of merit), then ρ_{SX} can be larger for certain values of a than Birnbaum's diagnostic test would allow. What values of a and m would be plausible in any given application, of course, would depend on the specifics of the situation. Ideally, one might wish to construct a model of the past salary policies pursued by the institution, treating each of the components of M as individual variables to obtain reasonable estimates of m and a. However, in the absence of any information about the reliability and validity of M or the extent to which salaries have been influenced by these fallible measures, it becomes impossible to draw confident conclusions about the existence of sex bias even if the correlation between sex and salary is very high.

In short, Birnbaum's criticisms of the ordinary regression approach to detecting sex bias in salaries are well taken; however, when salaries are likely to have been influenced by imperfect measures of merit, the diagnostic test he recommends can be misleading. The problems in using regression analysis to detect and interpret sex effects in these kinds of situations are exactly those encountered in using analysis of covariance in nonequivalent groups designs with fallible covariates. Investigators of sex bias would do well to familiarize themselves with the difficulties involved in drawing firm conclusions in these situations (e.g., see Cronbach, Rogosa, Floden, & Price, 1977; Reichardt, 1979).

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On the One-Mediator Null Hypothesis of Salary Equity

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Birnbaum (1979, 1981) criticized a popular method for studying group salary bias. Investigators have found that women are often paid less than men with the same qualifications, and they have interpreted this difference as evidence of sex bias in salaries. However, Birnbaum noted that if there were no sex bias, it is possible for women to have lower salaries on the average than men with the same measured qualifications and *simultaneously* for women to have lower qualifications on the average than men of the same salary. These paradoxical group differences follow from a one-mediator null hypothesis, which states that salary depends on true performance (not sex) plus error, and measured qualifications are also imperfectly correlated with true performance. This theoretical model can be rejected if women have greater merit than men with the same salaries, if they have lower salaries on the average than men.

McLaughlin (this issue) and McFatter (this issue) agree with Birnbaum's criticism of regression studies of salary bias but question Birnbaum's (1979, 1981) one-mediator null hypothesis. McLaughlin argues that the one-mediator null hypothesis may be too conservative because it might fit even when bias is present, whereas McFatter argues that the one-mediator model may be too liberal because it could be rejected for reasons other than true discrimination. Although these two arguments go in opposite directions, both are reasonable; however, the arguments are not unique to the null hypothesis of salary equity, and a good case can still be made for the usefulness of the one-mediator model and for its advantages over the suggestions of McFatter and McLaughlin.

McLaughlin (this issue) notes in agreement with Birnbaum (1981, Equation 8) that the one-mediator model can fit when the bias is small relative to the correlation between true quality of performance and salary. He suggests that Birnbaum's procedure may be more susceptible to the Type II error than regression. However, in the absence of bias, regression *always identifies* the group with lower mean salary as the victims of bias. In fact, any bias that exists when the one-mediator model fits *could be in either direction*.

For example, suppose B in Expression 6 of Birnbaum (1981) is *negative*, $-.10$, indicating bias *against* men. Suppose $P_X = .4$, $P_M = .7$, and $P_\$ = .8$. Then $\rho_{X\$} = .22$, $\rho_{XM} = .28$, and $\rho_{\$M} = .56$. The numerator of the partial correlation sex and salary with merit partialed out is positive, $.22 - (.28)(.56) = .06$, indicating that women are paid less than men of the same merit. Men have greater merit than women of the same salary because $.28 - (.56)(.22) = .16$, which is greater than zero. Thus, bias against men could go undetected by the test of the one-mediator model. Even worse, the "traditional" regression approach would conclude that there was discrimination against women!

Therefore, the issue is not simply a matter of Type I versus Type II errors. The best conclusion when correlations are low is that the analysis does not permit any strong conclusions regarding group differences. Unfortunately, questions of salary bias cannot be studied with any confidence when the correlations are low, because individual inequities enhance paradoxical group differences (Birnbaum, 1979, p. 133). Regression analysis is not more powerful; it gives a slanted (pun intended) result.

Analyses of salary bias are inherently limited even though statistical uncertainty is not the problem. In these studies, data for the entire population are usually available, so any difference, no matter how small, is "statistically significant" (i.e., reflects the population). The limitation in this area of research is the inability to conduct experimental studies to test alternative theories. Alternative explanations will always exist for any set of data. This state of affairs exists in all fields of investigation in which variables cannot be manipulated.

A theory consists of a set of premises from which testable conclusions can be deduced. When data contradict the implications of a theory, the theory can be rejected. When the data are consistent with the implied conclusions, the theory can be retained, along with other theories that could also yield the same implications. Data cannot be used to prove a theory true. On the other hand, when two theories make differential predictions, one can be rejected in favor of the other when the data allow rejection of one theory but agree with the predictions of the other.

In the case of salary-bias studies, the one-mediator model provides a useful null hypothesis because it can be rejected or retained depending on the data. The problem with the study of salary bias is that salary, merit, and sex are not manipulated (randomly assign people to merits or sexes?) to test causal theories. Therefore, if evidence is found that violates the one-mediator model, it could be attributed to other factors besides bias. For example, if errors in the measure of merit directly affect salary as McFatter (this issue) suggests, or if females are less mobile, or if females are more willing to accept jobs for which they are overqualified, then evidence could be obtained that would allow rejection of the one-mediator model. Unfortunately, these alternative two-path models cannot be discriminated from the two-path bias model, given the usual, uncontrolled data. Because the model of McFatter cannot be distinguished from the bias model, it does not make a useful null hypothesis.

Despite difficulties, a case can be made for conducting research on such societal questions as salary bias. Let us consider two hypothetical situations. In the first case suppose group A has lower salaries on the average than group B, and suppose group A has lower qualifications, less experience, and lower productivity on the average than group B. Suppose members of group A are paid less on the average than members of group B with the same qualifications, experience, and productivity. However, suppose also that members of group A are less productive, less experienced, and less qualified than members of group B who receive equal salaries. In this case, it seems reasonable to conclude that nothing has been proved either way. The results are consistent with Birnbaum's (1979, 1981) one-mediator hypothesis (no bias). There may actually be some bias, but the bias could exist in either direction.

Now consider the following case. Suppose that one can predict the salaries of group B perfectly by knowing experience and productivity. Suppose the salaries of group A can also be perfectly predicted from these variables, but their salaries are $40,000 less per year than members of group B with the same qualifications. The one-mediator null hypothesis of Birnbaum (1979, 1981) could be rejected in favor of the hypothesis that $B > 0$. However, as McFatter (this issue) points out, this result (perfect prediction of salary *within* groups with a large mean salary difference *between* groups) would also be consistent with his two-path, no-bias model, by assuming that the perfect correlation between measured merit and salary within groups is due to errors of merit directly affecting salary, and the group difference is due to an independent quality difference between the groups. Nevertheless, such a result seems troublesome enough to warrant further investigation.

In sum, when the one-mediator model is acceptable, there is no reason to argue for bias on the basis of mean differences in salary between matched groups. Any bias could even be in the opposite direction of the mean salary difference. However, when the correlation between measured qualifications and salary is high, it becomes easier to tell whether a given salary difference is consistent with the one-mediator model. When the one-mediator model is violated, it will not be possible to decide among various two-path interpretations without further evidence (such as experimental studies); however, violation of the one-mediator model should be regarded as a phenomenon that deserves further scrutiny.

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