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Improved Confidence Interval and Hypothesis Testing for the Ratio of the Coefficients of Variation of Two Uncorrelated Populations

Abbas Bahrampour [1], Zeynab Avazzadeh [2,*], Mohammad Reza Mahmoudi [3] and António M. Lopes [4]

[1] Department of Biostatistics and Epidemiology, Kerman University of Medical Sciences Research Center for Modeling in Health, Institute for Futures Studies in Health, Kerman 7616913555, Iran
[2] Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman 7616914115, Iran
[3] Department of Statistics, Faculty of Science, Fasa University, Fasa 7461686131, Iran
[4] LAETA/INEGI, Faculty of Engineering, University of Porto, 4200-465 Porto, Portugal
* Correspondence: z.evazzadeh@kmu.ac.ir

Abstract: One of the most accessible and useful statistical tools for comparing independent populations in different research areas is the coefficient of variation (CV). In this study, first, the asymptotic distribution of the ratio of CV of two uncorrelated populations is investigated. Then, the outputs are used to create a confidence interval and to establish a test of hypothesis about the CV ratio of the populations. The proposed approach is compared with an alternative method, showing its superiority and effectiveness.

Keywords: ratio of CV; test of hypothesis; symmetric distributions; asymmetric distributions

MSC: 62E20; 62P12; 97K50

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1. Introduction

According to the literature, three fundamental measures are used to explain a dataset (random variable). These include central, shape and dispersion tendencies. By obtaining the value of the central tendency, we can know how a random variable is gathered around a central value. The mean, median and mode are the most used criteria to express the central tendency's measures. Criteria such as range, variance and standard deviation can be used to measure the dispersion of a random variable. In some literature, this is called the random variable distribution scale. Another need of statisticians is to know how a random variable is distributed, or to know its pattern shape, which can be addressed by the use of statistical measures such as kurtosis or skewness.

The coefficient of variation (CV) is obtained by dividing the population standard deviation by the population mean, $CV = \sigma/\mu$, being an applicable and suitable statistic for evaluating relative variability. The CV is a free parameter that is used in many areas, such as agronomy, biology, engineering, finance, medicine and others, as an indicator of reliability or variability [1–3]. In many cases, relating standard deviation to the level of measurement is of great importance to researchers. For this reason, the CV is widely used to measure dispersion. When studying several independent populations, knowing how their CVs are compared is essential. This becomes even more important when populations have skewed distributions. In practical matters, statisticians may be interested in comparing two independent populations' CV to better understand the data structure. In situations where the means or variances of independent populations are equal, the analysis of