2171
DELY IN 80%	.88	.9	.82	.94	.86	.86	.91	.9	.64
DELY IN 50%	.83	.9	.73	.89	.81	.7	.88	.82	.48
DELY IN 30%	.88	.9	.81	.94	.77	.76	.87	.81	.6
RHO 100%	.32454	.29724	.29861	.50157	.50528	.50435	.69857	.70363	.69879
RHO 80%	.26596	.23856	.25531	.42967	.42567	.43168	.60532	.61138	.60267
RHO 50%	.12791	.15200	.15208	.31260	.28421	.30431	.44961	.46701	.44395
RHO 30%	.05058	.07475	.07463	.20598	.16338	.21570	.32207	.36005	.32289
RXYT 80%	.31695	.28276	.30274	.50194	.49654	.50750	.69052	.69704	.68790
RXYT 50%	.26681	.23584	.23434	.45633	.40389	.44233	.61472	.64186	.61469
RXYT 30%	.41929	.23695	.20498	.46352	.35716	.38233	.53432	.57760	.52973
V RATIO 80%	.67440	.68964	.68828	.66187	.67162	.65728	.62833	.62892	.63303
V RATIO 50%	.44022	.45933	.45119	.42496	.43358	.41297	.39309	.38750	.39741
V RATIO 30%	.29883	.33759	.31977	.28323	.30231	.28866	.27026	.26766	.28114
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02590	.01154	.00261	.01301	-.0053	.01262	.02987	.00640	.00720
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.97412	1.0018	1.0008	.98051	.99943	1.0066	.99866	1.0121	1.0043

MULTIPLE CUTOFF -- NONLINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12849	.08262	.07003	.12782	.08538	.06519	.09194	.06899	.05295
2 # A0 80%	.07676	.03986	.01685	.07540	.03880	.01669	.06703	.02816	.01725
2 # A0 50%	.24047	.11825	.04633	.25726	.11729	.05149	.18809	.09412	.04696
2 # A0 30%	.67981	.32283	.12617	.81354	.30385	.13864	.58382	.30025	.11827
B0 IN 80%	.31288	.28618	.39230	.21794	.36660	.34698	.27129	.3	.47696
B0 IN 50%	.37563	.3	.44899	.32496	.39230	.45825	.32496	.39230	.49989
B0 IN 30%	.32496	.27129	.38418	.23748	.39999	.42708	.33630	.39230	.48774
B1 100%	.11831	.09573	.07187	.14375	.08868	.07255	.11524	.07527	.05122
2 # A1 80%	.10930	.04845	.02641	.10766	.04332	.02448	.07827	.04090	.02014
2 # A1 50%	.25647	.11424	.05995	.26745	.10825	.05932	.19035	.11667	.04643
2 # A1 30%	.64876	.26692	.11956	.66750	.26065	.12502	.49941	.26660	.09617
B1 IN 80%	.21794	.25514	.3	.21794	.21794	.23748	.19595	.25514	.31288
B1 IN 50%	.27129	.19595	.35707	.3	.32496	.27129	.3	.32496	.48
B1 IN 30%	.28618	.21794	.28618	.19595	.36660	.38418	.3	.35707	.47696
SSE 100%	.15360	.12610	.08747	.15515	.09782	.07652	.10522	.06423	.04928
6 80%	.07791	.04229	.01946	.07782	.03196	.01634	.04952	.02198	.01072
6 50%	.22870	.10933	.04497	.20388	.08493	.04252	.12480	.06319	.02778
6 30%	.64580	.24237	.09814	.56661	.18259	.09258	.37717	.13905	.05813
SS IN 80%	.13999	.17058	.21794	.13999	.19595	.3	.17058	.25514	.19595
SS IN 50%	.21794	.09949	.13999	.21794	.13999	.09949	.19595	.23748	.19595
SS IN 30%	.19595	.19595	.13999	.21794	.19595	.25514	.09949	.25514	.21794
DEL Y 80%	.34023	.22794	.18881	.27069	.22727	.16691	.25783	.22067	.12245
DEL Y 50%	.23882	.18362	.15497	.25199	.17375	.14689	.22294	.15744	.10195
DEL Y 30%	.24560	.18899	.16315	.28552	.17485	.14031	.22827	.17415	.11491
2 # AD 80%	.24073	.10892	.05065	.22453	.09795	.04782	.17746	.08440	.04367
2 # AD 50%	.38802	.16944	.08095	.40953	.17893	.08577	.30435	.16785	.07682
2 # AD 30%	.91559	.37873	.16357	1.0775	.40225	.18654	.79697	.40125	.15286
DELY IN 80%	.32496	.3	.38418	.23748	.34698	.34698	.28618	.3	.48
DELY IN 50%	.37563	.3	.44395	.31288	.39230	.45825	.32496	.38418	.49959
DELY IN 30%	.32496	.3	.39230	.23748	.42083	.42708	.33630	.39230	.48989
RHO 100%	.10733	.09060	.06791	.11962	.06554	.05417	.07072	.04806	.03235
RHO 80%	.10844	.10125	.07504	.14518	.08480	.06458	.08998	.06654	.04880
RHO 50%	.18410	.11788	.10370	.19355	.13293	.08157	.14671	.10541	.07604
RHO 30%	.30291	.16200	.12916	.27056	.19439	.13616	.23224	.15257	.11405
RXYT 80%	.12607	.11766	.08674	.15557	.09232	.06873	.09019	.06242	.04706
RXYT 50%	.18462	.14441	.12753	.21726	.17104	.10843	.16929	.11134	.08543
RXYT 30%	.23607	.17117	.15242	.24383	.21179	.19203	.26589	.19722	.15912
V RATIO 80%	.09267	.06370	.04618	.09207	.06321	.05403	.09214	.06556	.04905
V RATIO 50%	.11424	.08563	.06207	.12791	.08485	.05696	.11203	.07966	.05219
V RATIO 30%	.11724	.09583	.06477	.12416	.09283	.06213	.10995	.08409	.05651
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13451	.08400	.07229	.15241	.10080	.08023	.15175	.08705	.08156
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08268	.06636	.04656	.09615	.06385	.05069	.09294	.06959	.04396

