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CRITICAL VALUES OF THE LOG-NORMAL DISTRIBUTION

Jack Moshman

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CRITICAL VALUES OF THE LOG-NORMAL DISTRIBUTION

Introduction:

A common statistical problem is that of testing a null hypothesis using a statistic drawn from some unknown distribution. The general configuration of the probability density function is known from empirical evidence. It is suggested that for certain applications, the logarithmic-normal distribution be used to approximate the unknown distribution by equating the first three moments. It would then be convenient to have a table of critical values of the log-normal distribution, standardized for the first two moments and tabulated for various values of the skewness.

Pearson Type III Distribution:

The Pearson Type III distribution is the only three-parameter distribution whose integral has been extensively tabulated and is generally available. There are several important differences between the log-normal and Type III distributions in spite of their superficial similarity. These differences may be exhibited as follows:

Criterion	Type III	Log-Normal
Points of Inflection	Equidistant from mode	At proportional distances from mode
High Contact	Not present at finite end for large skewness; lower part of curve may have negative curvature.	Always present
Kurtosis	Always mesokurtic	Varies with skewness from mesokurtic to moderately platykurtic

Application:

The use of the normal distribution in applications where the coefficient of variation is large, presents many difficulties. Observed values more than twice the mean would then imply the existence of observations with negative values. Frequently this is a logical absurdity. The use of the logarithmic-normal distribution has been suggested as a solution of this problem.

In a review of the literature Gaddum [3] found that the log-normal distribution could be used to describe :

(a) The threshold of sensation;
(b) The size of silver particles in a photographic emulsion;
(c) The sensitivity to drugs;
(d) The survival time of insects treated with disinfectants;
(e) The average size of the different species in each of various phylogenetic groups;
(f) The number of plankton caught in different hauls of a net; and
(g) The amount of electricity used in medium-class American homes.

Yuan [7] found there to be an excellent fit to weights of female students by the log-normal distribution. Kottler [5] wrote extensively of the application of the log-normal distribution to the distribution of sizes of small particles. Epstein [2] derived the log-normal distribution as the asymptotic distribution of particle sizes resulting from breakage processes, where he assumed the independence of size and probability of fracture. Recently, Krige [6] applied the log-normal curve to the distribution of gold values in the mines of the Witwatersrand.

Critical Values:

In many of the previously mentioned applications, as well as others, it would be quite convenient to have available a table of critical values of the log-normal cumulative distribution corresponding to specified values of the parameters of the distribution.

The log-normal probability density distribution may be written as

$$f(x) = \frac{1}{c(x-a)\sqrt{2\pi}} \exp\left\{-\frac{1}{2c^2}\left(\log\frac{x-a}{b}\right)^2\right\} \tag{1}$$

and the cumulative distribution function is then

$$F(x) = \int_a^x f(t)\, dt \tag{2}$$

where we assume $b > 0$. If $b < 0$, then $\underline{a}$ represents the upper rather than the lower limit of the distribution and all statements may be suitably modified.

The parameters a, b and c are related to the mean (μ), variance (σ^2), and skewness (α_3) as follows:

$$\left.\begin{aligned} \mu &= b\,\omega^{1/2} + a \\ \sigma^2 &= b^2\,\omega\,(\omega - 1) \\ \alpha_3 &= \pm(\omega - 1)^{1/2}(\omega + 2) \end{aligned}\right\} \tag{3}$$

where $\omega = e^{c^2}$. The sign of α_3 is chosen to agree with that of b.

If in (1) we let

$$t = \frac{1}{c} \log \frac{x-a}{b} \quad , \tag{4}$$

then t is distributed normally with zero mean and unit variance. Solving (4) for x

$$x = b\, e^{ct} + a \quad , \tag{5}$$

and solving (3) for b and a

$$\left.\begin{aligned} b &= \frac{\sigma}{\left[\omega(\omega - 1)\right]^{1/2}} \\ a &= \mu - b\,\omega^{1/2} = \mu - \frac{\sigma}{(\omega - 1)^{1/2}} \quad . \end{aligned}\right\} \tag{6}$$

Substituting from (6) in (5)

$$\begin{aligned} x &= \frac{\sigma}{\left[\omega(\omega - 1)\right]^{1/2}}\, e^{ct} + \mu - \frac{\sigma}{(\omega - 1)^{1/2}} \\ x &= \frac{\omega^{-1/2}\, e^{ct} - 1}{(\omega - 1)^{1/2}}\, \sigma + \mu \quad . \end{aligned} \tag{7}$$

Then from (7)

$$\tau = \frac{x - \mu}{\sigma} = \frac{\omega^{-1/2}\, e^{ct} - 1}{(\omega - 1)^{1/2}} \quad , \tag{8}$$

where τ may be considered a standardized log-normal variate in terms of the unit normal deviate t, ω and c, but ω and c are each expressible in terms of α_3. If t_β is defined by

$$\frac{1}{\sqrt{2\pi}} \int_{t_\beta}^{\infty} e^{-\frac{t^2}{2}} dt = \beta \tag{9}$$

then

$$\tau_\beta = \frac{\omega^{-1/2} e^{ct_\beta} - 1}{(\omega - 1)^{1/2}} \tag{10}$$

Thus to obtain say the 5 °/o critical value of the upper tail of the log-normal distribution for $\alpha_3 = 2$, one first solves the equation

$$\omega^3 + 3\omega^2 - (4 + \alpha_3^2) = 0 \tag{11}$$

for ω, which is the only real root. Knowing ω,

$$c = \sqrt{\log \omega} \quad ,$$

$t_{.05} = 1.644854$, and $\tau_{.05}$ may be determined from (10). Finally, from (8)

$$x = \mu + \tau_{.05}\,\sigma \quad . \tag{12}$$

Table I contains values of τ_β for β = .005, .01, .025, .05, .10, .90, .95, .975, .99 and .995 for α_3 = 0(.01) 3.00 . The computations were performed with punched card equipment and rounded to four decimal places. More extensive hand calculations were used to smooth out second differences where necessary. The tabular values are believed correct to within one to two digits in the last decimal place.

Example:

A standard laboratory procedure consists of submitting a certain compound in crystalline form to a grinding process. After 2 minutes the average diameter of the pieces is determined from a sample of 10, selected at random from the ground pieces. Considerable experience shows that the means are well described by a log-normal distribution with mean, 5.76 mm., standard deviation .81 mm. and skewness .13.

A new grinding process is now introduced which may have the property of displacing the previous distribution to the left which is an indication of greater efficiency. In any event the shape of the distribution will remain invariant. A sample of 10, selected from the result of a 2 minute application of the new process, has a mean diameter of 4.45 mm. Does this represent a significant departure from the established average for the older process?

The problem reduces to determining the probability that τ , from equation (8), will have as extreme a value as that noted. Since the shape of the curve is invariant σ = .81 and α_3 = .13. We find

$$\tau = \frac{4.45 - 5.76}{.81} = - 1.617 .$$

In Table I, for $\alpha_3 = .13$ we find that -1.617 lies between the tabulated values -1.6070 and -1.8981 which corresponds to values of β equal to .95 and .975 respectively. Hence in from 2.5 °/o to 5 °/o will one obtain a mean value of 4.45 or less. One has then good reason to conclude that the new process is more efficient. If, on the other hand, one ignored the skewness present, and used the normal curve then one finds that a value of $t = -1.617$ would occur by chance between 5 °/o and 10 °/o of the time. This may be seen when $\alpha_3 = 0$ in Table I which reduces to the normal curve.

