The Stan Clark Financial Team's

PERSPECTIVES

An excerpt from "Perspectives" - Volume 10 - Issue 2

Behavioral finance

Careful: You likely suffer from *exponential growth bias*

By Stan Clark - Senior Investment Advisor

Let's begin with a fable:

The man who invented the game of chess showed it to the ruler of his country. The ruler was so impressed he allowed the inventor to name his reward.

The inventor, being wise, asked only for this: one grain of wheat on the first square of the chessboard, two grains on the second square, four grains on the third square and so on. Basically he was doubling the number of grains per square until the last square of the chessboard.

Scoffing at its seeming meagreness, the ruler granted the request. He ordered his treasurer to hand over the wheat. The treasurer took a whole week to calculate the amount of wheat needed. He finally determined it was impossible to make the payment!

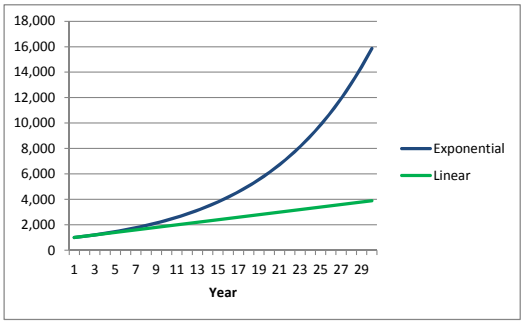
Just how much wheat were they talking about? A lot: 18,446,744,073,709,551,615 grains. Assuming each grain weighed 65 mg, at current world production levels the total amount would take more than 1,600 years to grow.

The above shows the power of compound interest – and of *exponential growth bias*, "the pervasive tendency to linearize exponential functions when assessing them intuitively."[1]

With *linear growth*, things change by a constant amount. With *exponential growth*, growth becomes bigger and bigger as the number itself gets bigger.

For our ancestors, most things were linear: the amount of food they gathered, the number of children they had, the distances they travelled. The linear perspective worked well for them (though not for the ruler in our fable). Naturally, our minds evolved to think in that same linear fashion. But this doesn't work so well in our modern world. Linear thinking can cause us to make mistakes when making judgements on things that grow exponentially.

Exponential vs Linear Growth: 10% per year



To give you a sense of the difference, if one of our ancestors took 30 linear steps (one step equalling a meter) from the entrance to her cave, she ended up 30 meters away. However, if she could take 30 exponential steps – i.e., one, two, four, eight, 16, 32, and so on – she would end up a billion meters away. She'd be lapping the globe 26 times.

Even if we are aware that growth is exponential, our intuition still leads us to think of things linearly. For that reason, it's vital to sit down and crunch numbers.

One of the best examples of exponential growth is compound interest. Our fable was an extreme example of its exponential effects, with the amount doubling on each square. However, even seemingly small differences in returns can make big differences. And the effect is truly amazing. According to Albert Einstein, "Compound interest is the eighth wonder of the world."

At lower rates of growth, the effects of compounding don't make much difference over short time periods. For example, the difference of investing $100,000 at 6% versus 8% over three years is less than $7,000. What if we look at the same example over 10 years? The difference is more than $36,000. For 30 years, it's more than $431,000. The difference is four times greater than the original investment of $100,000. And that's from a difference in growth of only 2% per year! As you can see in the table below, the longer the time period, the greater the effect. Plus, a bigger differential in returns will produce an even more significant difference in the final results.

	Compound Growth From $100,000			
Time Period	6% Return	8% Return	10% Return	12% Return
10 Years	$179,085	$215,892	$259,374	$310,585
20 Years	$320,714	$466,096	$672,750	$964,629
30 Years	$574,349	$1,006,266	$1,744,940	$2,995,992
Source: Stan Clark Financial Team				

What does this mean for you? When thinking longer term, *calculate* the effect of anything likely to change at an exponential rate. This includes your expected investment returns and, very importantly, inflation. Inflation can escalate your costs at an exponential rate, which can make a huge difference in what your money buys down the road. A calculator or computer is helpful. Or, as a quick check, try the **Rule of 72**. Your intuition will often be surprised at the results. ■

1 Exponential Growth Bias and Household Finance, The Journal of Finance December 2009.

The above examples are for demonstrative purposes only. Rates are not guaranteed and depend on investment choices and circumstances.

The Rule of 72

72 divided by the compound interest rate will give you the number of years something will take to double. Conversely, 72 divided by the number of years something took to double will give you the interest rate.

Example: if something is growing at 6%, it will take 12 years to double. If something took 10 years to double, the compound interest rate was 7.2%

CIBC Wood Gundy | The Stan Clark Financial Team
Where planning, investing and behavioral finance meet

Phone: (604) 641-4361 Toll free: 1 (800) 661-9442 Fax: (604) 608-5211 Email: StanClarkFinancialTeam@cibc.ca www.stanclark.ca