MULTIPLE CUTOFF -- LINEAR HETEROSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02643	.01284	.00529	.00717	-.0044	.01191	.01734	.00575	.01084
2 * A0 80%	.32808	.23393	.16198	.32066	.22155	.15635	.28730	.19853	.13655
2 * A0 50%	.92261	.64975	.45350	.93442	.64039	.44885	.83283	.58013	.39360
2 * A0 30%	2.0901	1.4008	.95914	2.1348	1.3564	.93195	1.7103	1.1475	.76320
B0 IN 80%	.87	.84	.77	.95	.82	.79	.92	.89	.64
B0 IN 50%	.89	.95	.86	.92	.92	.93	.94	.96	.91
B0 IN 30%	.89	.98	.95	.96	.94	.94	.95	.96	.94
B1 100%	.36116	.33893	.33854	.56990	.57791	.57812	.80759	.81182	.80437
2 * A1 80%	.50297	.34264	.23984	.47679	.32032	.23063	.42202	.29355	.20037
2 * A1 50%	1.0576	.70624	.49352	.99567	.66368	.47222	.86018	.59707	.39926
2 * A1 30%	1.8904	1.2037	.82232	1.7774	1.1071	.76692	1.3948	.92068	.60382
B1 IN 80%	.92	.91	.87	.97	.9	.91	.95	.95	.73
B1 IN 50%	.93	.98	.92	.95	.96	.97	.96	.96	.94
B1 IN 30%	.91	.98	.95	.96	.94	.94	.96	.95	.96
SSE 100%	.86418	.91367	.90564	.72368	.73721	.74425	.50447	.50833	.49987
G 80%	.37559	.26821	.18855	.32027	.21615	.15532	.22724	.15739	.10870
G 50%	.81804	.56113	.38475	.66942	.44913	.31005	.46623	.31175	.21249
G 30%	1.6249	.93281	.58208	1.3013	.68009	.44495	.79793	.40452	.26976
SS IN 80%	.95	1	.96	.96	.98	.94	.98	.96	.89
SS IN 50%	.95	.97	.97	.94	.95	.99	.96	.94	.89
SS IN 30%	.97	.95	.98	.95	.93	.86	.98	.84	.76
DEL Y 80%	.68860	.69180	.65215	1.0003	1.0589	1.0567	1.4664	1.4748	1.4835
DEL Y 50%	.64691	.58403	.57740	.90311	.94035	.94393	1.2761	1.2762	1.2802
DEL Y 30%	.59873	.60859	.59603	.94730	.97526	.97296	1.3207	1.3133	1.3096
2 * AD 80%	1.6561	1.1692	.81476	1.5695	1.0992	.78014	1.3989	.98893	.68185
2 * AD 50%	1.8655	1.2990	.91193	1.8373	1.2761	.89685	1.6467	1.1594	.78804
2 * AD 30%	3.0165	1.9974	1.3749	3.0098	1.9365	1.3301	2.4278	1.6369	1.0906
DELY IN 80%	.88	.84	.77	.94	.82	.79	.91	.9	.63
DELY IN 50%	.88	.95	.86	.94	.92	.93	.94	.96	.91
DELY IN 30%	.9	.98	.95	.97	.94	.93	.95	.96	.94
RHO 100%	.36034	.33621	.33592	.54889	.55712	.55442	.74567	.74915	.74984
RHO 80%	.26856	.24893	.26250	.45044	.45299	.45072	.63159	.63291	.63166
RHO 50%	.17299	.21760	.21439	.39812	.38207	.39234	.56387	.57586	.56750
RHO 30%	.15357	.20517	.20634	.37651	.35194	.38995	.55275	.59045	.57827
RXYT 80%	.31878	.29431	.31070	.52284	.52572	.52782	.71556	.71699	.71518
RXYT 50%	.29945	.31308	.31050	.54214	.52538	.55010	.72851	.74665	.73647
RXYT 30%	.43713	.35471	.35292	.59079	.54920	.60975	.75904	.81317	.79819
V RATIO 80%	.67440	.68964	.68828	.66187	.67162	.65728	.62833	.62892	.63303
V RATIO 50%	.44022	.45933	.45119	.42496	.43358	.41297	.39309	.38750	.39741
V RATIO 30%	.29883	.33759	.31977	.28323	.30231	.28866	.27026	.26766	.28114
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02314	.01309	.00339	.01355	-.0020	.01234	.03310	.00806	.01140
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.97956	1.0075	1.0074	1.0066	1.0267	1.0334	1.0554	1.0735	1.0655

MULTIPLE CUTOFF -- LINEAR HETEROSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12761	.08378	.06975	.12906	.08537	.06489	.09148	.06538	.05169
2 # A0 80%	.07632	.03954	.01705	.07628	.03844	.01668	.06478	.02867	.01708
2 # A0 50%	.23804	.11649	.04762	.24784	.11259	.05024	.15315	.08763	.04166
2 # A0 30%	.66559	.31380	.12538	.76578	.29027	.13142	.47029	.24972	.09772
B0 IN 80%	.33630	.36660	.42083	.21794	.38418	.40730	.27129	.31288	.48
B0 IN 50%	.31288	.21794	.34698	.27129	.27129	.25514	.23748	.19595	.28618
B0 IN 30%	.31288	.13999	.21794	.19595	.23748	.23748	.21794	.19595	.23748
B1 100%	.10631	.08960	.06973	.13278	.07696	.06342	.09457	.06189	.04010
2 # A1 80%	.11164	.04907	.02699	.11113	.04540	.02586	.08408	.04466	.02171
2 # A1 50%	.25919	.11580	.06125	.26803	.11035	.06166	.19009	.12098	.04756
2 # A1 30%	.64573	.26428	.11943	.63981	.25662	.12236	.46187	.24080	.08762
B1 IN 80%	.27129	.28618	.33630	.17058	.3	.28618	.21794	.21794	.44395
B1 IN 50%	.25514	.13999	.27129	.21794	.19595	.17058	.19595	.19595	.23748
B1 IN 30%	.28618	.13999	.21794	.19595	.23748	.23748	.19595	.21794	.19595
SSE 100%	.15027	.12294	.08617	.15741	.09471	.07643	.10188	.06734	.04694
G 80%	.07748	.04207	.01991	.08029	.03133	.01681	.04880	.02302	.01136
G 50%	.22292	.10952	.04564	.20114	.08427	.04395	.13256	.06338	.03039
G 30%	.61284	.23326	.09535	.52848	.17477	.08735	.33960	.11138	.04984
SS IN 80%	.21794	0	.19595	.19595	.13999	.23748	.13999	.19595	.31288
SS IN 50%	.21794	.17058	.17058	.23748	.21794	.09949	.19595	.23748	.31288
SS IN 30%	.17058	.21794	.13999	.21794	.25514	.34698	.13999	.36660	.42708
DEL Y 80%	.33749	.21880	.18370	.27493	.22810	.16180	.25688	.23617	.11887
DEL Y 50%	.24264	.18138	.15394	.25240	.18036	.14654	.23675	.17700	.10795
DEL Y 30%	.24392	.18949	.16197	.28140	.18218	.14210	.24495	.19175	.12142
2 # AD 80%	.24344	.11023	.05214	.22901	.09911	.04999	.17797	.08885	.04646
2 # AD 50%	.38884	.16971	.08298	.39998	.17768	.08707	.28380	.16739	.07890
2 # AD 30%	.90375	.37057	.16163	1.0232	.39250	.17865	.69939	.34689	.13547
DELY IN 80%	.32496	.36660	.42083	.23748	.38418	.40730	.28618	.3	.48280
DELY IN 50%	.32496	.21794	.34698	.23748	.27129	.25514	.23748	.19595	.28618
DELY IN 30%	.3	.13999	.21794	.17058	.23748	.25514	.21794	.19595	.23748
RHO 100%	.09838	.08587	.06779	.11069	.06141	.04899	.06420	.04807	.02872
RHO 80%	.11171	.10069	.07546	.13619	.08239	.06274	.08285	.06898	.04499
RHO 50%	.17870	.11706	.10008	.17525	.12022	.07542	.12876	.09497	.06184
RHO 30%	.29827	.15781	.12104	.23481	.16337	.10372	.18870	.11826	.07947
RXYT 80%	.12690	.11526	.08600	.14672	.08696	.06428	.08029	.06116	.04003
RXYT 50%	.18433	.15055	.12986	.21006	.13730	.08661	.12555	.07762	.05432
RXYT 30%	.24822	.18788	.16640	.24981	.19134	.12748	.18318	.08118	.05963
V RATIO 80%	.09267	.06370	.04618	.09207	.06321	.05403	.09214	.06556	.04905
V RATIO 50%	.11424	.08563	.06207	.12791	.08485	.05696	.11203	.07966	.05219
V RATIO 30%	.11724	.09583	.06477	.12416	.09283	.06213	.10995	.08409	.05651
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13455	.08610	.07276	.15803	.10511	.08334	.16109	.09286	.08704
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08358	.06598	.04685	.09893	.06557	.04984	.09486	.07616	.04571