Comment:

The critical values tabulated apply to cases where σ and α_3 are known. In many applications there will exist a fund of experience which will insure this. However frequently one will have not σ and α_3, but estimates s and a_3. If s and a_3 are based on small samples, the use of Table I may well be invalid.

REFERENCES

1. Cureton, E. E., "A Method of Item Analysis Based on the Theory of Sampling from a Finite Population." Paper read at the 1952 meeting of the Southern Society for Philosophy and Psychology at Knoxville, Tennessee.
2. Epstein, Benjamin, "The Mathematical Description of Certain Breakage Mechanisms Leading to the Logarithmico-Normal Distribution," Journal of the Franklin Institute, 244:471-477 (1947).
3. Gaddum, J H., "Lognormal Distributions," Nature 156:463 (1945).
4. Kendall, M. G., The Advanced Theory of Statistics, 2nd ed., London, Charles Griffin and Co., 1945, p. 284.
5. Kottler, F., "The Distribution of Particle Size," Journal of the Franklin Institute, 250:339-356 and 250:419-441 (1950).
6. Krige, D. G., "A Statistical Approach to Some Basic Mine Valuation Problems on the Witwatersrand," Journal of the Chemical, Metallurgical and Mining Society of South Africa, 52: 119-139 (1951).
7. Yuan, Pae-Tsi, "On the Logarithmic Frequency Distribution and the Semi-Logarithmic Correlation Surface," Annals of Mathematical Statistics, 4:30-74 (1933).

TABLE I

CRITICAL VALUES OF LOGARITHMIC-NORMAL DISTRIBUTION

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
0.00	1.2816	1.6449	1.9600	2.3263	2.5758
0.00	-1.2816	-1.6449	-1.9600	-2.3263	-2.5758
0.01	1.2826	1.6477	1.9647	2.3337	2.5822
0.01	-1.2804	-1.6420	-1.9552	-2.3190	-2.5664
0.02	1.2837	1.6505	1.9694	2.3411	2.5947
0.02	-1.2794	-1.6392	-1.9505	-2.3117	-2.5571
0.03	1.2847	1.6534	1.9742	2.3485	2.6042
0.03	-1.2783	-1.6363	-1.9458	-2.3044	-2.5478
0.04	1.2858	1.6562	1.9790	2.3559	2.6137
0.04	-1.2772	-1.6335	-1.9411	-2.2971	-2.5385
0.05	1.2868	1.6590	1.9837	2.3632	2.6230
0.05	-1.2761	-1.6306	-1.9364	-2.2897	-2.5293
0.06	1.2877	1.6617	1.9883	2.3706	2.6325
0.06	-1.2749	-1.6276	-1.9315	-2.2824	-2.5199
0.07	1.2888	1.6645	1.9930	2.3780	2.6420
0.07	-1.2737	-1.6248	-1.9267	-2.2751	-2.5106
0.08	1.2897	1.6672	1.9977	2.3854	2.6516
0.08	-1.2726	-1.6217	-1.9220	-2.2678	-2.5014
0.09	1.2906	1.6700	2.0024	2.3928	2.6611
0.09	-1.2714	-1.6189	-1.9172	-2.2605	-2.4922
0.10	1.2916	1.6727	2.0070	2.4002	2.6707
0.10	-1.2702	-1.6159	-1.9124	-2.2533	-2.4830
0.11	1.2925	1.6754	2.0117	2.4076	2.6803
0.11	-1.2690	-1.6130	-1.9077	-2.2460	-2.4739
0.12	1.2934	1.6781	2.0164	2.4150	2.6898
0.12	-1.2678	-1.6100	-1.9029	-2.2388	-2.4647
0.13	1.2943	1.6808	2.0210	2.4224	2.6994
0.13	-1.2665	-1.6070	-1.8981	-2.2315	-2.4556
0.14	1.2952	1.6835	2.0256	2.4298	2.7091
0.14	-1.2653	-1.6041	-1.8933	-2.2243	-2.4465

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
0.15	1.2960	1.6862	2.0303	2.4373	2.7187
0.15	-1.2640	-1.6011	-1.8886	-2.2172	-2.4375
0.16	1.2969	1.6888	2.0349	2.4447	2.7284
0.16	-1.2628	-1.5981	-1.8838	-2.2100	-2.4285
0.17	1.2977	1.6914	2.0395	2.4522	2.7381
0.17	-1.2615	-1.5951	-1.8790	-2.2028	-2.4195
0.18	1.2986	1.6941	2.0441	2.4596	2.7477
0.18	-1.2602	-1.5921	-1.8743	-2.1957	-2.4105
0.19	1.2993	1.6967	2.0487	2.4670	2.7574
0.19	-1.2589	-1.5891	-1.8695	-2.1885	-2.4016
0.20	1.3001	1.6993	2.0533	2.4744	2.7671
0.20	-1.2576	-1.5861	-1.8647	-2.1814	-2.3926
0.21	1.3009	1.7018	2.0579	2.4818	2.7768
0.21	-1.2562	-1.5831	-1.8599	-2.1743	-2.3838
0.22	1.3017	1.7044	2.0625	2.4893	2.7865
0.22	-1.2549	-1.5801	-1.8552	-2.1672	-2.3749
0.23	1.3024	1.7069	2.0670	2.4967	2.7962
0.23	-1.2536	-1.5770	-1.8504	-2.1601	-2.3661
0.24	1.3032	1.7095	2.0715	2.5041	2.8060
0.24	-1.2522	-1.5740	-1.8457	-2.1530	-2.3573
0.25	1.3039	1.7120	2.0761	2.5115	2.8157
0.25	-1.2508	-1.5710	-1.8409	-2.1460	-2.3485
0.26	1.3046	1.7145	2.0806	2.5190	2.8255
0.26	-1.2495	-1.5679	-1.8361	-2.1390	-2.3398
0.27	1.3053	1.7170	2.0851	2.5264	2.8352
0.27	-1.2481	-1.5648	-1.8314	-2.1320	-2.3311
0.28	1.3059	1.7194	2.0896	2.5338	2.8450
0.28	-1.2467	-1.5618	-1.8266	-2.1250	-2.3224
0.29	1.3066	1.7219	2.0940	2.5412	2.8548
0.29	-1.2453	-1.5587	-1.8219	-2.1180	-2.3137

