Learn How to Test for Normality in Excel: A Step-by-Step Guide

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November 5, 2025

Many of the most powerful and commonly used parametric statistical tests rely on the critical assumption that the underlying population from which the data is drawn follows a normal distribution. Violating this assumption can lead to unreliable results and invalid conclusions. Therefore, performing a normality test is an essential preliminary step in data analysis.

One of the most straightforward and effective methods for assessing this assumption is to perform the **Jarque-Bera test**. This test is a type of goodness-of-fit statistic designed specifically to determine whether a sample's skewness and kurtosis align sufficiently with the values expected from a perfect normal distribution.

Theoretical Foundation of the Jarque-Bera Test

The **Jarque-Bera test** uses the third and fourth standardized moments of the data--skewness (S) and kurtosis (C)--to calculate a test statistic (JB). For a truly normal distribution, both skewness and excess kurtosis should be zero. The JB test evaluates how far the observed sample moments deviate from these expected values.

The test operates under the following formalized hypotheses:

H0 (Null Hypothesis): The data is normally distributed.

HA (Alternative Hypothesis): The data is *not* normally distributed.

The test statistic ***JB*** is defined by the following formula:

JB =(n/6) * (S2 + (C2/4))

In this equation, the variables represent the following metrics:

n: The number of **observations** in the sample data.
S: The sample skewness (a measure of symmetry).
C: The sample kurtosis (a measure of the "tailedness" of the distribution).

Crucially, under the null hypothesis of normality, the computed *JB* statistic is known to follow a Chi-Square distribution with 2 degrees of freedom (i.e., *JB* ~ X2(2)). This distributional property allows us to calculate the corresponding P-value for hypothesis testing.

If the P-value associated with the test statistic is less than a predetermined significance level (commonly set at α = 0.05), we possess sufficient evidence to reject the null hypothesis. In practical terms, this means we conclude that the data is statistically **not** normally distributed.

Applying the Jarque-Bera Test in Excel: A Step-by-Step Guide

While specialized statistical software can automate this process, Microsoft Excel provides all the necessary functions to calculate the Jarque-Bera test statistic manually. This detailed tutorial walks through the precise steps required to perform this analysis using Excel's built-in functions.

Step 1: Input and Organize the Data

To begin, we need a dataset to analyze. For this example, we will use a small sample of 15 observations. Ensure your data is organized neatly in a single column within your Excel spreadsheet.

Let's visualize this initial dataset:

	A	B	C	D	E	F
1	**Data**					
2	4					
3	5.6					
4	7.8					
5	7.9					
6	9					
7	9.3					
8	10.4					
9	12					
10	13.4					
11	14.4					
12	15.6					
13	18.7					
14	20.1					
15	20.5					
16	20.9					
17						
18						
19						
20						
21						
22						
23						
24						
25						

For the purposes of the calculation, we must also determine the sample size, **n**. In this case, **n = 15**. It is often helpful to denote this directly in a separate cell for easy reference in subsequent formulas.

Step 2: Calculate Skewness and Kurtosis (S and C)

The core components of the JB statistic are the sample skewness (S) and the sample kurtosis (C). Excel provides direct functions to calculate these moments, significantly simplifying the process.

Use the following Excel functions, assuming your data is located in cells A2 through A16:

Calculating Skewness (S): Use the function `=SKEW(A2:A16)`. This yields the value for S.
Calculating Kurtosis (C): Use the function `=KURT(A2:A16)`. Note that Excel's `KURT` function already calculates the **excess kurtosis**, which is the value required for the Jarque-Bera formula. This yields the value for C.

Once these two values are calculated, you have the necessary inputs to proceed to the final test statistic calculation.

Step 3: Calculate the Jarque-Bera Test Statistic (JB)

Now, we apply the main Jarque-Bera formula using the calculated values for n, S, and C. If S is in cell D2, C is in cell D3, and n (15) is in cell D1, the formula translating *JB* =(n/6) * (S2 + (C2/4)) into Excel looks like this:

=(D1/6) * (D2^2 + (D3^2/4))

The screenshot below illustrates the layout and the calculated results for the necessary components. Column E shows the formulas used in the respective cells:

	A	B	C	D	E	F
1	**Data**		observations	15	=COUNT(A2:A16)	
2	4		sample skewness	0.1943	=SKEW(A2:A16)	
3	5.6		sample kurtosis	-1.2153	=KURT(A2:A16)	
4	7.8					
5	7.9		JB test statistic	**1.0175**	=(D1/6)*(D2^2+(D3^2)/4)	
6	9					
7	9.3					
8	10.4					
9	12					
10	13.4					
11	14.4					
12	15.6					
13	18.7					
14	20.1					
15	20.5					
16	20.9					
17						
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19						
20						
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22						

Based on this sample data, the computed test statistic ***JB*** turns out to be approximately **1.0175**. This value quantifies the deviation of our sample distribution from a perfect normal distribution.

Step 4: Determine the P-Value and Draw the Conclusion

The final and most critical step is determining the P-value corresponding to our calculated JB statistic. As established earlier, under the null hypothesis, the JB statistic follows a Chi-Square distribution with 2 degrees of freedom.

To find the P-value, we need to calculate the right-tail probability of the Chi-Square distribution for our observed JB value. Excel provides a specific function for this purpose:

Formula: `=CHISQ.DIST.RT(JB test statistic, degrees of freedom)`

Using our result (1.0175) and 2 degrees of freedom, the formula is: `=CHISQ.DIST.RT(1.0175, 2)`

	A	B	C	D	E
1	**Data**		observations	15	=COUNT(A2:A16)
2	4		sample skewness	0.1943	=SKEW(A2:A16)
3	5.6		sample kurtosis	-1.2153	=KURT(A2:A16)
4	7.8				
5	7.9		JB test statistic	**1.0175**	=(D1/6)*(D2^2+(D3^2)/4)
6	9		p-value	**0.601244**	=CHISQ.DIST.RT(D5, 2)
7	9.3				
8	10.4				
9	12				
10	13.4				
11	14.4				
12	15.6				
13	18.7				
14	20.1				
15	20.5				
16	20.9				
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23					

The resultant P-value for this test is **0.601244**.

We must now compare this P-value to our chosen significance level, α = 0.05. Since 0.601244 is significantly greater than 0.05, we **fail to reject the null hypothesis** (H0).

Conclusion: We do not have sufficient statistical evidence to claim that the dataset is non-normally distributed. Therefore, for subsequent statistical analysis, we can proceed with the assumption that the data follows a normal distribution.

Additional Considerations and Resources

While the Jarque-Bera test is highly effective for examining deviations in skewness and kurtosis, it is important to remember its limitations. This test is generally more powerful with larger sample sizes (n > 200). For very small samples, it might lack the statistical power to detect meaningful deviations from normality.

For robust analysis, analysts often pair the Jarque-Bera test with visual methods, such as constructing a histogram or a Q-Q plot, to gain a more comprehensive understanding of the data's distributional shape.