MULTIPLE CUTOFF -- NONLINEAR HETEROSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02949	.01110	.00461	.00744	-.0065	.01237	.01783	.00554	.00935
2 # A0 80%	.33004	.23466	.16244	.32114	.22230	.15643	.28770	.19831	.13663
2 # A0 50%	.92534	.65289	.45438	.93747	.64330	.44945	.83604	.58033	.39426
2 # A0 30%	2.0987	1.4106	.96192	2.1440	1.3603	.93486	1.7205	1.1552	.77036
B0 IN 80%	.89	.9	.8	.95	.82	.83	.91	.9	.58
B0 IN 50%	.84	.93	.75	.9	.82	.79	.89	.89	.68
B0 IN 30%	.88	.93	.83	.95	.85	.83	.85	.9	.84
B1 100%	.36981	.34358	.34396	.58241	.58522	.58579	.82024	.82056	.80973
2 # A1 80%	.50528	.34360	.24050	.47741	.32122	.23070	.42234	.29322	.20046
2 # A1 50%	1.0596	.70929	.49452	.99834	.66623	.47271	.86236	.59711	.39985
2 # A1 30%	1.8951	1.2114	.82470	1.7850	1.1099	.76921	1.4016	.92638	.60936
B1 IN 80%	.95	.93	.92	.95	.95	.95	.98	.97	.8
B1 IN 50%	.92	.96	.84	.92	.9	.92	.92	.91	.74
B1 IN 30%	.91	.95	.95	.94	.87	.87	.92	.92	.85
SSE 100%	.87249	.92257	.91311	.72807	.74477	.75050	.50971	.51097	.50570
G 80%	.37990	.26984	.18962	.32116	.21762	.15545	.22792	.15716	.10882
G 50%	.82343	.56623	.38646	.67351	.45314	.31077	.46866	.31236	.21319
G 30%	1.6428	.94573	.58589	1.3137	.68474	.44789	.80524	.41142	.27504
SS IN 80%	.97	.98	.96	.99	.98	.94	.98	.94	.92
SS IN 50%	.95	.98	.98	.95	.98	.99	.96	.93	.91
SS IN 30%	.97	.96	.98	.96	.94	.86	.98	.83	.77
DEL Y 80%	.67776	.68388	.64433	1.0103	1.0694	1.0650	1.4931	1.4939	1.5040
DEL Y 50%	.69938	.63602	.63375	.96836	1.0059	1.0120	1.3501	1.3503	1.3549
DEL Y 30%	.65863	.66297	.65555	1.0070	1.0334	1.0348	1.3800	1.3737	1.3699
2 # AD 80%	1.6650	1.1727	.81709	1.5717	1.1027	.78047	1.4004	.98798	.68220
2 # AD 50%	1.8699	1.3049	.91384	1.8426	1.2815	.89793	1.6515	1.1598	.78925
2 # AD 30%	3.0267	2.0109	1.3791	3.0221	1.9417	1.3343	2.4412	1.6476	1.1008
DELY IN 80%	.89	.9	.81	.95	.83	.84	.91	.9	.58
DELY IN 50%	.83	.93	.75	.91	.82	.79	.89	.89	.68
DELY IN 30%	.88	.93	.83	.95	.85	.84	.86	.91	.84
RHO 100%	.36458	.33795	.33906	.55546	.55946	.55748	.74970	.75231	.75019
RHO 80%	.29496	.26842	.28408	.46890	.46797	.47008	.64652	.64725	.64260
RHO 50%	.16225	.18860	.18798	.37207	.34802	.36344	.53912	.54875	.53225
RHO 30%	.09548	.12291	.12327	.29066	.25459	.30175	.47383	.51022	.48156
RXYT 80%	.35023	.31707	.33569	.54264	.54157	.54836	.72953	.73032	.72519
RXYT 50%	.29165	.27846	.27758	.51389	.48450	.51642	.70729	.72288	.70444
RXYT 30%	.41669	.26869	.25187	.52578	.44014	.49763	.68367	.74611	.71361
V RATIO 80%	.67440	.68964	.68828	.66187	.67162	.65728	.62833	.62892	.63303
V RATIO 50%	.44022	.45933	.45119	.42496	.43358	.41297	.39309	.38750	.39741
V RATIO 30%	.29883	.33759	.31977	.28323	.30231	.28866	.27026	.26766	.28114
X BAR 100%	-.0133	-.0032	-.0047	.01391	.00346	.00168	.01859	.00290	.00050
Y BAR 100%	.02558	.01159	.00270	.01366	-.0044	.01282	.03338	.00834	.01013
SIGMA X 100%	.98446	1.0025	1.0007	.97663	.99261	.99279	.97756	.99177	.99394
SIGMA Y 100%	.98638	1.0131	1.0125	1.0141	1.0334	1.0404	1.0647	1.0793	1.0716

MULTIPLE CUTOFF -- NONLINEAR HETEROSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12834	.08277	.07021	.12813	.08540	.06517	.09225	.06739	.05174
2 # A0 80%	.07673	.03984	.01682	.07603	.03885	.01661	.06569	.02864	.01714
2 # A0 50%	.23918	.11763	.04602	.24913	.11272	.05011	.15718	.08721	.04161
2 # A0 30%	.67054	.31733	.12371	.77060	.28582	.13046	.47152	.24935	.09508
B0 IN 80%	.31288	.3	.39999	.21794	.38418	.37563	.28618	.3	.49355
B0 IN 50%	.36660	.25514	.43301	.3	.38418	.40730	.31288	.31288	.46647
B0 IN 30%	.32496	.25514	.37563	.21794	.35707	.37563	.35707	.3	.36660
B1 100%	.11575	.09400	.07056	.13505	.08376	.06837	.09731	.06343	.04367
2 # A1 80%	.10999	.04875	.02667	.11060	.04477	.02540	.08452	.04449	.02155
2 # A1 50%	.25668	.11462	.06027	.26757	.10771	.06042	.18891	.11962	.04689
2 # A1 30%	.64311	.26373	.11842	.64178	.25258	.12098	.45870	.23893	.08520
B1 IN 80%	.21794	.25514	.27129	.21794	.21794	.21794	.13999	.17058	.39999
B1 IN 50%	.27129	.19595	.36660	.27129	.3	.27129	.27129	.28618	.43863
B1 IN 30%	.28618	.21794	.21794	.23748	.33630	.33630	.27129	.27129	.35707
SSE 100%	.15266	.12560	.08661	.15656	.09697	.07632	.10460	.06772	.04920
G 80%	.07783	.04239	.01954	.07975	.03232	.01650	.05031	.02353	.01137
G 50%	.22818	.10954	.04517	.20178	.08433	.04285	.13160	.06520	.03014
G 30%	.63441	.23958	.09701	.53576	.17406	.08759	.33424	.11903	.04978
SS IN 80%	.17058	.13999	.19595	.09949	.13999	.23748	.13999	.23748	.27129
SS IN 50%	.21794	.13999	.13999	.21794	.13999	.09949	.19595	.25514	.28618
SS IN 30%	.17058	.19595	.13999	.19595	.23748	.34698	.13999	.37563	.42083
DEL Y 80%	.33911	.22542	.18766	.27033	.22429	.16319	.24758	.21528	.11431
DEL Y 50%	.24048	.18278	.15554	.25118	.17904	.14815	.22976	.16643	.10690
DEL Y 30%	.24504	.18873	.16254	.28031	.17875	.14155	.23047	.18054	.11867
2 # AD 80%	.24037	.10956	.05101	.22752	.09979	.04873	.18226	.08971	.04620
2 # AD 50%	.38704	.16913	.08094	.40066	.17487	.08549	.28438	.16614	.07781
2 # AD 30%	.90454	.37241	.16089	1.0276	.38486	.17710	.69715	.34482	.13174
DELY IN 80%	.31288	.3	.39230	.21794	.37563	.36660	.28618	.3	.49355
DELY IN 50%	.37563	.25514	.43301	.28618	.38418	.40730	.31288	.31288	.46647
DELY IN 30%	.32496	.25514	.37563	.21794	.35707	.36660	.34698	.28618	.36660
RHO 100%	.10196	.08665	.06532	.10591	.05895	.04814	.05875	.04185	.02742
RHO 80%	.10464	.09850	.07280	.13257	.07889	.06030	.07546	.06149	.04363
RHO 50%	.17865	.11494	.10106	.17533	.12217	.07479	.12279	.09027	.06108
RHO 30%	.29788	.15930	.12599	.25316	.18203	.12457	.20056	.12202	.08874
RXYT 80%	.11989	.11333	.08324	.14247	.08352	.06198	.07214	.05480	.03929
RXYT 50%	.18706	.14781	.13043	.21470	.14984	.09305	.12605	.08170	.06079
RXYT 30%	.24534	.18189	.15985	.24183	.22092	.17306	.22338	.11414	.09433
V RATIO 80%	.09267	.06370	.04618	.09207	.06321	.05403	.09214	.06556	.04905
V RATIO 50%	.11424	.08563	.06207	.12791	.08485	.05696	.11203	.07966	.05219
V RATIO 30%	.11724	.09583	.06477	.12416	.09283	.06213	.10995	.08409	.05651
X BAR 100%	.14434	.10155	.06540	.13952	.10595	.06543	.14277	.09022	.08080
Y BAR 100%	.13627	.08547	.07335	.15902	.10487	.08333	.16298	.09308	.08738
SIGMA X 100%	.09536	.06126	.05025	.08967	.06814	.04405	.09032	.07279	.04596
SIGMA Y 100%	.08319	.06713	.04678	.09710	.06398	.05093	.08866	.06789	.04240

