

ROBUSTNESS OF MANN-WHITNEY-WILCOXON TEST FOR SCALE TO DEPENDENCE IN THE VARIABLES

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The asymptotic efficiency of the Mann-Whitney-Wilcoxon (MWW) test for scale relative to the likelihood ratio test for equality of exponential scale parameters is evaluated. This efficiency is studied when the underlying variables have a bivariate exponential distribution of the form due to Morgenstern (1956), Gumbel (1960), Marshall and Olkin (1967), Downton (1970), Cowan (1987), and Sarkar (1987).

1. Introduction. Serfling (1968) studied the use of the Wilcoxon test statistic when there is some dependence among the X 's and among the Y 's. Hollander, Pledger, and Lin (1974) showed that the two-sample Wilcoxon test is asymptotically conservative when the X 's and Y 's having a bivariate distribution which is positively quadrant dependent. Govindarajulu (1975) studied the sensitivity of the Mann-Whitney-Wilcoxon (MWW) test for location alternatives when X and Y are dependent having an unknown bivariate distribution with continuous marginals. In the present paper we study the sensitivity of MWW test for scale alternatives when X and Y are dependent. In particular, we evaluate the Pitman efficiency of the MWW test relative to the likelihood ratio test for scale alternatives when (X, Y) has a bivariate exponential distribution. Several bivariate exponential distributions are available in the literature. See, for instance, Basu (1986) and Sarkar (1987) for a survey of these forms. Here we select a few of the bivariate exponential forms and evaluate the Pitman efficiencies of the MWW test.

2. An Asymptotically Distribution-free Test. Let $X[Y]$ be distributed as $F[G]$ where F and G are continuous. We wish to test the null hypothesis

$$H_0 : F(x) = G(x) \text{ for all } x$$

against the alternative

$$H_1 : F(x) \geq G(x) \text{ with strict inequality for some } x.$$

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