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
0.30	1.3072	1.7243	2.0985	2.5486	2.8646
0.30	-1.2438	-1.5557	-1.8171	-2.1110	-2.3051
0.31	1.3078	1.7268	2.1030	2.5560	2.8744
0.31	-1.2424	-1.5526	-1.8124	-2.1041	-2.2965
0.32	1.3085	1.7292	2.1074	2.5634	2.8841
0.32	-1.2410	-1.5495	-1.8077	-2.0972	-2.2880
0.33	1.3090	1.7315	2.1118	2.5707	2.8939
0.33	-1.2395	-1.5464	-1.8029	-2.0903	-2.2795
0.34	1.3096	1.7339	2.1162	2.5781	2.9037
0.34	-1.2381	-1.5433	-1.7982	-2.0834	-2.2710
0.35	1.3102	1.7363	2.1206	2.5855	2.9135
0.35	-1.2366	-1.5403	-1.7935	-2.0765	-2.2625
0.36	1.3107	1.7386	2.1250	2.5929	2.9233
0.36	-1.2351	-1.5372	-1.7888	-2.0697	-2.2541
0.37	1.3113	1.7409	2.1294	2.6002	2.9331
0.37	-1.2336	-1.5341	-1.7841	-2.0629	-2.2457
0.38	1.3118	1.7432	2.1337	2.6076	2.9429
0.38	-1.2322	-1.5310	-1.7794	-2.0561	-2.2373
0.39	1.3123	1.7455	2.1380	2.6149	2.9527
0.39	-1.2307	-1.5279	-1.7747	-2.0493	-2.2290
0.40	1.3128	1.7478	2.1424	2.6222	2.9626
0.40	-1.2291	-1.5248	-1.7700	-2.0425	-2.2207
0.41	1.3132	1.7500	2.1467	2.6296	2.9724
0.41	-1.2276	-1.5217	-1.7653	-2.0358	-2.2125
0.42	1.3137	1.7523	2.1509	2.6369	2.9822
0.42	-1.2261	-1.5186	-1.7606	-2.0291	-2.2043
0.43	1.3141	1.7545	2.1552	2.6442	2.9920
0.43	-1.2246	-1.5155	-1.7560	-2.0224	-2.1961
0.44	1.3146	1.7567	2.1594	2.6515	3.0018
0.44	-1.2230	-1.5124	-1.7513	-2.0157	-2.1879

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
0.45	1.3150	1.7589	2.1637	2.6588	3.0116
0.45	-1.2215	-1.5093	-1.7466	-2.0091	-2.1798
0.46	1.3154	1.7610	2.1679	2.6660	3.0214
0.46	-1.2199	-1.5062	-1.7420	-2.0024	-2.1717
0.47	1.3157	1.7632	2.1721	2.6733	3.0312
0.47	-1.2184	-1.5030	-1.7374	-1.9958	-2.1637
0.48	1.3161	1.7653	2.1763	2.6805	3.0410
0.48	-1.2168	-1.4999	-1.7327	-1.9893	-2.1556
0.49	1.3164	1.7674	2.1804	2.6878	3.0508
0.49	-1.2152	-1.4968	-1.7281	-1.9827	-2.1477
0.50	1.3168	1.7695	2.1846	2.6950	3.0605
0.50	-1.2136	-1.4937	-1.7235	-1.9762	-2.1397
0.51	1.3171	1.7716	2.1887	2.7022	3.0703
0.51	-1.2120	-1.4906	-1.7189	-1.9696	-2.1318
0.52	1.3174	1.7736	2.1928	2.7094	3.0801
0.52	-1.2104	-1.4875	-1.7143	-1.9632	-2.1239
0.53	1.3177	1.7756	2.1969	2.7166	3.0899
0.53	-1.2088	-1.4844	-1.7097	-1.9567	-2.1161
0.54	1.3180	1.7777	2.2010	2.7238	3.0996
0.54	-1.2072	-1.4813	-1.7052	-1.9502	-2.1083
0.55	1.3182	1.7797	2.2050	2.7309	3.1094
0.55	-1.2056	-1.4782	-1.7006	-1.9438	-2.1005
0.56	1.3185	1.7816	2.2091	2.7381	3.1191
0.56	-1.2040	-1.4751	-1.6960	-1.9374	-2.0928
0.57	1.3187	1.7836	2.2131	2.7452	3.1289
0.57	-1.2023	-1.4720	-1.6915	-1.9311	-2.0851
0.58	1.3189	1.7855	2.2171	2.7523	3.1386
0.58	-1.2007	-1.4689	-1.6870	-1.9247	-2.0774
0.59	1.3191	1.7875	2.2211	2.7594	3.1483
0.59	-1.1991	-1.4658	-1.6824	-1.9184	-2.0698

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
0.60	1.3193	1.7894	2.2250	2.7665	3.1580
0.60	-1.1974	-1.4627	-1.6779	-1.9121	-2.0622
0.61	1.3195	1.7912	2.2289	2.7735	3.1677
0.61	-1.1958	-1.4596	-1.6734	-1.9058	-2.0547
0.62	1.3196	1.7931	2.2329	2.7806	3.1774
0.62	-1.1941	-1.4565	-1.6689	-1.8996	-2.0472
0.63	1.3198	1.7950	2.2368	2.7876	3.1871
0.63	-1.1925	-1.4534	-1.6645	-1.8934	-2.0397
0.64	1.3199	1.7968	2.2406	2.7946	3.1967
0.64	-1.1908	-1.4503	-1.6600	-1.8872	-2.0323
0.65	1.3200	1.7986	2.2445	2.8016	3.2064
0.65	-1.1891	-1.4472	-1.6556	-1.8810	-2.0249
0.66	1.3201	1.8004	2.2483	2.8086	3.2160
0.66	-1.1875	-1.4441	-1.6511	-1.8749	-2.0175
0.67	1.3202	1.8022	2.2521	2.8155	3.2257
0.67	-1.1858	-1.4410	-1.6467	-1.8688	-2.0102
0.68	1.3203	1.8039	2.2559	2.8225	3.2353
0.68	-1.1841	-1.4380	-1.6423	-1.8627	-2.0029
0.69	1.3203	1.8056	2.2597	2.8294	3.2449
0.69	-1.1824	-1.4349	-1.6379	-1.8566	-1.9956
0.70	1.3204	1.8074	2.2634	2.8363	3.2545
0.70	-1.1807	-1.4318	-1.6335	-1.8506	-1.9884
0.71	1.3204	1.8091	2.2672	2.8432	3.2641
0.71	-1.1790	-1.4287	-1.6291	-1.8445	-1.9812
0.72	1.3204	1.8107	2.2709	2.8500	3.2736
0.72	-1.1773	-1.4257	-1.6247	-1.8386	-1.9741
0.73	1.3204	1.8124	2.2746	2.8569	3.2832
0.73	-1.1756	-1.4226	-1.6204	-1.8326	-1.9670
0.74	1.3204	1.8140	2.2782	2.8637	3.2927
0.74	-1.1739	-1.4196	-1.6160	-1.8267	-1.9599