COMPENSATORY SELECTION -- LINEAR HOMOSCEDASTIC
MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02600	.01263	.00500	.00754	-.0050	.01189	.01570	.00399	.00794
2 # A0 80%	.32421	.23635	.16243	.32160	.21913	.15358	.27825	.19069	.13185
2 # A0 50%	.84225	.59326	.41401	.84847	.57405	.40870	.76417	.52917	.36200
2 # A0 30%	1.6238	1.0979	.75789	1.7010	1.1272	.76145	1.5891	1.0680	.70004
B0 IN 80%	.82	.8	.57	.86	.7	.6	.85	.65	.42
B0 IN 50%	.85	.77	.58	.87	.64	.52	.8	.69	.39
B0 IN 30%	.84	.85	.65	.86	.63	.56	.87	.79	.51
B1 100%	.31721	.29445	.29415	.49778	.50467	.50559	.70611	.71188	.70189
2 # A1 80%	.45280	.31978	.21875	.45227	.30100	.21537	.39764	.27553	.18888
2 # A1 50%	.88017	.59719	.41559	.86499	.57324	.41388	.77926	.53751	.36224
2 # A1 30%	1.4221	.92052	.63209	1.4181	.91535	.62793	1.3052	.86784	.55972
B1 IN 80%	.85	.87	.77	.88	.82	.76	.9	.75	.56
B1 IN 50%	.88	.9	.75	.92	.76	.72	.85	.8	.56
B1 IN 30%	.88	.9	.83	.93	.79	.71	.93	.88	.68
SSE 100%	.86618	.91596	.90742	.72517	.74155	.74782	.51035	.51238	.50547
6 80%	.37173	.26672	.18852	.32021	.21511	.15305	.21928	.14955	.10465
6 50%	.81591	.55669	.38772	.67459	.44242	.31084	.46549	.31163	.21470
6 30%	1.6360	.90935	.58452	1.3820	.72387	.47218	.99384	.49631	.32377
SS IN 80%	.94	.95	.98	.95	.95	.95	.98	.97	.96
SS IN 50%	.94	.99	.99	.96	.97	.92	.97	.94	.94
SS IN 30%	1	.92	.98	.94	.93	.94	.99	.94	.94
DEL Y 80%	.69842	.67652	.66291	.96512	.99739	.99581	1.3490	1.3571	1.3381
DEL Y 50%	.62416	.58849	.58433	.86318	.92231	.90688	1.1953	1.2054	1.2044
DEL Y 30%	.61596	.62648	.61442	.94207	.94985	.95349	1.2276	1.2419	1.2387
2 # AD 80%	1.6354	1.1808	.81663	1.5695	1.0863	.76673	1.3520	.95040	.65829
2 # AD 50%	1.7075	1.1880	.83131	1.6656	1.1450	.81609	1.5022	1.0561	.72366
2 # AD 30%	2.3496	1.5703	1.0856	2.3887	1.6067	1.0867	2.2464	1.5228	.99999
DELY IN 80%	.82	.81	.56	.86	.69	.6	.87	.64	.43
DELY IN 50%	.83	.78	.59	.88	.65	.53	.8	.69	.4
DELY IN 30%	.84	.83	.66	.85	.65	.56	.87	.8	.51
RHO 100%	.32044	.29574	.29572	.49564	.50392	.50215	.69622	.70239	.70097
RHO 80%	.21203	.19531	.20364	.37107	.38720	.38948	.57025	.58004	.58043
RHO 50%	.11100	.13243	.13984	.30459	.27657	.29218	.46510	.46963	.45757
RHO 30%	.05861	.10692	.10180	.23467	.18629	.22968	.37096	.41084	.38265
RXYT 80%	.25432	.22661	.23433	.43059	.44618	.45179	.64905	.66084	.65988
RXYT 50%	.21451	.19179	.19397	.42007	.36558	.39242	.60619	.61447	.59989
RXYT 30%	.28116	.23488	.19363	.41857	.31264	.33458	.55469	.59210	.55266
V RATIO 80%	.73380	.73054	.74434	.69243	.70790	.69456	.65316	.65144	.65741
V RATIO 50%	.57579	.58042	.58354	.52378	.53499	.50436	.45946	.45498	.46682
V RATIO 30%	.47906	.51806	.50721	.43122	.43986	.42897	.36546	.35274	.37874
X BAR 100%	-.0021	.01429	-.0008	.00409	.00384	.01079	.02567	.02164	.00152
Y BAR 100%	.02347	.01303	.00330	.01291	-.0029	.01214	.02959	.00612	.00847
SIGMA X 100%	.97892	.99270	1.0009	1.0026	.99103	.99742	.98585	.98777	.98787
SIGMA Y 100%	.96574	.99452	.99419	.97074	.99004	.99712	.98608	1.0029	.99406

