**Estimated Type I Errors of two sample t test after a passed Shapiro-Wilk test for normality.**

The tables below contain the estimated type I error rate for the two-sample t test for samples drawn from uniform and normally distributed population. at after both samples had passed Shapiro-Wilk test for normality. To the left are our simulations, and to the right are the estimates from the paper “To test or not to test.”

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Estimates from Our simulation | | | | | |  | Estimates from the paper | | | | | |
| Uniform Distribution | | | | | |  | Uniform Distribution | | | | | |
| **α\_pre/n** | **10** | **20** | **30** | **40** | **50** |  | **α\_pre/n** | **10** | **20** | **30** | **40** | **50** |
| **0.1** | 0.042 | 0.044 | 0.039 | 0.035 | 0.036 |  | **0.1** | 0.043 | 0.044 | 0.039 | 0.039 | 0.036 |
| **0.05** | 0.044 | 0.044 | 0.042 | 0.038 | 0.037 |  | **0.05** | 0.043 | 0.037 | 0.04 | 0.04 | 0.037 |
| **0.01** | 0.049 | 0.046 | 0.046 | 0.044 | 0.044 |  | **0.01** | 0.049 | 0.05 | 0.046 | 0.045 | 0.041 |
| **0.005** | 0.052 | 0.049 | 0.047 | 0.045 | 0.045 |  | **0.005** | 0.052 | 0.05 | 0.048 | 0.044 | 0.043 |
| **w/o pretest** | 0.053 | 0.048 | 0.051 | 0.052 | 0.049 |  | **w/o pretest** | 0.058 | 0.047 | 0.052 | 0.047 | 0.05 |
| **Normal Distribution** | | | | | |  | **Normal Distribution** | | | | | |
| **α\_pre/n** | 10 | 20 | 30 | 40 | 50 |  | **α\_pre/n** | 10 | 20 | 30 | 40 | 50 |
| **0.1** | 0.05 | 0.053 | 0.05 | 0.048 | 0.05 |  | **0.1** | 0.049 | 0.053 | 0.05 | 0.049 | 0.05 |
| **0.05** | 0.044 | 0.049 | 0.047 | 0.05 | 0.047 |  | **0.05** | 0.049 | 0.05 | 0.05 | 0.053 | 0.046 |
| **0.01** | 0.05 | 0.049 | 0.054 | 0.049 | 0.048 |  | **0.01** | 0.05 | 0.05 | 0.047 | 0.048 | 0.051 |
| **0.005** | 0.046 | 0.051 | 0.046 | 0.053 | 0.05 |  | **0.005** | 0.047 | 0.047 | 0.05 | 0.054 | 0.05 |
| **w/o pretest** | 0.048 | 0.051 | 0.047 | 0.049 | 0.05 |  | **w/o pretest** | 0.051 | 0.053 | 0.049 | 0.053 | 0.05 |

**Observations:**

The two results are relatively the same with a few differences in decimal places. There is no results for exponential. It has unreasonable runtime after sample size 30. I verified that my code works with different sample sizes and that result is shown below. The plot of Type I error rate against various sample sizes are also shown below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Exponential Distribution | | | | | |
| **α\_pre/n** | 5 | 10 | 15 | 20 | 25 |
| **0.1** | 0.033 | 0.075 | 0.119 | 0.142 | 0.155 |
| **0.05** | 0.033 | 0.067 | 0.096 | 0.118 | 0.135 |
| **0.01** | 0.03 | 0.05 | 0.073 | 0.092 | 0.105 |
| **0.005** | 0.029 | 0.049 | 0.065 | 0.079 | 0.1 |
| **w/o pretest** | 0.026 | 0.036 | 0.04 | 0.044 | 0.046 |

Chart

Description automatically generated with medium confidence

Chart

Description automatically generated

**Estimated Type I Error probability of the two-stage procedure (Student’s t test or Mann-Whitney’s U test depending on preliminary Shapiro Wilk test for normality) for different sample sizes and**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Estimates from Our simulation | | | | | |  | Estimates from the paper | | | | | | |
| Exponential Distribution | | | | | |  | Exponential Distribution | | | | | | |
| **α\_pre/n** | **10** | **20** | **30** | **40** | **50** |  | **α\_pre/n** | **10** | **20** | **30** | **40** | **50** | |
| **0.1** | 0.050 | 0.052 | 0.049 | 0.050 | 0.049 |  | **0.1** | 0.053 | 0.050 | 0.048 | 0.049 | 0.048 | |
| **0.05** | 0.050 | 0.051 | 0.05 | 0.050 | 0.050 |  | **0.05** | 0.055 | 0.052 | 0.048 | 0.049 | 0.050 | |
| **0.01** | 0.051 | 0.052 | 0.049 | 0.050 | 0.049 |  | **0.01** | 0.054 | 0.054 | 0.048 | 0.049 | 0.050 | |
| **0.005** | 0.051 | 0.051 | 0.051 | 0.051 | 0.050 |  | **0.005** | 0.050 | 0.055 | 0.049 | 0.048 | 0.049 | |
| **Normal Distribution** | | | | | |  | **Normal Distribution** | | | | | | |
| **α\_pre/n** | 10 | 20 | 30 | 40 | 50 |  | **α\_pre/n** | 10 | 20 | 30 | 40 | 50 | |
| **0.1** | 0.05 | 0.052 | 0.052 | 0.051 | 0.051 |  | **0.1** | 0.051 | 0.052 | 0.053 | 0.051 | 0.051 | |
| **0.05** | 0.05 | 0.051 | 0.051 | 0.051 | 0.051 |  | **0.05** | 0.051 | 0.051 | 0.051 | 0.051 | 0.050 | |
| **0.01** | 0.051 | 0.051 | 0.052 | 0.052 | 0.052 |  | **0.01** | 0.051 | 0.051 | 0.051 | 0.051 | 0.051 | |
| **0.005** | 0.05 | 0.051 | 0.052 | 0.051 | 0.051 |  | **0.005** | 0.051 | 0.050 | 0.049 | 0.050 | 0.050 | |
| **Uniform Distribution** | | | | | |  | **Uniform Distribution** | | | | | | |
| **α\_pre/n** | 10 | 20 | 30 | 40 | 50 |  | **α\_pre/n** | 10 | 20 | 30 | 40 | 50 | |
| **0.1** | 0.052 | 0.050 | 0.051 | 0.049 | 0.049 |  | **0.1** | 0.052 | 0.051 | 0.048 | 0.049 | 0.049 |
| **0.05** | 0.051 | 0.052 | 0.051 | 0.05 | 0.051 |  | **0.05** | 0.053 | 0.051 | 0.051 | 0.050 | 0.048 |
| **0.01** | 0.051 | 0.052 | 0.051 | 0.050 | 0.050 |  | **0.01** | 0.051 | 0.051 | 0.052 | 0.051 | 0.051 |
| **0.005** | 0.052 | 0.052 | 0.051 | 0.051 | 0.048 |  | **0.005** | 0.052 | 0.050 | 0.050 | 0.052 | 0.050 |