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
0.75	1.3204	1.8156	2.2819	2.8705	3.3022
0.75	-1.1722	-1.4165	-1.6117	-1.8207	-1.9529
0.76	1.3203	1.8172	2.2855	2.8773	3.3117
0.76	-1.1705	-1.4135	-1.6074	-1.8149	-1.9459
0.77	1.3203	1.8188	2.2891	2.8840	3.3212
0.77	-1.1688	-1.4104	-1.6031	-1.8090	-1.9389
0.78	1.3202	1.8204	2.2927	2.8908	3.3306
0.78	-1.1671	-1.4074	-1.5988	-1.8032	-1.9320
0.79	1.3201	1.8219	2.2962	2.8975	3.3401
0.79	-1.1654	-1.4043	-1.5945	-1.7974	-1.9251
0.80	1.3200	1.8235	2.2998	2.9042	3.3495
0.80	-1.1636	-1.4013	-1.5903	-1.7916	-1.9183
0.81	1.3199	1.8250	2.3033	2.9109	3.3589
0.81	-1.1619	-1.3983	-1.5860	-1.7859	-1.9114
0.82	1.3198	1.8265	2.3068	2.9175	3.3683
0.82	-1.1602	-1.3953	-1.5818	-1.7801	-1.9047
0.83	1.3197	1.8279	2.3102	2.9241	3.3777
0.83	-1.1585	-1.3923	-1.5776	-1.7744	-1.8979
0.84	1.3195	1.8294	2.3137	2.9308	3.3870
0.84	-1.1567	-1.3893	-1.5734	-1.7688	-1.8912
0.85	1.3194	1.8308	2.3171	2.9373	3.3964
0.85	-1.1550	-1.3863	-1.5692	-1.7631	-1.8846
0.86	1.3192	1.8322	2.3205	2.9439	3.4057
0.86	-1.1533	-1.3833	-1.5650	-1.7575	-1.8779
0.87	1.3190	1.8336	2.3239	2.9504	3.4150
0.87	-1.1516	-1.3803	-1.5609	-1.7519	-1.8713
0.88	1.3188	1.8350	2.3272	2.9569	3.4242
-0.88	-1.1498	-1.3773	-1.5567	-1.7463	-1.8648
0.89	1.3186	1.8363	2.3306	2.9634	3.4335
0.89	-1.1481	-1.3743	-1.5526	-1.7408	-1.8583

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
0.90	1.3184	1.8377	2.3339	2.9699	3.4427
0.90	-1.1463	-1.3714	-1.5485	-1.7353	-1.8518
0.91	1.3182	1.8390	2.3372	2.9763	3.4519
0.91	-1.1446	-1.3684	-1.5444	-1.7298	-1.8453
0.92	1.3179	1.8403	2.3404	2.9828	3.4611
0.92	-1.1429	-1.3654	-1.5403	-1.7244	-1.8389
0.93	1.3177	1.8416	2.3437	2.9891	3.4703
0.93	-1.1411	-1.3625	-1.5362	-1.7189	-1.8325
0.94	1.3174	1.8428	2.3469	2.9955	3.4794
0.94	-1.1394	-1.3595	-1.5321	-1.7135	-1.8262
0.95	1.3171	1.8441	2.3501	3.0019	3.4885
0.95	-1.1376	-1.3566	-1.5281	-1.7082	-1.8199
0.96	1.3168	1.8453	2.3533	3.0082	3.4976
0.96	-1.1359	-1.3537	-1.5241	-1.7028	-1.8136
0.97	1.3165	1.8465	2.3564	3.0145	3.5067
0.97	-1.1342	-1.3507	-1.5201	-1.6975	-1.8074
0.98	1.3162	1.8477	2.3595	3.0207	3.5157
0.98	-1.1324	-1.3478	-1.5161	-1.6922	-1.8012
0.99	1.3159	1.8489	2.3627	3.0270	3.5247
0.99	-1.1307	-1.3449	-1.5121	-1.6869	-1.7950
1.00	1.3156	1.8501	2.3657	3.0332	3.5337
1.00	-1.1289	-1.3420	-1.5081	-1.6817	-1.7895
1.01	1.3152	1.8512	2.3688	3.0394	3.5427
1.01	-1.1272	-1.3391	-1.5042	-1.6765	-1.7828
1.02	1.3148	1.8523	2.3718	3.0455	3.5516
1.02	-1.1255	-1.3362	-1.5002	-1.6713	-1.7768
1.03	1.3145	1.8534	2.3749	3.0517	3.5606
1.03	-1.1237	-1.3334	-1.4963	-1.6661	-1.7707
1.04	1.3141	1.8545	2.3778	3.0578	3.5694
1.04	-1.1220	-1.3305	-1.4924	-1.6610	-1.7648

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
1.05	1.3137	1.8556	2.3808	3.0639	3.5783
1.05	-1.1202	-1.3276	-1.4885	-1.6559	-1.7588
1.06	1.3133	1.8566	2.3838	3.0700	3.5872
1.06	-1.1185	-1.3248	-1.4847	-1.6508	-1.7529
1.07	1.3129	1.8577	2.3867	3.0760	3.5960
1.07	-1.1168	-1.3219	-1.4808	-1.6457	-1.7470
1.08	1.3125	1.8587	2.3896	3.0820	3.6048
1.08	-1.1150	-1.3191	-1.4770	-1.6407	-1.7412
1.09	1.3121	1.8597	2.3925	3.0880	3.6135
1.09	-1.1133	-1.3162	-1.4731	-1.6357	-1.7353
1.10	1.3116	1.8607	2.3953	3.0939	3.6223
1.10	-1.1115	-1.3134	-1.4693	-1.6307	-1.7296
1.11	1.3112	1.8616	2.3982	3.0999	3.6310
1.11	-1.1098	-1.3106	-1.4655	-1.6257	-1.7238
1.12	1.3107	1.8626	2.4010	3.1058	3.6397
1.12	-1.1081	-1.3078	-1.4618	-1.6208	-1.7181
1.13	1.3102	1.8635	2.4038	3.1116	3.6483
1.13	-1.1063	-1.3050	-1.4580	-1.6159	-1.7124
1.14	1.3098	1.8644	2.4065	3.1175	3.6569
1.14	-1.1046	-1.3022	-1.4543	-1.6110	-1.7068
1.15	1.3093	1.8653	2.4093	3.1233	3.6655
1.15	-1.1029	-1.2994	-1.4505	-1.6062	-1.7012
1.16	1.3088	1.8662	2.4120	3.1291	3.6741
1.16	-1.1011	-1.2967	-1.4468	-1.6014	-1.6956
1.17	1.3083	1.8671	2.4147	3.1349	3.6826
1.17	-1.0994	-1.2939	-1.4431	-1.5966	-1.6901
1.18	1.3077	1.8679	2.4174	3.1406	3.6912
1.18	-1.0977	-1.2911	-1.4394	-1.5918	-1.6845
1.19	1.3072	1.8687	2.4200	3.1463	3.6996
1.19	-1.0960	-1.2884	-1.4358	-1.5871	-1.6791