COMPENSATORY SELECTION -- LINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.[illegible]			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12749	.08346	.06944	.12824	.08513	.06471	.09053	.06646	.05240
2 # A0 80%	.07461	.04215	.01685	.07746	.03794	.01574	.06404	.02607	.01609
2 # A0 50%	.20163	.08830	.04443	.22537	.10047	.04460	.16447	.08489	.04313
2 # A0 30%	.47343	.21899	.10387	.54562	.22908	.09851	.41533	.22087	.09478
B0 IN 80%	.38418	.39999	.49507	.34698	.45825	.48989	.35707	.47696	.49355
B0 IN 50%	.35707	.42083	.49355	.33630	.48	.49959	.39999	.46249	.48774
B0 IN 30%	.36660	.35707	.47696	.34698	.48280	.49638	.33630	.40730	.49989
B1 100%	.10831	.09091	.07073	.14073	.08103	.06710	.11131	.07186	.04751
2 # A1 80%	.10376	.05087	.02624	.10265	.04207	.02354	.07684	.03850	.01901
2 # A1 50%	.21757	.08473	.04656	.21752	.09681	.04774	.17586	.10049	.04232
2 # A1 30%	.43461	.19869	.09123	.44332	.18735	.08260	.36878	.21624	.07717
B1 IN 80%	.35707	.33630	.42083	.32496	.38418	.42708	.3	.43301	.49638
B1 IN 50%	.32496	.3	.43301	.27129	.42708	.44899	.35707	.39999	.49638
B1 IN 30%	.32496	.3	.37563	.25514	.40730	.45376	.25514	.32496	.46647
SSE 100%	.15026	.12290	.08655	.15489	.09386	.07588	.10227	.06161	.04595
G 80%	.07446	.04170	.01927	.08084	.03059	.01665	.04763	.02116	.01078
G 50%	.22351	.10558	.04576	.19873	.08313	.04603	.12454	.06062	.02840
G 30%	.62042	.23956	.09269	.52306	.18893	.08710	.35151	.13211	.05793
SS IN 80%	.23748	.21794	.13999	.21794	.21794	.21794	.13999	.17058	.19595
SS IN 50%	.23748	.09949	.09949	.19595	.17058	.27129	.17058	.23748	.23748
SS IN 30%	0	.27129	.13999	.23748	.25514	.23748	.09949	.23748	.23748
DEL Y 80%	.34746	.23995	.17847	.28266	.22139	.16241	.24507	.22432	.13564
DEL Y 50%	.22223	.17452	.15055	.24432	.17387	.15615	.22078	.17514	.10826
DEL Y 30%	.26854	.19892	.16639	.27776	.19216	.15134	.22304	.18374	.12331
2 # AD 80%	.22255	.11665	.05270	.22429	.09450	.04777	.17369	.07852	.04107
2 # AD 50%	.38894	.12973	.07159	.35972	.16581	.07200	.26751	.14917	.07291
2 # AD 30%	.67528	.28524	.13319	.70840	.29625	.13070	.57446	.30527	.12850
DELY IN 80%	.38418	.39230	.49638	.34698	.46249	.48989	.33630	.48	.49507
DELY IN 50%	.37563	.41424	.49183	.32496	.47696	.49909	.39999	.46249	.48989
DELY IN 30%	.36660	.37563	.47370	.35707	.47696	.49638	.33630	.39999	.49989
RHO 100%	.10231	.08899	.06994	.12360	.06634	.05374	.07630	.05281	.03305
RHO 80%	.13617	.09479	.07911	.15238	.08147	.06555	.10746	.06923	.04729
RHO 50%	.17694	.12428	.09884	.21156	.12597	.09168	.15035	.11051	.07017
RHO 30%	.25018	.18318	.12695	.27434	.18360	.11695	.21321	.14431	.09951
RXYT 80%	.13766	.10784	.08909	.16308	.08947	.07072	.11210	.06523	.04563
RXYT 50%	.15539	.13319	.10849	.21575	.14257	.11349	.16443	.11500	.07356
RXYT 30%	.18911	.15070	.11526	.25075	.18521	.15489	.20832	.16534	.11633
V RATIO 80%	.11245	.07704	.05905	.09907	.06882	.05610	.09904	.06671	.04935
V RATIO 50%	.14303	.09119	.07106	.14759	.10006	.06438	.12243	.08637	.06019
V RATIO 30%	.16879	.11729	.08879	.17483	.11638	.07012	.12909	.09623	.07090
X BAR 100%	.13600	.10658	.07223	.14141	.09059	.07190	.14933	.08363	.07244
Y BAR 100%	.13251	.08456	.07156	.15117	.10085	.08005	.14953	.08623	.08091
SIGMA X 100%	.09393	.07149	.04848	.10039	.07071	.04977	.09431	.07394	.04581
SIGMA Y 100%	.08270	.06515	.04633	.09705	.06446	.04962	.09634	.07577	.04630

COMPENSATORY SELECTION -- NONLINEAR HOMOSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02906	.01088	.00431	.00781	-.0072	.01236	.00517	.00378	.00645
2 # A0 80%	.32623	.23715	.16283	.32251	.22013	.15388	.27186	.19117	.13262
2 # A0 50%	.84626	.59507	.41455	.85041	.57484	.40815	.77533	.52724	.36176
2 # A0 30%	1.6275	1.1049	.75925	1.7024	1.1235	.75899	1.6035	1.0644	.69783
B0 IN 80%	.83	.84	.63	.86	.7	.61	.87	.72	.43
B0 IN 50%	.8	.69	.45	.79	.5	.35	.7	.53	.16
B0 IN 30%	.82	.73	.46	.82	.47	.32	.73	.6	.15
B1 100%	.32585	.29910	.29957	.51029	.51199	.51326	.72578	.72062	.70724
2 # A1 80%	.45498	.32079	.21929	.45359	.30225	.21575	.40645	.27618	.18994
2 # A1 50%	.88324	.59889	.41616	.86653	.57377	.41325	.81148	.53551	.36195
2 # A1 30%	1.4238	.92595	.63327	1.4195	.91203	.62578	1.3355	.86471	.55790
B1 IN 80%	.89	.91	.83	.92	.87	.82	.89	.84	.66
B1 IN 50%	.88	.87	.72	.92	.72	.62	.81	.68	.37
B1 IN 30%	.87	.82	.65	.85	.63	.5	.79	.66	.21
SSE 100%	.87771	.92829	.91826	.73496	.75471	.75966	.52879	.52220	.51956
G 80%	.37602	.26849	.18950	.32215	.21711	.15365	.22834	.15045	.10587
G 50%	.82329	.55964	.38884	.67775	.44371	.30997	.49637	.30973	.21445
G 30%	1.6472	.92023	.58697	1.3835	.71919	.46900	1.0171	.49398	.32184
SS IN 80%	.97	.93	.96	.97	.95	.92	.98	.94	.95
SS IN 50%	.95	.99	.99	.95	.97	.92	.96	.93	.94
SS IN 30%	.98	.92	.97	.95	.93	.95	.96	.95	.93
DEL Y 80%	.71091	.69194	.67905	.99092	1.0211	1.0168	1.3543	1.3807	1.3628
DEL Y 50%	.66557	.63004	.62842	.91745	.97614	.96412	1.2694	1.2693	1.2690
DEL Y 30%	.65218	.65642	.64894	.98383	.99085	.99758	1.2844	1.2921	1.2872
2 # AD 80%	1.6445	1.1847	.81873	1.5743	1.0912	.76820	1.3835	.95297	.66207
2 # AD 50%	1.7142	1.1914	.83248	1.6690	1.1464	.81495	1.5657	1.0523	.72312
2 # AD 30%	2.3528	1.5800	1.0878	2.3904	1.6011	1.0831	2.3058	1.5176	.99675
DELY IN 80%	.85	.85	.62	.86	.72	.63	.87	.72	.47
DELY IN 50%	.78	.72	.44	.79	.48	.36	.68	.55	.16
DELY IN 30%	.82	.72	.47	.81	.48	.31	.74	.6	.15
RHO 100%	.32454	.29724	.29861	.50157	.50528	.50435	.70021	.70363	.69879
RHO 80%	.23514	.21219	.22238	.38973	.40226	.40914	.59616	.59528	.59128
RHO 50%	.11020	.11656	.12753	.29016	.25495	.27521	.43976	.44874	.42835
RHO 30%	.01998	.04753	.04486	.16872	.10999	.16338	.31655	.33246	.29075
RXYT 80%	.27695	.24614	.25561	.45029	.46250	.47322	.67546	.67571	.67027
RXYT 50%	.21900	.18010	.18153	.40458	.33884	.37150	.57716	.59258	.56826
RXYT 30%	.28690	.21409	.15895	.38763	.26010	.25906	.51545	.50072	.43688
V RATIO 80%	.73380	.73054	.74434	.69243	.70790	.69456	.65045	.65144	.65741
V RATIO 50%	.57579	.58042	.58354	.52378	.53499	.50436	.45535	.45498	.46682
V RATIO 30%	.47906	.51806	.50721	.43122	.43986	.42897	.36643	.35274	.37874
X BAR 100%	-.0021	.01429	-.0008	.00409	.00384	.01079	-.0087	.02164	.00152
Y BAR 100%	.02590	.01154	.00261	.01301	-.0053	.01262	-.0056	.00640	.00720
SIGMA X 100%	.97892	.99270	1.0009	1.0026	.99103	.99742	.98173	.98777	.98787
SIGMA Y 100%	.97412	1.0018	1.0008	.98051	.99943	1.0066	1.0078	1.0121	1.0043

