Exponentials

“The greatest shortcoming of the human race is man’s inability to understand the exponential function.”

*Albert Bartlett*

Most people have heard a logic puzzle that goes something like this:

“A patch of algae on a lake doubles in size every day. If it takes 24 days to cover the entire lake, on what day was half the lake covered?”

The answer (day 23) is obvious but unintuitive.

We aren’t good at perceiving multiple orders of magnitude—we pick one order of magnitude as a point of reference through which to view a set of data. We live in a world where this makes sense. The temperature outside on any given day is always around the same order of magnitude. Your income is always around the same order of magnitude. The number of people in your social circle is always around the same order of magnitude.

Very rarely do we interact with exponentials in our daily life. The economy might be one big exception. Take Coca-Cola’s stock graph for example. I find myself biased towards viewing its growth using its current order of magnitude as my point of reference. It looks like the stock really took off in the 2010s. Actually, its performance over the first 10 years (1983-1993) was *five times* better than its performance over the last 10 years (2013-2023). That 80’s growth just isn’t visible using 2023’s scale.

A green line graph with numbers

Description automatically generated with low confidence

A graph with a red line

Description automatically generated with low confidenceThe problem is exponential functions viewed from a single order of magnitude are like hockey sticks. They start flat and look like they’re doing nothing until they quickly blow up.

A graph with a red line

Description automatically generated with medium confidenceA graph with a red line

Description automatically generated with low confidence

Economic Growth

It’s amazing that we live during a time where exponential economic growth is the norm because exponential growth, by its nature, can’t be sustained all that long. With the world’s average GDP growth of 3%, it has a doubling time of 23 years.

Jared Diamond (Guns Germs and Steel author) has another book called Collapse, looking at how civilizations fail. One of his takeaways is “a society’s steep decline may begin only a decade or two after the society reaches its peak numbers, wealth, and power. The reason is simple: maximum population, wealth, resource consumption, and waste production mean maximum environmental impact, approaching the limit where impact outstrips resources.”

Whether its energy, fresh water, phosphorous, it feels like eventually some resource is going to give. Maybe sooner rather than later. On the other hand, the world’s population is peaking this century. Maybe we’ll get off the exponential curve before it blows up in our faces. The perpetual growth required for our capitalistic system is going to stop working at some point, the question is whether we’ll have a graceful transition to something new, or a collapse.