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
1.20	1.3067	1.8695	2.4227	3.1520	3.7081
1.20	-1.0942	-1.2856	-1.4321	-1.5823	-1.6736
1.21	1.3061	1.8703	2.4253	3.1577	3.7165
1.21	-1.0925	-1.2829	-1.4285	-1.5776	-1.6682
1.22	1.3056	1.8711	2.4279	3.1633	3.7249
1.22	-1.0908	-1.2802	-1.4248	-1.5730	-1.6628
1.23	1.3050	1.8719	2.4304	3.1689	3.7333
1.23	-1.0891	-1.2775	-1.4212	-1.5683	-1.6575
1.24	1.3045	1.8726	2.4330	3.1745	3.7416
1.24	-1.0874	-1.2748	-1.4177	-1.5637	-1.6522
1.25	1.3039	1.8734	2.4355	3.1800	3.7500
1.25	-1.0857	-1.2721	-1.4141	-1.5591	-1.6469
1.26	1.3033	1.8741	2.4380	3.1855	3.7582
1.26	-1.0839	-1.2694	-1.4105	-1.5545	-1.6416
1.27	1.3027	1.8748	2.4405	3.1910	3.7665
1.27	-1.0822	-1.2667	-1.4070	-1.5500	-1.6364
1.28	1.3021	1.8755	2.4429	3.1965	3.7747
1.28	-1.0805	-1.2640	-1.4035	-1.5455	-1.6312
1.29	1.3015	1.8762	2.4454	3.2019	3.7829
1.29	-1.0788	-1.2614	-1.4000	-1.5410	-1.6260
1.30	1.3009	1.8768	2.4478	3.2074	3.7911
1.30	-1.0771	-1.2587	-1.3965	-1.5365	-1.6209
1.31	1.3002	1.8775	2.4502	3.2127	3.7992
1.31	-1.0754	-1.2561	-1.3930	-1.5321	-1.6158
1.32	1.2996	1.8781	2.4526	3.2181	3.8073
1.32	-1.0737	-1.2534	-1.3895	-1.5276	-1.6108
1.33	1.2990	1.8787	2.4549	3.2234	3.8154
1.33	-1.0720	-1.2508	-1.3861	-1.5232	-1.6057
1.34	1.2983	1.8793	2.4573	3.2287	3.8234
1.34	-1.0704	-1.2482	-1.3826	-1.5189	-1.6007

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
1.35	1.2977	1.8799	2.4596	3.2340	3.8314
1.35	-1.0687	-1.2456	-1.3792	-1.5145	-1.5957
1.36	1.2970	1.8805	2.4618	3.2392	3.8394
1.36	-1.0670	-1.2430	-1.3758	-1.5102	-1.5908
1.37	1.2963	1.8810	2.4641	3.2445	3.8474
1.37	-1.0653	-1.2404	-1.3724	-1.5059	-1.5859
1.38	1.2956	1.8816	2.4664	3.2496	3.8553
1.38	-1.0636	-1.2378	-1.3691	-1.5016	-1.5810
1.39	1.2950	1.8821	2.4686	3.2548	3.8632
1.39	-1.0619	-1.2353	-1.3657	-1.4974	-1.5761
1.40	1.2943	1.8826	2.4708	3.2599	3.8711
1.40	-1.0603	-1.2327	-1.3624	-1.4931	-1.5713
1.41	1.2936	1.8831	2.4730	3.2650	3.8789
1.41	-1.0586	-1.2301	-1.3591	-1.4889	-1.5665
1.42	1.2929	1.8836	2.4751	3.2701	3.8867
1.42	-1.0569	-1.2276	-1.3557	-1.4847	-1.5618
1.43	1.2922	1.8841	2.4773	3.2752	3.8944
1.43	-1.0553	-1.2251	-1.3525	-1.4806	-1.5570
1.44	1.2914	1.8845	2.4794	3.2802	3.9022
1.44	-1.0536	-1.2225	-1.3492	-1.4764	-1.5519
1.45	1.2907	1.8850	2.4815	3.2852	3.9099
1.45	-1.0520	-1.2200	-1.3459	-1.4723	-1.5476
1.46	1.2900	1.8854	2.4836	3.2902	3.9176
1.46	-1.0503	-1.2175	-1.3427	-1.4682	-1.5430
1.47	1.2892	1.8858	2.4856	3.2951	3.9252
1.47	-1.0486	-1.2150	-1.3394	-1.4642	-1.5384
1.48	1.2885	1.8862	2.4877	3.3000	3.9328
1.48	-1.0470	-1.2125	-1.3362	-1.4601	-1.5338
1.49	1.2877	1.8866	2.4897	3.3049	3.9404
1.49	-1.0454	-1.2101	-1.3330	-1.4561	-1.5292

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
1.50	1.2870	1.8870	2.4917	3.3098	3.9479
1.50	-1.0437	-1.2076	-1.3298	-1.4521	-1.5246
1.51	1.2862	1.8873	2.4937	3.3146	3.9555
1.51	-1.0421	-1.2051	-1.3267	-1.4481	-1.5201
1.52	1.2855	1.8877	2.4957	3.3194	3.9629
1.52	-1.0405	-1.2027	-1.3235	-1.4441	-1.5157
1.53	1.2847	1.8880	2.4976	3.3242	3.9704
1.53	-1.0388	-1.2002	-1.3204	-1.4402	-1.5112
1.54	1.2839	1.8884	2.4995	3.3289	3.9778
1.54	-1.0372	-1.1978	-1.3172	-1.4363	-1.5068
1.55	1.2831	1.8887	2.5014	3.3337	3.9852
1.55	-1.0356	-1.1954	-1.3141	-1.4324	-1.5024
1.56	1.2823	1.8890	2.5033	3.3384	3.9926
1.56	-1.0340	-1.1930	-1.3110	-1.4285	-1.4980
1.57	1.2816	1.8893	2.5052	3.3430	3.9999
1.57	-1.0323	-1.1906	-1.3080	-1.4247	-1.4936
1.58	1.2808	1.8895	2.5070	3.3477	4.0072
1.58	-1.0307	-1.1882	-1.3049	-1.4209	-1.4893
1.59	1.2799	1.8898	2.5088	3.3523	4.0145
1.59	-1.0291	-1.1858	-1.3018	-1.4171	-1.4850
1.60	1.2791	1.8901	2.5107	3.3569	4.0217
1.60	-1.0275	-1.1834	-1.2988	-1.4133	-1.4807
1.61	1.2783	1.8903	2.5124	3.3614	4.0289
1.61	-1.0259	-1.1810	-1.2958	-1.4095	-1.4765
1.62	1.2775	1.8905	2.5142	3.3660	4.0361
1.62	-1.0243	-1.1787	-1.2928	-1.4058	-1.4723
1.63	1.2767	1.8907	2.5160	3.3705	4.0432
1.63	-1.0227	-1.1763	-1.2898	-1.4020	-1.4681
1.64	1.2759	1.8910	2.5177	3.3750	4.0503
1.64	-1.0211	-1.1740	-1.2868	-1.3983	-1.4639