COMPENSATORY SELECTION -- NONLINEAR HOMOSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12849	.08262	.07003	.12782	.08538	.06519	.11412	.06899	.05295
2 # A0 80%	.07532	.04232	.01655	.07714	.03831	.01577	.06838	.02606	.01620
2 # A0 50%	.20437	.08930	.04347	.22704	.10081	.04410	.22019	.08523	.04238
2 # A0 30%	.47773	.22241	.10235	.54918	.22968	.09858	.56481	.22192	.09460
B0 IN 80%	.37563	.36660	.48280	.34698	.45825	.48774	.33630	.44899	.49507
B0 IN 50%	.39999	.46249	.49749	.40730	.5	.47696	.45825	.49909	.36660
B0 IN 30%	.38418	.44395	.49839	.38418	.49909	.46647	.44395	.48989	.35707
B1 100%	.11831	.09573	.07187	.14375	.08868	.07255	.10852	.07527	.05122
2 # A1 80%	.10271	.05055	.02595	.10223	.04170	.02313	.08028	.03800	.01878
2 # A1 50%	.21645	.08477	.04604	.21791	.09546	.04667	.21402	.10030	.04123
2 # A1 30%	.43362	.19926	.09051	.44597	.18614	.08178	.45860	.21602	.07685
B1 IN 80%	.31288	.28618	.37563	.27129	.33630	.38418	.31288	.36660	.47370
B1 IN 50%	.32496	.33630	.44899	.27129	.44899	.48538	.39230	.46647	.48280
B1 IN 30%	.33630	.38418	.47696	.35707	.48280	.5	.40730	.47370	.40730
SSE 100%	.15360	.12610	.08747	.15515	.09782	.07652	.10456	.06423	.04928
G 80%	.07470	.04168	.01914	.08085	.03163	.01655	.05119	.02197	.01082
G 50%	.22638	.10528	.04545	.20092	.08377	.04507	.15280	.06279	.02784
G 30%	.64443	.24298	.09363	.52579	.18822	.08576	.41895	.13749	.05787
SS IN 80%	.17058	.25514	.19595	.17058	.21794	.27129	.13999	.23748	.21794
SS IN 50%	.21794	.09949	.09949	.21794	.17058	.27129	.19595	.25514	.23748
SS IN 30%	.13999	.27129	.17058	.21794	.25514	.21794	.19595	.21794	.25514
DEL Y 80%	.33931	.24413	.17843	.27733	.22293	.16187	.27155	.20641	.13172
DEL Y 50%	.22415	.17392	.14985	.24521	.17067	.15829	.22143	.16832	.10768
DEL Y 30%	.26897	.19507	.16698	.27828	.18977	.15320	.24596	.17729	.12335
2 # AD 80%	.22062	.11585	.05165	.22371	.09645	.04706	.18006	.07925	.04059
2 # AD 50%	.38822	.13031	.07050	.36269	.16547	.07032	.35255	.15009	.07080
2 # AD 30%	.67239	.28810	.13270	.71321	.29633	.13015	.73594	.30656	.12795
DELY IN 80%	.35707	.35707	.48538	.34698	.44899	.48280	.33630	.44899	.49909
DELY IN 50%	.41424	.44899	.49638	.40730	.49959	.48	.46647	.49749	.36660
DELY IN 30%	.38418	.44899	.49909	.39230	.49959	.46249	.43863	.48989	.35707
RHO 100%	.10733	.09060	.06791	.11962	.06554	.05417	.07246	.04806	.03235
RHO 80%	.13150	.09509	.07908	.14880	.08038	.06358	.09835	.06324	.04771
RHO 50%	.17541	.12233	.09927	.21112	.12703	.09490	.16186	.11036	.07220
RHO 30%	.25730	.18666	.12952	.28699	.19061	.12808	.26644	.14672	.10826
RXYT 80%	.13928	.10887	.08982	.16031	.08897	.06886	.09736	.06056	.04684
RXYT 50%	.15042	.12437	.10687	.21857	.15021	.12077	.18128	.12172	.08193
RXYT 30%	.18786	.14273	.10750	.24372	.17747	.15322	.23332	.18747	.14627
V RATIO 80%	.11245	.07704	.05905	.09907	.06802	.05610	.10025	.06671	.04935
V RATIO 50%	.14303	.09119	.07106	.14759	.10006	.06438	.12254	.08637	.06019
V RATIO 30%	.16879	.11729	.08879	.17483	.11638	.07012	.14139	.09623	.07090
X BAR 100%	.13600	.10658	.07223	.14141	.09059	.07190	.14205	.08363	.07244
Y BAR 100%	.13451	.08400	.07229	.15241	.10080	.08023	.15051	.08705	.08156
SIGMA X 100%	.09393	.07149	.04848	.10039	.07071	.04977	.10504	.07394	.04581
SIGMA Y 100%	.08268	.06636	.04656	.09615	.06385	.05069	.09079	.06959	.04396

COMPENSATORY SELECTION -- LINEAR HETEROSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02643	.01284	.00529	.00717	-.0044	.01191	.01734	.00575	.01084
2 * A0 80%	.32446	.23658	.16261	.32372	.22027	.15444	.28336	.19523	.13467
2 * A0 50%	.84139	.59296	.41395	.84651	.57262	.40831	.75340	.52835	.36112
2 * A0 30%	1.6134	1.0918	.75360	1.6642	1.1018	.74605	1.4576	.97590	.64940
B0 IN 80%	.8	.8	.58	.86	.71	.58	.86	.73	.4
B0 IN 50%	.84	.77	.6	.88	.69	.55	.81	.71	.47
B0 IN 30%	.83	.87	.67	.87	.67	.6	.92	.79	.59
B1 100%	.36116	.33893	.33854	.56990	.57791	.57812	.80759	.81182	.80437
2 * A1 80%	.45324	.32014	.21902	.45561	.30266	.21667	.40617	.28242	.19304
2 * A1 50%	.87958	.59699	.41556	.86453	.57234	.41369	.77265	.53783	.36180
2 * A1 30%	1.4136	.91577	.62859	1.3899	.89571	.61564	1.2061	.79632	.52005
B1 IN 80%	.82	.86	.76	.88	.81	.73	.9	.8	.5
B1 IN 50%	.88	.9	.75	.95	.8	.76	.87	.81	.65
B1 IN 30%	.88	.93	.84	.93	.83	.73	.94	.87	.79
SSE 100%	.86418	.91367	.90564	.72368	.73721	.74425	.50447	.50833	.49987
G 80%	.37230	.26729	.18896	.32436	.21737	.15480	.22828	.15687	.10925
G 50%	.81451	.55641	.38765	.67386	.44100	.31044	.45898	.31170	.21438
G 30%	1.6159	.89998	.57801	1.3295	.69401	.45393	.85879	.41893	.28013
SS IN 80%	.95	.95	.98	.94	.97	.98	.99	.93	.86
SS IN 50%	.94	.99	.99	.96	.95	.93	.96	.96	.93
SS IN 30%	1	.92	.98	.94	.93	.94	1	.84	.82
DEL Y 80%	.75994	.74077	.72445	1.0733	1.1052	1.1058	1.5078	1.5162	1.5021
DEL Y 50%	.67544	.64025	.63547	.95019	1.0139	.99609	1.3259	1.3389	1.3390
DEL Y 30%	.67102	.68155	.67007	1.0378	1.0522	1.0502	1.3713	1.3865	1.3852
2 * AD 80%	1.6367	1.1820	.81758	1.5798	1.0919	.77114	1.3796	.97321	.67259
2 * AD 50%	1.7061	1.1875	.83124	1.6633	1.1428	.81552	1.4879	1.0558	.72281
2 * AD 30%	2.3351	1.5618	1.0795	2.3386	1.5715	1.0650	2.0713	1.3939	.92893
DELY IN 80%	.83	.81	.55	.86	.69	.6	.85	.72	.41
DELY IN 50%	.83	.8	.61	.88	.71	.56	.81	.71	.48
DELY IN 30%	.85	.85	.67	.86	.69	.6	.92	.79	.58
RHO 100%	.36034	.33621	.33592	.54889	.55712	.55442	.74567	.74915	.74984
RHO 80%	.24645	.22978	.23787	.41850	.43645	.43526	.61878	.62340	.62579
RHO 50%	.14845	.17047	.17683	.36090	.33796	.34886	.54232	.53785	.53149
RHO 30%	.10292	.15248	.14705	.30857	.26781	.30567	.49761	.53506	.51141
RXYT 80%	.28972	.26578	.27275	.48070	.49899	.50113	.69657	.70217	.70316
RXYT 50%	.23881	.22820	.23247	.47743	.43781	.46169	.68300	.68336	.67534
RXYT 30%	.28737	.25892	.23020	.45927	.39176	.43398	.66966	.72031	.69257
V RATIO 80%	.73380	.73054	.74434	.69243	.70790	.69456	.65316	.65144	.65741
V RATIO 50%	.57579	.58042	.58354	.52378	.53499	.50436	.45946	.45498	.46682
V RATIO 30%	.47906	.51806	.50721	.43122	.43986	.42897	.36546	.35274	.37874
X BAR 100%	-.0021	.01429	-.0008	.00409	.00384	.01079	.02567	.02164	.00152
Y BAR 100%	.02314	.01309	.00339	.01355	-.0020	.01234	.03310	.00806	.01140
SIGMA X 100%	.97892	.99270	1.0009	1.0026	.99103	.99742	.98585	.98777	.98787
SIGMA Y 100%	.97956	1.0075	1.0074	1.0066	1.0267	1.0334	1.0554	1.0735	1.0655

