Limits to Growth

April 13, 2016 | Matthew Mimms

The following is an edited extract of a presentation given to the 6th Annual Perfecting Investment Portfolios Conference in Auckland on 5th April 2016. The subject was: Limits to Growth; can we expect global growth rates (and consequently asset price growth) to slow in the decades ahead? If so, why? And what are the implications for investment portfolios?

Economic growth is important; it contributes to innovation, progress and greater efficiency; to greater wealth and health, it has the ability to lift millions out of poverty, and in the context of today, it enables investment portfolios to grow.

I was born in 1966, and in my life time, the world's population has more than doubled; output as measured by GDP has grown 6-fold. We have witnessed massive (3 fold) increases in global food production. Prosperity has spread from the developed world to the developing world with China being a great example of this; it has seen its income per capita increase from just $US 99 in 1966 to roughly $13,000 in 2014 (according to the World Bank). And despite the recent effects of the GFC and burgeoning debt levels (sovereign, corporate, private), the consensus from many groups is that economic growth will continue but at a lower level than in the previous 50 years. A recent report by PWC projects global growth of just over 3% per annum between 2014 and 2050. This means that the global economy will double in size by 2037, and triple by 2050. Some economies will do better than others. The report suggests that economies such as Nigeria and Vietnam could grow at 5% per annum over this period, China at 3 – 4%, and the developed world by 1.5 to 2.5%.[1]

According to a recent report by McKinsey and Company[2], two key factors have helped to drive growth over the past 50 years. Firstly employment which has grown at a rate of 1.7% per annum, supported by a growing global population, particularly those of a working age. The second was rising productivity which grew on average by 1.8% between 1964 and 2014. Of the countries included in the survey (G19 and Nigeria), the average worker produces 2.4 times as much output now as they did in 1964. But looking forward, employment growth is set to slow as populations' age and workforce numbers peak, and thus contribute little to growth. Thus the burden for continued growth needs to fall on increases in productivity. If we assume productivity gains over the past 50 years are replicated over the next 50, growth will slow (from a 6 fold increase to just a 3 fold increase).

All things being equal therefore, for demographic reasons, growth is likely to be lower than it has been.

There has also likely been one other factor in the strong global growth we have witnessed over the past 50 years plus; and that has been the relatively cheap availability of fossil fuels; this is a point I will come back to in a moment.

I do however want to raise the issue of resource constraint as another likely factor in influencing growth over the coming decades.

"Limits to Growth"[3] is also the name given to a 1972 book, commissioned by The Club of Rome, a global Think Tank. Researchers from MIT built a computer model to track the world's economy and environment called World3. The model tracked industrialisation, population, food production, use of resources and pollution. They modelled data from 1900 to 1972 and then built a range of scenarios out to 2100 dependent on policy towards environmental and resource issues. The books central point is that the earth's resources are finite and that the pursuit of unlimited growth in population, material wealth etc. would eventually lead to collapse (under the standard or business as usual scenario). Under thisscenario, the model suggested an overshoot and collapse of the global economy, environment and population at some time prior to 2070. As the book concluded…

"If the present growth trends in world population, industrialization, pollution, food production and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next 100 years. The most probably result will be a rather sudden and uncontrollable decline in population and industrial capacity".

The scenario plays out a bit like this; in order to enable growth in industrial output, there has to be an ever increasing use of resources. But resources become more expensive to extract as they are used up (think light crude first vs oil sands and fracking). More and more capital is therefore directed at resource extraction and industrial output per person starts to fall (the book predicts worryingly from 2015). Pollution mounts and industrial input in to agriculture falls as does food production per capita. Health and education services are cut back and that combines to bring about a rise in the death rate. Subsequently population starts to fall, from around 2030.4

Limits to growth was and has been heavily criticised over the years, and understandably, the World3 computer model was coarse by modern standards; but many of its predictions captured in subsequent reports indicate that reality has most closely matched the BAU model. For example, and according to research carried out by Graham Turner from the

University of Melbourne (in a paper, Is Global Collapse Imminent published in August 2014[5]), the world is tracking pretty closely to the "business as usual" (as opposed to other) scenarios. The global population and economy have grown pretty much as expected in 1970 for example.

It is probably still too early to tell whether LtG's BAU run will prove to be accurate, time will tell, and by 2030 we will have a much clearer answer. However, it's important to note that the main scientific conclusion of the book was "that delays in global decision making would cause the human economy to overshoot planetary limits before the growth in the human ecological footprint slowed. Once in unsustainable territory, society would be forced to reduce its rate of resource use and emissions, either though managed decline, or though collapse".