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
1.65	1.2750	1.8911	2.5194	3.3794	4.0574
1.65	-1.0196	-1.1717	-1.2838	-1.3947	-1.4598
1.66	1.2742	1.8913	2.5211	3.3839	4.0645
1.66	-1.0180	-1.1694	-1.2809	-1.3910	-1.4556
1.67	1.2733	1.8915	2.5228	3.3883	4.0715
1.67	-1.0164	-1.1670	-1.2779	-1.3874	-1.4516
1.68	1.2725	1.8917	2.5245	3.3926	4.0785
1.68	-1.0148	-1.1647	-1.2750	-1.3838	-1.4475
1.69	1.2716	1.8918	2.5261	3.3970	4.0854
1.69	-1.0133	-1.1625	-1.2721	-1.3802	-1.4434
1.70	1.2708	1.8920	2.5277	3.4013	4.0923
1.70	-1.0117	-1.1602	-1.2692	-1.3766	-1.4394
1.71	1.2699	1.8921	2.5293	3.4056	4.0992
1.71	-1.0101	-1.1579	-1.2663	-1.3730	-1.4354
1.72	1.2691	1.8922	2.5309	3.4099	4.1061
1.72	-1.0086	-1.1556	-1.2635	-1.3695	-1.4315
1.73	1.2682	1.8923	2.5325	3.4141	4.1129
1.73	-1.0070	-1.1534	-1.2606	-1.3660	-1.4275
1.74	1.2673	1.8924	2.5341	3.4184	4.1197
1.74	-1.0055	-1.1511	-1.2578	-1.3625	-1.4236
1.75	1.2665	1.8925	2.5356	3.4226	4.1265
1.75	-1.0039	-1.1489	-1.2550	-1.3590	-1.4197
1.76	1.2656	1.8926	2.5371	3.4267	4.1332
1.76	-1.0024	-1.1467	-1.2521	-1.3555	-1.4158
1.77	1.2647	1.8926	2.5386	3.4309	4.1399
1.77	-1.0009	-1.1444	-1.2493	-1.3521	-1.4120
1.78	1.2638	1.8927	2.5401	3.4350	4.1466
1.78	-0.9993	-1.1422	-1.2466	-1.3487	-1.4081
1.79	1.2629	1.8927	2.5416	3.4391	4.1533
1.79	-0.9978	-1.1400	-1.2438	-1.3453	-1.4043

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
1.80	1.2620	1.8928	2.5430	3.4432	4.1599
1.80	-0.9963	-1.1378	-1.2410	-1.3419	-1.4005
1.81	1.2611	1.8928	2.5445	3.4472	4.1665
1.81	-0.9948	-1.1356	-1.2383	-1.3385	-1.3968
1.82	1.2602	1.8928	2.5459	3.4512	4.1730
1.82	-0.9933	-1.1335	-1.2356	-1.3352	-1.3930
1.83	1.2593	1.8928	2.5473	3.4552	4.1795
1.83	-0.9918	-1.1313	-1.2328	-1.3319	-1.3893
1.84	1.2584	1.8928	2.5487	3.4592	4.1860
1.84	-0.9903	-1.1291	-1.2301	-1.3286	-1.3856
1.85	1.2575	1.8928	2.5501	3.4631	4.1925
1.85	-0.9888	-1.1270	-1.2274	-1.3253	-1.3820
1.86	1.2566	1.8928	2.5514	3.4670	4.1989
1.86	-0.9873	-1.1249	-1.2248	-1.3220	-1.3783
1.87	1.2557	1.8927	2.5527	3.4709	4.2053
1.87	-0.9858	-1.1227	-1.2221	-1.3187	-1.3747
1.88	1.2548	1.8927	2.5541	3.4748	4.2117
1.88	-0.9843	-1.1206	-1.2194	-1.3155	-1.3711
1.89	1.2539	1.8926	2.5554	3.4787	4.2180
1.89	-0.9828	-1.1185	-1.2168	-1.3123	-1.3675
1.90	1.2530	1.8926	2.5567	3.4825	4.2243
1.90	-0.9813	-1.1164	-1.2142	-1.3091	-1.3639
1.91	1.2520	1.8925	2.5580	3.4863	4.2306
1.91	-0.9798	-1.1143	-1.2116	-1.3059	-1.3604
1.92	1.2511	1.8924	2.5592	3.4901	4.2369
1.92	-0.9784	-1.1122	-1.2090	-1.3028	-1.3569
1.93	1.2502	1.8923	2.5605	3.4938	4.2431
1.93	-0.9769	-1.1101	-1.2064	-1.2996	-1.3534
1.94	1.2492	1.8922	2.5617	3.4975	4.2493
1.94	-0.9754	-1.1081	-1.2038	-1.2965	-1.3499

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
1.95	1.2483	1.8921	2.5629	3.5012	4.2555
1.95	-0.9740	-1.1060	-1.2012	-1.2934	-1.3464
1.96	1.2474	1.8920	2.5641	3.5049	4.2616
1.96	-0.9725	-1.1039	-1.1987	-1.2903	-1.3430
1.97	1.2464	1.8919	2.5653	3.5086	4.2677
1.97	-0.9711	-1.1019	-1.1962	-1.2872	-1.3396
1.98	1.2455	1.8918	2.5665	3.5122	4.2738
1.98	-0.9696	-1.0999	-1.1936	-1.2841	-1.3362
1.99	1.2445	1.8917	2.5676	3.5158	4.2798
1.99	-0.9682	-1.0978	-1.1911	-1.2811	-1.3328
2.00	1.2436	1.8915	2.5688	3.5194	4.2858
2.00	-0.9668	-1.0958	-1.1886	-1.2781	-1.3294
2.01	1.2426	1.8914	2.5699	3.5230	4.2918
2.01	-0.9653	-1.0938	-1.1861	-1.2751	-1.3261
2.02	1.2417	1.8912	2.5710	3.5265	4.2978
2.02	-0.9639	-1.0918	-1.1836	-1.2721	-1.3228
2.03	1.2407	1.8910	2.5721	3.5300	4.3037
2.03	-0.9625	-1.0898	-1.1812	-1.2691	-1.3195
2.04	1.2398	1.8909	2.5732	3.5335	4.3096
2.04	-0.9611	-1.0878	-1.1787	-1.2661	-1.3162
2.05	1.2388	1.8907	2.5743	3.5370	4.3155
2.05	-0.9597	-1.0858	-1.1763	-1.2632	-1.3129
2.06	1.2379	1.8905	2.5753	3.5405	4.3213
2.06	-0.9583	-1.0839	-1.1739	-1.2603	-1.3097
2.07	1.2369	1.8903	2.5764	3.5437	4.3271
2.07	-0.9568	-1.0819	-1.1714	-1.2573	-1.3065
2.08	1.2360	1.8901	2.5774	3.5473	4.3329
2.08	-0.9554	-1.0800	-1.1690	-1.2545	-1.3033
2.09	1.2350	1.8899	2.5784	3.5507	4.3387
2.09	-0.9541	-1.0780	-1.1666	-1.2516	-1.3001