COMPENSATORY SELECTION -- LINEAR HETEROSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12761	.08378	.06975	.12906	.08537	.06489	.09148	.06538	.05169
2 # A0 80%	.07460	.04215	.01687	.07834	.03823	.01571	.06325	.02673	.01609
2 # A0 50%	.19967	.08778	.04421	.21868	.09731	.04340	.14068	.07937	.03880
2 # A0 30%	.46766	.21610	.10241	.51946	.21613	.09262	.32854	.19219	.07715
B0 IN 80%	.39999	.39999	.49355	.34698	.45376	.49355	.34698	.44395	.48989
B0 IN 50%	.36660	.42083	.48989	.32496	.46249	.49749	.39230	.45376	.49909
B0 IN 30%	.37563	.33630	.47021	.33630	.47021	.48989	.27129	.40730	.49183
B1 100%	.10631	.08960	.06973	.13278	.07696	.06342	.09457	.06189	.04010
2 # A1 80%	.10427	.05116	.02643	.10581	.04322	.02429	.08222	.04206	.02012
2 # A1 50%	.21723	.08482	.04653	.21634	.09722	.04842	.17646	.10238	.04219
2 # A1 30%	.43238	.19772	.09059	.43022	.18221	.08112	.34034	.20939	.06996
B1 IN 80%	.38418	.34698	.42708	.32496	.39230	.44395	.3	.39999	.5
B1 IN 50%	.32496	.3	.43301	.21794	.39999	.42708	.33630	.39230	.47696
B1 IN 30%	.32496	.25514	.36660	.25514	.37563	.44395	.23748	.33630	.40730
SSE 100%	.15027	.12294	.08617	.15741	.09471	.07643	.10188	.06734	.04694
G 80%	.07453	.04205	.01933	.08248	.03142	.01694	.05014	.02346	.01134
G 50%	.22163	.10633	.04570	.19846	.08322	.04618	.12837	.06112	.02969
G 30%	.61003	.23772	.09121	.50380	.18352	.08447	.32594	.12441	.05302
SS IN 80%	.21794	.21794	.13999	.23748	.17058	.13999	.09949	.25514	.34698
SS IN 50%	.23748	.09949	.09949	.19595	.21794	.25514	.19595	.19595	.25514
SS IN 30%	0	.27129	.13999	.23748	.25514	.23748	0	.36660	.38419
DEL Y 80%	.34948	.24014	.17835	.27933	.21863	.15937	.24563	.22224	.13277
DEL Y 50%	.22370	.17437	.15223	.24314	.17881	.15882	.22819	.18512	.11431
DEL Y 30%	.26987	.19980	.16653	.27467	.19649	.15323	.22495	.18690	.12795
2 # AD 80%	.22213	.11732	.05306	.22866	.09638	.04881	.17926	.08462	.04268
2 # AD 50%	.38651	.12967	.07145	.35046	.16395	.07146	.25484	.14703	.07260
2 # AD 30%	.66960	.28226	.13133	.67722	.28353	.12457	.50009	.27952	.11429
DELY IN 80%	.37563	.39230	.49749	.34698	.46249	.48989	.35707	.44899	.49183
DELY IN 50%	.37563	.39999	.48774	.32496	.45376	.49638	.39230	.45376	.49959
DELY IN 30%	.35707	.35707	.47021	.34698	.46249	.48989	.27129	.40730	.49355
RHO 100%	.09838	.08587	.06779	.11069	.06141	.04899	.06420	.04807	.02872
RHO 80%	.13174	.09232	.07755	.14001	.07727	.06304	.09012	.06750	.04371
RHO 50%	.17371	.12236	.09728	.19973	.12086	.08612	.13247	.10418	.06258
RHO 30%	.24686	.18124	.12598	.25975	.17863	.11083	.19918	.13612	.08463
RXYT 80%	.13509	.10430	.08702	.15024	.08283	.06600	.08956	.06096	.03949
RXYT 50%	.16067	.14211	.11690	.20457	.13669	.10184	.13754	.09926	.05912
RXYT 30%	.19980	.16843	.13220	.26844	.19917	.14105	.20204	.12929	.08154
V RATIO 80%	.11245	.07704	.05905	.09907	.06882	.05610	.09904	.06671	.04935
V RATIO 50%	.14303	.09119	.07106	.14759	.10006	.06438	.12243	.08637	.06019
V RATIO 30%	.16879	.11729	.08879	.17483	.11638	.07012	.12909	.09623	.07090
X BAR 100%	.13600	.10658	.07223	.14141	.09059	.07190	.14933	.08363	.07244
Y BAR 100%	.13455	.08610	.07276	.15803	.10511	.08334	.16109	.09286	.08704
SIGMA X 100%	.09393	.07149	.04848	.10039	.07071	.04977	.09431	.07394	.04581
SIGMA Y 100%	.08358	.06598	.04685	.09893	.06557	.04984	.09486	.07616	.04571

