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A Nonparametric Statistic for Joint Mean-Variance Quality Control

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For statistical process control, a number of single charts that jointly monitor both process mean and variance have been developed (see Ho and Chang (1999); Gan, Ting, and Chang (2004); Costa and Rahim (2004); and Wu et al. (2005)). For quality control-related hypothesis testing, however, there has been little analogous development of joint mean-variance tests: only one two-sample statistic that is not computationally intensive has been designed specifically for the one-sided test of Ho: Mean1 <= Mean2 and Variance1 <= Variance2 vs. Ha: Mean1 > Mean2 OR Variance1 > Variance2 (see Opdyke (2005)). This paper further develops this statistic and demonstrates via thorough Monte Carlo simulation that under typical quality control conditions a) it always maintains good level control; b) it has good power under symmetry and modest power under asymmetry; and c) it often has dramatically more power *and* better level control than the only proposed competitor. The statistic is easily implemented (i.e. not computationally intensive), and although initially designed for quality control testing in regulatory telecommunications, its range of application is as broad as the number of quality control settings requiring a test of the joint hypotheses listed above.

Keywords: Quality control, Statistical process control, Six sigma, Mean-Variance, Location-Scale, Telecommunications