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
2.10	1.2340	1.8896	2.5794	3.5540	4.3444
2.10	-0.9527	-1.0761	-1.1643	-1.2487	-1.2969
2.11	1.2331	1.8894	2.5804	3.5574	4.3501
2.11	-0.9513	-1.0742	-1.1619	-1.2459	-1.2937
2.12	1.2321	1.8892	2.5814	3.5607	4.3558
2.12	-0.9499	-1.0722	-1.1595	-1.2430	-1.2906
2.13	1.2311	1.8889	2.5823	3.5640	4.3614
2.13	-0.9485	-1.0703	-1.1572	-1.2402	-1.2875
2.14	1.2302	1.8887	2.5833	3.5672	4.3670
2.14	-0.9471	-1.0684	-1.1548	-1.2374	-1.2844
2.15	1.2292	1.8884	2.5842	3.5705	4.3726
2.15	-0.9458	-1.0665	-1.1525	-1.2346	-1.2813
2.16	1.2282	1.8882	2.5851	3.5737	4.3782
2.16	-0.9444	-1.0646	-1.1502	-1.2318	-1.2783
2.17	1.2272	1.8879	2.5861	3.5769	4.3837
2.17	-0.9430	-1.0628	-1.1479	-1.2291	-1.2752
2.18	1.2263	1.8876	2.5870	3.5801	4.3892
2.18	-0.9417	-1.0609	-1.1456	-1.2263	-1.2722
2.19	1.2253	1.8873	2.5878	3.5833	4.3947
2.19	-0.9403	-1.0590	-1.1433	-1.2236	-1.2692
2.20	1.2243	1.8871	2.5887	3.5864	4.4001
2.20	-0.9390	-1.0572	-1.1411	-1.2209	-1.2662
2.21	1.2233	1.8868	2.5896	3.5896	4.4055
2.21	-0.9376	-1.0553	-1.1388	-1.2182	-1.2632
2.22	1.2224	1.8865	2.5904	3.5927	4.4109
2.22	-0.9363	-1.0535	-1.1366	-1.2155	-1.2603
2.23	1.2214	1.8862	2.5913	3.5957	4.4163
2.23	-0.9350	-1.0516	-1.1343	-1.2129	-1.2573
2.24	1.2204	1.8858	2.5921	3.5988	4.4216
2.24	-0.9336	-1.0498	-1.1321	-1.2102	-1.2544

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$	$\tau_{.05}$	$\tau_{.025}$	$\tau_{.01}$	$\tau_{.005}$
	$\tau_{.90}$	$\tau_{.95}$	$\tau_{.975}$	$\tau_{.99}$	$\tau_{.995}$
2.25	1.2194	1.8855	2.5929	3.6019	4.4270
2.25	-0.9323	-1.0480	-1.1299	-1.2076	-1.2515
2.26	1.2184	1.8852	2.5937	3.6049	4.4322
2.26	-0.9310	-1.0462	-1.1277	-1.2049	-1.2486
2.27	1.2175	1.8849	2.5945	3.6079	4.4375
2.27	-0.9297	-1.0444	-1.1255	-1.2023	-1.2457
2.28	1.2165	1.8845	2.5953	3.6109	4.4427
2.28	-0.9284	-1.0426	-1.1233	-1.1997	-1.2429
2.29	1.2155	1.8842	2.5960	3.6138	4.4479
2.29	-0.9271	-1.0408	-1.1211	-1.1971	-1.2400
2.30	1.2145	1.8838	2.5968	3.6168	4.4531
2.30	-0.9258	-1.0390	-1.1190	-1.1946	-1.2372
2.31	1.2135	1.8835	2.5975	3.6197	4.4583
2.31	-0.9245	-1.0373	-1.1168	-1.1920	-1.2344
2.32	1.2125	1.8831	2.5982	3.6226	4.4634
2.32	-0.9232	-1.0355	-1.1147	-1.1895	-1.2316
2.33	1.2115	1.8828	2.5990	3.6255	4.4685
2.33	-0.9219	-1.0337	-1.1125	-1.1869	-1.2288
2.34	1.2105	1.8824	2.5997	3.6283	4.4736
2.34	-0.9206	-1.0320	-1.1104	-1.1844	-1.2261
2.35	1.2096	1.8820	2.6004	3.6312	4.4786
2.35	-0.9193	-1.0302	-1.1083	-1.1819	-1.2233
2.36	1.2086	1.8816	2.6011	3.6340	4.4837
2.36	-0.9180	-1.0285	-1.1062	-1.1794	-1.2206
2.37	1.2076	1.8812	2.6017	3.6368	4.4887
2.37	-0.9167	-1.0268	-1.1041	-1.1769	-1.2179
2.38	1.2066	1.8809	2.6024	3.6396	4.4936
2.38	-0.9155	-1.0251	-1.1020	-1.1745	-1.2152
2.39	1.2056	1.8805	2.6030	3.6423	4.4986
2.39	-0.9142	-1.0233	-1.0999	-1.1720	-1.2125

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ $\tau_{.90}$	$\tau_{.05}$ $\tau_{.95}$	$\tau_{.025}$ $\tau_{.975}$	$\tau_{.01}$ $\tau_{.99}$	$\tau_{.005}$ $\tau_{.995}$
2.40	1.2046	1.8801	2.6037	3.6451	4.5035
2.40	-0.9129	-1.0216	-1.0979	-1.1696	-1.2098
2.41	1.2036	1.8796	2.6043	3.6478	4.5084
2.41	-0.9117	-1.0199	-1.0958	-1.1672	-1.2072
2.42	1.2026	1.8792	2.6049	3.6505	4.5133
2.42	-0.9104	-1.0182	-1.0938	-1.1647	-1.2045
2.43	1.2016	1.8788	2.6055	3.6532	4.5181
2.43	-0.9092	-1.0166	-1.0917	-1.1623	-1.2019
2.44	1.2006	1.8784	2.6061	3.6559	4.5230
2.44	-0.9079	-1.0149	-1.0897	-1.1599	-1.1993
2.45	1.1997	1.8780	2.6067	3.6585	4.5278
2.45	-0.9067	-1.0132	-1.0877	-1.1576	-1.1967
2.46	1.1987	1.8775	2.6073	3.6612	4.5325
2.46	-0.9055	-1.0115	-1.0857	-1.1552	-1.1941
2.47	1.1977	1.8771	2.6079	3.6638	4.5373
2.47	-0.9042	-1.0099	-1.0837	-1.1529	-1.1915
2.48	1.1967	1.8767	2.6084	3.6664	4.5420
2.48	-0.9030	-1.0082	-1.0817	-1.1505	-1.1890
2.49	1.1957	1.8762	2.6090	3.6690	4.5467
2.49	-0.9018	-1.0066	-1.0797	-1.1482	-1.1864
2.50	1.1947	1.8758	2.6095	3.6715	4.5514
2.50	-0.9006	-1.0050	-1.0778	-1.1459	-1.1839
2.51	1.1937	1.8753	2.6101	3.6741	4.5560
2.51	-0.8993	-1.0033	-1.0758	-1.1436	-1.1814
2.52	1.1927	1.8749	2.6106	3.6766	4.5607
2.52	-0.8981	-1.0017	-1.0739	-1.1413	-1.1789
2.53	1.1917	1.8744	2.6111	3.6791	4.5653
2.53	-0.8969	-1.0001	-1.0719	-1.1390	-1.1764
2.54	1.1907	1.8739	2.6116	3.6816	4.5699
2.54	-0.8957	-0.9985	-1.0700	-1.1367	-1.1739