COMPENSATORY SELECTION -- NONLINEAR HETEROSCEDASTIC MEANS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.02949	.01110	.00461	.00744	-.0065	.01237	.01783	.00554	.00935
2 * A0 80%	.32596	.23699	.16275	.32356	.22051	.15426	.28306	.19457	.13449
2 * A0 50%	.84407	.59371	.41377	.84566	.57140	.40643	.75019	.52313	.35813
2 * A0 30%	1.6150	1.0973	.75390	1.6621	1.0955	.74177	1.4531	.96864	.64329
B0 IN 80%	.84	.83	.6	.87	.71	.6	.88	.74	.45
B0 IN 50%	.8	.7	.47	.79	.51	.43	.73	.59	.19
B0 IN 30%	.81	.75	.47	.81	.49	.37	.75	.61	.23
B1 100%	.36981	.34358	.34396	.58241	.58522	.58579	.82024	.82056	.80973
2 * A1 80%	.45475	.32063	.21921	.45550	.30291	.21639	.40559	.28147	.19277
2 * A1 50%	.88132	.59764	.41542	.86332	.57089	.41173	.76869	.53256	.35880
2 * A1 30%	1.4136	.91993	.62889	1.3884	.89033	.61198	1.2008	.79024	.51513
B1 IN 80%	.9	.91	.8	.9	.87	.78	.9	.88	.64
B1 IN 50%	.89	.88	.73	.93	.72	.65	.81	.7	.45
B1 IN 30%	.87	.85	.7	.87	.65	.58	.84	.69	.33
SSE 100%	.87249	.92257	.91311	.72807	.74477	.75050	.50971	.51097	.50570
G 80%	.37541	.26817	.18932	.32418	.21791	.15445	.22792	.15596	.10896
G 50%	.81921	.55736	.38742	.67227	.43910	.30754	.45479	.30589	.21086
G 30%	1.6225	.90822	.57877	1.3242	.68596	.44854	.85086	.41330	.27494
SS IN 80%	.97	.95	.96	.97	.97	.96	.98	.94	.89
SS IN 50%	.95	.99	.99	.95	.96	.93	.95	.91	.94
SS IN 30%	.99	.93	.97	.95	.92	.94	1	.8	.78
DEL Y 80%	.77243	.75619	.74059	1.0991	1.1289	1.1269	1.5366	1.5397	1.5269
DEL Y 50%	.71685	.68181	.67956	1.0044	1.0677	1.0533	1.3900	1.4028	1.4036
DEL Y 30%	.70723	.71149	.70458	1.0796	1.0932	1.0943	1.4199	1.4367	1.4337
2 * AD 80%	1.6432	1.1839	.81837	1.5795	1.0932	.77025	1.3779	.97016	.67168
2 * AD 50%	1.7101	1.1888	.83097	1.6613	1.1403	.81172	1.4806	1.0454	.71678
2 * AD 30%	2.3353	1.5694	1.0802	2.3354	1.5623	1.0588	2.0635	1.3835	.92012
DELY IN 80%	.85	.83	.62	.85	.7	.61	.87	.75	.44
DELY IN 50%	.79	.73	.46	.79	.51	.43	.72	.58	.19
DELY IN 30%	.82	.73	.49	.81	.5	.36	.76	.61	.23
RHO 100%	.36458	.33795	.33906	.55546	.55946	.55748	.74970	.75231	.75019
RHO 80%	.26927	.24653	.25645	.43700	.45149	.45460	.63550	.63896	.63765
RHO 50%	.14777	.15504	.16498	.34842	.31867	.33392	.52894	.52319	.50941
RHO 30%	.06397	.09334	.09054	.24506	.19425	.24240	.43619	.46989	.43302
RXYT 80%	.31284	.28507	.29385	.50087	.51495	.52176	.71254	.71686	.71416
RXYT 50%	.24018	.21442	.21906	.46299	.41446	.44420	.67123	.66982	.65391
RXYT 30%	.28981	.22970	.18215	.42689	.32123	.35644	.60956	.65855	.61186
V RATIO 80%	.73380	.73054	.74434	.69243	.70790	.69456	.65316	.65144	.65741
V RATIO 50%	.57579	.58042	.58354	.52378	.53499	.50436	.45946	.45498	.46682
V RATIO 30%	.47906	.51806	.50721	.43122	.43986	.42897	.36546	.35274	.37874
X BAR 100%	-.0021	.01429	-.0008	.00409	.00384	.01079	.02567	.02164	.00152
Y BAR 100%	.02558	.01159	.00270	.01366	-.0044	.01282	.03338	.00834	.01013
SIGMA X 100%	.97892	.99270	1.0009	1.0026	.99103	.99742	.98585	.98777	.98787
SIGMA Y 100%	.98638	1.0131	1.0125	1.0141	1.0334	1.0404	1.0647	1.0793	1.0716

COMPENSATORY SELECTION --NONLINEAR HETEROSCEDASTIC
STANDARD DEVIATIONS

	COR=.3			COR=.5			COR=.7		
	N=50	N=100	N=200	N=50	N=100	N=200	N=50	N=100	N=200
B0 100%	.12834	.08277	.07021	.12813	.08540	.06517	.09225	.06739	.05174
2 # A0 80%	.07515	.04227	.01654	.07771	.03836	.01565	.06376	.02650	.01606
2 # A0 50%	.20206	.08863	.04318	.21971	.09734	.04283	.14466	.08016	.03831
2 # A0 30%	.47180	.21955	.10094	.52262	.21682	.09262	.33022	.19369	.07786
B0 IN 80%	.36660	.37563	.48989	.33630	.45376	.48989	.32496	.43863	.49749
B0 IN 50%	.39999	.45825	.49909	.40730	.49989	.49507	.44395	.49183	.39230
B0 IN 30%	.39230	.43301	.49909	.39230	.49989	.48280	.43301	.48774	.42083
B1 100%	.11575	.09400	.07056	.13505	.08376	.06837	.09731	.06343	.04367
2 # A1 80%	.10317	.05085	.02613	.10530	.04280	.02390	.08260	.04167	.01994
2 # A1 50%	.21600	.08484	.04601	.21650	.09581	.04746	.17715	.10272	.04154
2 # A1 30%	.43132	.19833	.08990	.43257	.18091	.08016	.33613	.20929	.07009
B1 IN 80%	.3	.28618	.39999	.3	.33630	.41424	.3	.32496	.48
B1 IN 50%	.31288	.32496	.44395	.25514	.44899	.47696	.39230	.45825	.49749
B1 IN 30%	.33630	.35707	.45825	.33630	.47696	.49355	.36660	.46249	.47021
SSE 100%	.15266	.12560	.08661	.15656	.09697	.07632	.10460	.06772	.04920
6 80%	.07445	.04190	.01911	.08197	.03203	.01673	.05135	.02388	.01135
6 50%	.22329	.10554	.04507	.19839	.08292	.04502	.12891	.06276	.02904
6 30%	.63125	.24039	.09180	.50130	.18097	.08257	.31638	.12713	.05272
SS IN 80%	.17058	.21794	.19595	.17058	.17058	.19595	.13999	.23748	.31288
SS IN 50%	.21794	.09949	.09949	.21794	.19595	.25514	.21794	.28618	.23748
SS IN 30%	.09949	.25514	.17058	.21794	.27129	.23748	0	.39999	.41424
DEL Y 80%	.33950	.24332	.17748	.27120	.21790	.15734	.23792	.19994	.12612
DEL Y 50%	.22498	.17332	.15124	.24329	.17489	.16051	.22229	.17695	.11312
DEL Y 30%	.26916	.19522	.16666	.27359	.19278	.15434	.21248	.17799	.12689
2 # AD 80%	.21987	.11648	.05193	.22737	.09764	.04801	.18310	.08507	.04239
2 # AD 50%	.38536	.13002	.07023	.35268	.16321	.06985	.25831	.14883	.07127
2 # AD 30%	.66643	.28515	.13089	.68160	.28345	.12380	.49575	.28103	.11456
DELY IN 80%	.35707	.37563	.48538	.35707	.45825	.48774	.33630	.43301	.49638
DELY IN 50%	.40730	.44395	.49839	.40730	.49989	.49507	.44899	.49355	.39230
DELY IN 30%	.38418	.44395	.49989	.39230	.5	.48	.42708	.48774	.42083
RHO 100%	.10196	.08665	.06532	.10591	.05895	.04814	.05875	.04185	.02742
RHO 80%	.12586	.09175	.07666	.13563	.07431	.05961	.08191	.05955	.04235
RHO 50%	.17106	.11963	.09678	.19728	.11885	.08667	.12602	.09824	.05964
RHO 30%	.25463	.18496	.12765	.27302	.18337	.11908	.19466	.13156	.08864
RXYT 80%	.13504	.10425	.08643	.14424	.08022	.06262	.08047	.05405	.03887
RXYT 50%	.15869	.13383	.11564	.20725	.14094	.10599	.13218	.09764	.06133
RXYT 30%	.19171	.14951	.11953	.24986	.19269	.14942	.20975	.14443	.10378
V RATIO 80%	.11245	.07704	.05905	.09907	.06882	.05610	.09904	.06671	.04935
V RATIO 50%	.14303	.09119	.07106	.14759	.10006	.06438	.12243	.08637	.06019
V RATIO 30%	.16879	.11729	.08879	.17483	.11638	.07012	.12909	.09623	.07090
X BAR 100%	.13600	.10658	.07223	.14141	.09059	.07190	.14933	.08363	.07244
Y BAR 100%	.13627	.08547	.07335	.15902	.10487	.08333	.16298	.09308	.08738
SIGMA X 100%	.09393	.07149	.04848	.10039	.07071	.04977	.09431	.07394	.04581
SIGMA Y 100%	.08319	.06713	.04678	.09710	.06398	.05093	.08866	.06789	.04240

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