

Computing Compound Growth Rates

Finance 476
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This is a short tutorial on how to compute the compound growth rate of a stream of figures. The techniques illustrated in this tutorial can be used to advantage throughout FIN 476 and especially in the Week 3 Problem Set and the Final Exam.

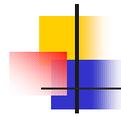


Overview

- What is a “Compound Growth Rate”
- What data do you need
- What tools do you need
- How do you compute it
- Illustrated Example
- Conclusion



In this short presentation, we will explore what a compound growth rate is, what data is needed to compute it, what tools are used (assuming financial calculators are not an option, as in this class), and how it is computed. We will then illustrate this with a detailed example and summarize our technique in the conclusion.



Definition

- Growth rate
- Compound Growth Rate



When financial professionals discuss growth rates, they usually mean compound growth rates. The compound growth rate is the rate at which an initial sum would have to grow to achieve the final sum over a set number of periods. Since the rate is a compound rate, we know that we can not just divide the difference in the two sums by the number of periods we are interested in, as this technique would result in a growth rate that would not take into account the cumulative effect of the interest or growth period-over-period. So we need another technique.

Data Needed

- Initial sum
- Final sum
- Periods



To find a compound growth rate, we need only three data points:

The initial sum, or the value of something at time $t=0$.

The value of that same something at the end of the period of concern.

And, finally, the number of periods that we are concerned with.

Periods could be and often are years, but they could be any even interval in time and don't need to be specifically defined for our purposes.



Tools

- Calculator
- Future Value Tables
- Equation for present value

$$i = K^{1/n} - 1$$



About all you need to solve for a compound growth rate is a calculator and the right formula. The formula is $k=(1+I)^n$ where I is the interest rate you are looking for and n is the number of periods. K in this case is the ratio of the final and initial value of the sum you are evaluating.

If you don't want to use the formula, you can easily look up the value of the ratio on the FVIF chart to find the interest rate.



Step by step procedure

- Find initial value
- Find final value
- Divide final by initial value
- Go to Table A-3 in the text
- Look for the number of periods on the left side of the chart.
- Read over until you find the ratio you computed above.
- Read up to find the interest rate you need.



Here are the steps you have to take to find the growth or interest rate.

1. Find the initial value
2. Find the final value
3. Take a ratio of the final to the initial value
4. Go to page A-6, table A-3 in the text
5. Find the row of numbers that corresponds to the number of periods you are evaluating
6. Read across the row until you see a number near the ratio you just computed
7. Read up the chart to see what interest rate this corresponds with
8. This is your answer



Illustrated Example

<ul style="list-style-type: none"> ■ Stream of values: <ul style="list-style-type: none"> ■ t=0: 34.50 ■ t=1: 33.80 ■ t=2: 45.00 ■ t=4: 42.50 ■ What is the growth rate of this stream over these four years? 	$V_f = 42.50$ $V_i = 34.50$ $\frac{V_f}{V_i} = \frac{42.50}{34.50}$ $K = \frac{V_f}{V_i} = \frac{42.50}{34.50} = 1.2319$ $1.2319 = (1+i)^n = (1+i)^4$ $1.2319^{1/4} - 1 = i$ $i = 1.0535 - 1$ $i = .0535 = 5.35\%$
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To find the compound growth rate of a stream of cash flows, you only need the initial and final flows, you do not need the intermediate flows. They are included to confuse you!

You take the final cash flow figure, which is 42.50 in this case and divide by the beginning value of 34.50. This gives you a ratio, which we will call K, of 1.2319.

This ratio is equal to one plus the unknown interest rate raised to the nth power, where n is the number of periods. Here we have four periods, each being one year in length.

To solve the equation, you must know that the inverse of taking a quantity to the nth power is to take the quantity to the 1/n th power. So if you do this to both sides of the equation, you get 1.2319 to the 1/4 or 0.25 power and 1 + I on the other side. To raise a number to a power other than a whole number, you will need a calculator or excel spreadsheet. 1.2319 to the 0.25th power is 1.0535. Now all that is left to do is to subtract 1 from this quantity and we have the compound growth rate implied by the four data points, or 5.35%.

If you do not want to raise a number to a power using a calculator or excel, you can stop when you get the K ratio. Once you have this ratio, you can look in the table in Appendix A-3 in the book (page A-6). Find 4 periods and read across until you see a number near to 1.2319. You would see that this exact



Conclusion

- Finding growth rate is simple
- Ignore intermediate points
- Use number of periods given
- Use either a calculator, spreadsheet or the FVIF tables



We have seen that finding the growth rate is a relatively simple exercise.

First, you must know what you don't need, and that's the intermediate points. Just focus on the first and last values in the series you are evaluating.

Then take a ratio of the final to the initial value and look up the result in the FVIF charts. You can also use a scientific calculator to algebraically solve for the interest rate, I .

Hopefully, everyone will now be able to do this simple calculation without problems.