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
2.55	1.1897	1.8735	2.6121	3.6841	4.5744
2.55	-0.8945	-0.9969	-1.0681	-1.1345	-1.1714
2.56	1.1887	1.8730	2.6126	3.6866	4.5790
2.56	-0.8933	-0.9953	-1.0662	-1.1322	-1.1690
2.57	1.1877	1.8725	2.6130	3.6890	4.5835
2.57	-0.8921	-0.9937	-1.0643	-1.1300	-1.1666
2.58	1.1868	1.8720	2.6135	3.6914	4.5880
2.58	-0.8909	-0.9921	-1.0624	-1.1278	-1.1641
2.59	1.1858	1.8715	2.6140	3.6938	4.5924
2.59	-0.8898	-0.9905	-1.0605	-1.1256	-1.1617
2.60	1.1848	1.8710	2.6144	3.6962	4.5969
2.60	-0.8886	-0.9890	-1.0586	-1.1234	-1.1593
2.61	1.1838	1.8705	2.6148	3.6986	4.6013
2.61	-0.8874	-0.9874	-1.0567	-1.1212	-1.1570
2.62	1.1828	1.8700	2.6153	3.7010	4.6057
2.62	-0.8862	-0.9858	-1.0549	-1.1190	-1.1546
2.63	1.1818	1.8695	2.6157	3.7033	4.6101
2.63	-0.8851	-0.9843	-1.0530	-1.1168	-1.1522
2.64	1.1808	1.8690	2.6161	3.7056	4.6144
2.64	-0.8839	-0.9827	-1.0512	-1.1147	-1.1499
2.65	1.1798	1.8685	2.6165	3.7079	4.6187
2.65	-0.8827	-0.9812	-1.0493	-1.1125	-1.1475
2.66	1.1788	1.8680	2.6169	3.7102	4.6230
2.66	-0.8816	-0.9797	-1.0475	-1.1104	-1.1452
2.67	1.1778	1.8675	2.6173	3.7125	4.6273
2.67	-0.8804	-0.9781	-1.0457	-1.1083	-1.1429
2.68	1.1769	1.8670	2.6177	3.7148	4.6316
2.68	-0.8793	-0.9766	-1.0439	-1.1062	-1.1406
2.69	1.1759	1.8665	2.6180	3.7170	4.6358
2.69	-0.8781	-0.9751	-1.0421	-1.1041	-1.1383

TABLE I (Cont.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
2.70	1.1749	1.8659	2.6184	3.7192	4.6400
2.70	-0.8770	-0.9736	-1.0403	-1.1020	-1.1361
2.71	1.1739	1.8654	2.6187	3.7215	4.6442
2.71	-0.8759	-0.9721	-1.0385	-1.0999	-1.1338
2.72	1.1729	1.8649	2.6191	3.7237	4.6484
2.72	-0.8747	-0.9706	-1.0367	-1.0978	-1.1315
2.73	1.1719	1.8643	2.6194	3.7258	4.6526
2.73	-0.8736	-0.9691	-1.0349	-1.0957	-1.1293
2.74	1.1709	1.8638	2.6197	3.7280	4.6567
2.74	-0.8725	-0.9676	-1.0332	-1.0937	-1.1271
2.75	1.1700	1.8632	2.6201	3.7302	4.6608
2.75	-0.8714	-0.9662	-1.0314	-1.0917	-1.1249
2.76	1.1690	1.8627	2.6204	3.7323	4.6649
2.76	-0.8702	-0.9647	-1.0297	-1.0896	-1.1227
2.77	1.1680	1.8621	2.6207	3.7344	4.6690
2.77	-0.8691	-0.9632	-1.0279	-1.0876	-1.1205
2.78	1.1670	1.8616	2.6210	3.7365	4.6730
2.78	-0.8680	-0.9618	-1.0262	-1.0856	-1.1183
2.79	1.1660	1.8610	2.6213	3.7386	4.6770
2.79	-0.8669	-0.9603	-1.0245	-1.0836	-1.1161
2.80	1.1650	1.8605	2.6215	3.7407	4.6810
2.80	-0.8658	-0.9589	-1.0228	-1.0816	-1.1140
2.81	1.1641	1.8599	2.6218	3.7428	4.6850
2.81	-0.8647	-0.9574	-1.0211	-1.0796	-1.1118
2.82	1.1631	1.8593	2.6221	3.7448	4.6890
2.82	-0.8636	-0.9560	-1.0194	-1.0776	-1.1097
2.83	1.1621	1.8588	2.6223	3.7468	4.6929
2.83	-0.8625	-0.9546	-1.0177	-1.0757	-1.1076
2.84	1.1611	1.8582	2.6226	3.7488	4.6968
2.84	-0.8614	-0.9531	-1.0160	-1.0737	-1.1054

TABLE I (Conc.)

Skewness (α_3)	$\tau_{.10}$ / $\tau_{.90}$	$\tau_{.05}$ / $\tau_{.95}$	$\tau_{.025}$ / $\tau_{.975}$	$\tau_{.01}$ / $\tau_{.99}$	$\tau_{.005}$ / $\tau_{.995}$
2.85	1.1601	1.8576	2.6228	3.7509	4.7007
2.85	-0.8603	-0.9517	-1.0143	-1.0718	-1.1033
2.86	1.1592	1.8571	2.6231	3.7528	4.7046
2.86	-0.8593	-0.9503	-1.0126	-1.0699	-1.1013
2.87	1.1582	1.8565	2.6233	3.7548	4.7085
2.87	-0.8582	-0.9489	-1.0110	-1.0679	-1.0992
2.88	1.1572	1.8559	2.6235	3.7568	4.7123
2.88	-0.8571	-0.9475	-1.0093	-1.0660	-1.0971
2.89	1.1562	1.8553	2.6237	3.7587	4.7161
2.89	-0.8560	-0.9461	-1.0077	-1.0641	-1.0950
2.90	1.1553	1.8547	2.6239	3.7607	4.7199
2.90	-0.8550	-0.9447	-1.0060	-1.0622	-1.0930
2.91	1.1543	1.8541	2.6241	3.7626	4.7237
2.91	-0.8539	-0.9433	-1.0044	-1.0603	-1.0909
2.92	1.1533	1.8536	2.6243	3.7645	4.7275
2.92	-0.8529	-0.9420	-1.0028	-1.0584	-1.0889
2.93	1.1523	1.8530	2.6245	3.7664	4.7312
2.93	-0.8518	-0.9406	-1.0012	-1.0566	-1.0869
2.94	1.1514	1.8524	2.6247	3.7682	4.7349
2.94	-0.8507	-0.9392	-0.9996	-1.0547	-1.0849
2.95	1.1504	1.8518	2.6249	3.7701	4.7386
2.95	-0.8497	-0.9379	-0.9979	-1.0529	-1.0829
2.96	1.1494	1.8512	2.6250	3.7720	4.7423
2.96	-0.8487	-0.9365	-0.9964	-1.0510	-1.0809
2.97	1.1485	1.8506	2.6252	3.7738	4.7460
2.97	-0.8476	-0.9352	-0.9948	-1.0492	-1.0789
2.98	1.1475	1.8500	2.6253	3.7756	4.7496
2.98	-0.8466	-0.9338	-0.9932	-1.0474	-1.0769
2.99	1.1465	1.8493	2.6255	3.7774	4.7533
2.99	-0.8455	-0.9325	-0.9916	-1.0455	-1.0750
3.00	1.1456	1.8487	2.6256	3.7792	4.7569
3.00	-0.8445	-0.9311	-0.9900	-1.0437	-1.0730