Are we in overshoot? And are we seeing the first signs of resource constraint? The Global FootPrint Network[6] (a global scientific NGO) estimates that currently, humanity uses the equivalent of 1.6 planets to provide the resources we use and absorb our waste. This means it now takes the Earth one year and six months to regenerate what we use in a year. Moderate UN scenarios suggest that if current population and consumption trends continue, by the 2030s, we will need the equivalent of two Earths to support us. And of course, we only have one. Turning resources into waste faster than waste can be turned back into resources puts us in global ecological overshoot, depleting the very resources on which human life and biodiversity depend. Obvious examples of this overshoot are climate change, aquifer and fishing stocks depletion.

Resource constraint is therefore likely to act as a break on economic growth.

As I mentioned earlier, one of the key drivers of economic growth has been the relatively cheap and abundant availability of fossil fuels. Dr Tim Morgan, Economist, in his research paper, "Perfect Storm"[7], describes the economy in terms of a "surplus energy equation". He estimates that one gallon of petrol in terms of energy is equal to roughly 426 hours of human endeavour; it is this release of energy that has been the key driver of economic growth and technological advance over the last 2 – 300 years. Both he and others such as ex UBS analyst and now independent researcher and author, Andrew Lees highlight the importance of Energy Returned on Energy Invested (EROEI). This captures the relationship between how much energy is required to extract energy. For example, an EROEI of 50/1 means that 50 units of energy are extracted for each unit used in the extraction process. In this example, the net cost of the energy is just 1.96%.

Many of the early sources of fossil fuels such as oil discovered in the 1930's had very high ratios, 100/1 making them very profitable. This according to Tim Morgan fell to 30/1 in the 1970s and today few discoveries offer an EROEI of greater than 10/1. As an aside, Tar Sands have an EROEI of about 5/1 and Shale gas and oil of 3/1. Some renewables fair better such as Hydro where much of the cost is embedded up front; wind for example has a relatively high ratio of 17/1, biofuels seldom exceed 3/1. One thing you will note is the much lower levels of "return" for more recent forms of extraction.

At a global level, both Tim Morgan and Andrew Lees have plotted historically, (and made predictions) of where energy costs sit as a percentage of GDP and at the same time taken into account changes (falls) in EROEI. Historically, this relationship has been very positive prior to 1973. However, following the oil crisis, in 1979, energy accounted for almost 15% of global GDP, but fell during the 1980s and 1990 averaging 3.1% between 1986 and 1999. Morgan estimated that the EROEI is about 17/1 (2010), will be 11.5/1 by 2020, translating to energy absorbing almost 10% of global GDP up from 6.7% (in 2010). His projections suggest that by 2030 energy costs will absorb almost 15% of global GDP7. Increasing cost and allocation to resource extraction; less available for consumption, investment and essentials. Sound familiar?

The increasing cost and burden of resource extraction will likely lead to slower economic growth.

My final point is *Don't Panic*. Words like overshoot, collapse, limits can all sound a tad negative. Remember that one of the key conclusions from LtG was that overshoot can be avoided through forward looking global policy. And whilst you could argue there has been little policy to date, there are some positive examples of what can be done when needed (the transformation of the US economy in WW2, the Montreal Protocol, and most recently, the Paris Climate Change summit for example).

The Holy Grail for unlimited energy and in large part a solution to the resource constraint issue is the successful and commercial development of nuclear fusion; and you may have heard of projects such as Iter and DEMO[8]. They currently have a timeline of introducing commercially available reactor by around 2050. Sooner would of course be better (as an aside, I noted in my research that Britons apparently spend more on ringtone that their government does on nuclear fusion research).

In concluding, economic growth is not just concerned with inflation, monetary policy, China soft or hard landings, the Euro; there other limits to growth, notably the fact that we live on a planet whose resources are on the face of it finite; & that government and corporate policy action on these issues is becoming critically important.

Matt Mimms, April 2016.

[1]The World in 2050. Will the Shift in global economic power continue? PWC, February 2015.
[2]McKinsey Global Institute. Global Growth: can productivity save the day in an aging world? Executive Summary, January 2015.
[3]Limits to Growth. Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, William W. Behrens III. Universe Books 1972.
[4]Limits to Growth was right. New research shows we're nearing collapse. Graham Turner and Cathy Alexander. The Guardian, 2 September 2014. http://www.theguardian.com/commentisfree/2014/sep/02/limits-to-growth-was-right-new-research-shows-were-nearing-collapse
[5]Is Global Collapse Imminent? An Updated Comparison of The Limits to Growth with Historical Data. Graham Turner, Melbourne Sustainable Society Institute. Research Paper No 4 August 2014.
[6]http://www.footprintnetwork.org/en/index.php/GFN/
[7]Perfect Storm - energy, finance and the end of growth. Dr Tim Morgan, Tullet Prebon; strategy insights issue 9, January 2013.
[8]Wikipedia; https://en.wikipedia.org/wiki/DEMO