Calculating Average Annual Growth Rates

Average Annual Growth Rate (AAGR) is often used to evaluate population growth or Christian Growth rates. This is the formula to calculate the Average Annual Growth Rate (AAGR) for a specific population.

\[
AAGR = 100 \times \left( \frac{P_2}{P_1} \right)^{\frac{1}{Y_2-Y_1}} - 1
\]

\(P_1\) is the population size in year \(y_1\) and \(P_2\) is the population size in year \(y_2\).

Tables found in the Church Growth Survey Handbook are useful to determine AAGRs (found in the research library). However these tables have limits to precision. So you may wish to use a scientific calculator or a spreadsheet to perform this calculation.

The formula for an MS Excel spreadsheet is:

\[
=100*(\text{POWER}((P_2/P_1),(1/(Y_2-Y_1))))-1
\]

It is possible to copy this formula into a spreadsheet to perform individual calculations or a series of calculations.

To perform individual calculations set up a spreadsheet like this:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Year 1</td>
<td>Year 2</td>
<td>Population 1</td>
<td>Population 2</td>
<td>Formula</td>
</tr>
<tr>
<td>2</td>
<td>Input data</td>
<td>Input data</td>
<td>Input data</td>
<td>Input data</td>
<td>=100*(POWER((D2/C2),(1/(B2-A2))))-1</td>
</tr>
</tbody>
</table>

A spreadsheet configured like this can be found in the Research Download under tools.

When using a spreadsheet to perform a series of calculations, use the same formula as above, but replace the cell address that contains the respective data for \(P_1\) and \(P_2\). It is also may be easier to insert the number for \((Y_2-Y_1)\) than to place this data in each row.

It is a good idea to test that your formula is working correctly by inserting data that you know the answer for. Sample test data follows

Sample Data

<table>
<thead>
<tr>
<th>Year 1:</th>
<th>Population 1:</th>
<th>Year 2:</th>
<th>Population 2:</th>
<th>AAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>184,000</td>
<td>2020</td>
<td>291,000</td>
<td>0.92%</td>
</tr>
</tbody>
</table>

One special situation for calculating growth rates occurs when the starting population is zero. In such cases, to avoid dividing by zero in the rate equation (thus giving an infinite growth rate), an approximation of the growth rate was made by substituting 10 as the starting population (or 1 as the
initial value if the final population value is less than 50). The resulting growth rate estimate is subject to a much wider margin of error than where the true starting value is greater than zero. This is especially true when the number of adherents of a particular religion is reported as 0 for an entire continent.

References:


Author: Russ Mitchell, 2013