Austerity – Our "New Normal"

Our "old normal" – prosperity – was enabled by abundant and cheap NNRs. Our "new normal" – austerity – is being thrust upon us by increasingly scarce and expensive NNRs.

Introduction

When I wrote **"Scarcity – Humanity's Final Chapter?"** in 2009/10, it was obvious that the episode of epidemic global nonrenewable natural resource (NNR) scarcity that occurred immediately prior to the Great Recession was historically unprecedented. Global NNR prices associated with the vast majority of NNRs had increased during the years immediately prior to the recession, in many cases dramatically, as earth's increasingly constrained – i.e., increasingly expensive, lower quality – global NNR supplies struggled to address our historically unprecedented global NNR requirements.

It was unclear at the time, however, whether the episode of pre-recession global NNR scarcity was predominantly temporary or permanent. That is, in which cases would sufficient economically viable NNR supplies ultimately be brought online to completely address our continuously increasing global requirements; and in which cases would globally available, economically viable NNR supplies never again be sufficient to completely address our global requirements?

Post-recession data indicate that while the earth is still yielding "more" NNR supplies than ever in the majority of cases, it is failing to yield "enough" economically viable NNR supplies in an increasing number of cases to completely address our enormous and ever-increasing global requirements.

While only time will tell whether this trend will continue, the following analysis presents compelling evidence to support the contention that permanent global NNR scarcity is becoming increasingly prevalent – and that ever-increasing global NNR scarcity is the underlying cause associated with our new normal.

NNRs – the Enablers

Our modern industrial existence is enabled almost exclusively by enormous and ever-increasing quantities of nonrenewable natural resources (NNRs) – the fossil fuels, metals, and nonmetallic minerals that serve as:

- The raw material inputs to our industrialized economies;
- The building blocks that comprise our industrialized infrastructure and support systems; and
- The primary energy sources that power our industrialized societies.

As an example, NNRs comprise approximately 95% of the raw material inputs to the US economy each year.[1] During 2006, the year during which aggregate US NNR utilization peaked (to date), America used over 7.1 billion tons of newly mined NNRs – an almost inconceivable 180,000% increase since the year 1800 – which equated to almost 48,000 pounds per US citizen.[2]

NNRs play two essential roles in enabling our industrial lifestyle paradigm:

- NNRs enable renewable natural resources (RNRs) – water, soil, forests, and other naturally occurring biota – to be exploited in ways and at levels that are necessary to support the extraordinary population levels and material living standards associated with industrialized human societies. Examples include water storage/distribution systems, food production/distribution systems, and energy generation/distribution systems, which would support only a negligible fraction of today's global human population were they enabled exclusively by RNRs.

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- NNRs enable the production and provisioning of manmade goods and infrastructure – e.g., airplanes, computers, skyscrapers, super-highways, refrigerators, light bulbs, communication networks, etc. – that differentiate industrialized societies from pre-industrial agrarian and hunter-gatherer societies; goods and infrastructure that are inconceivable through the exclusive utilization of RNRs.

In sum, NNR inputs to our global economy generate the economic output that enables the material living standards enjoyed by our industrialized and industrializing populations.

NNR Inputs → Economic Output → Material Living Standards

Prosperity – Our "Old Normal"

Since the inception of our industrial revolution over 200 years ago until approximately the end of the 20th century, there was "more"; and better yet, there was "enough". As a result, there was increasing "prosperity"!

Global NNR supplies remained generally abundant during the 20th century, despite our continuously increasing utilization levels.[3]

"…a rising long-term price for a commodity indicates increasing scarcity of supply relative to demand. This is what we should expect with minerals as depletion progresses. However, in general, mineral prices have historically fallen in real terms. Therefore, the data show that supply has grown faster than demand [during the 20th century]." – USGS[4]

From the inception of our industrial revolution until approximately the end of the 20th century, mankind, especially people living in the industrialized West, experienced continuously improving material living standards, which were enabled by our ever-increasing utilization of abundant and cheap NNRs.

Throughout this period, there were typically "more" globally available, economically viable supplies of literally every NNR type – i.e., annual NNR extraction/production level trajectories and overall NNR supply level trajectories increased in nearly all cases since the dawn of industrialism.[5]

"Although the U.S. economy generally continues its increasing consumption trend [as did other industrialized nations], the international supply of minerals has been able to keep pace [through the end of the 20th century]." – USGS[6]

More importantly, there were "enough" economically viable supplies of nearly every NNR type during the period – i.e., abundant NNR supplies enabled NNR price trajectories to actually decrease in the vast majority of cases.[7]

"In 1929, D.F. Hewett, of the United States Geological Survey (USGS), reflecting on the effects of war on metal production … (Hewett, 1929). 'Since 1800 the trend of prices for the common metals, measured not only by monetary units but by the cost in human effort, has been almost steadily downward…'" And,

"In spite of the fact that the use of mineral raw materials increased over the last [20th] century, the long-term constant dollar price of key U.S. mineral raw materials declined during the same period." – USGS[8]

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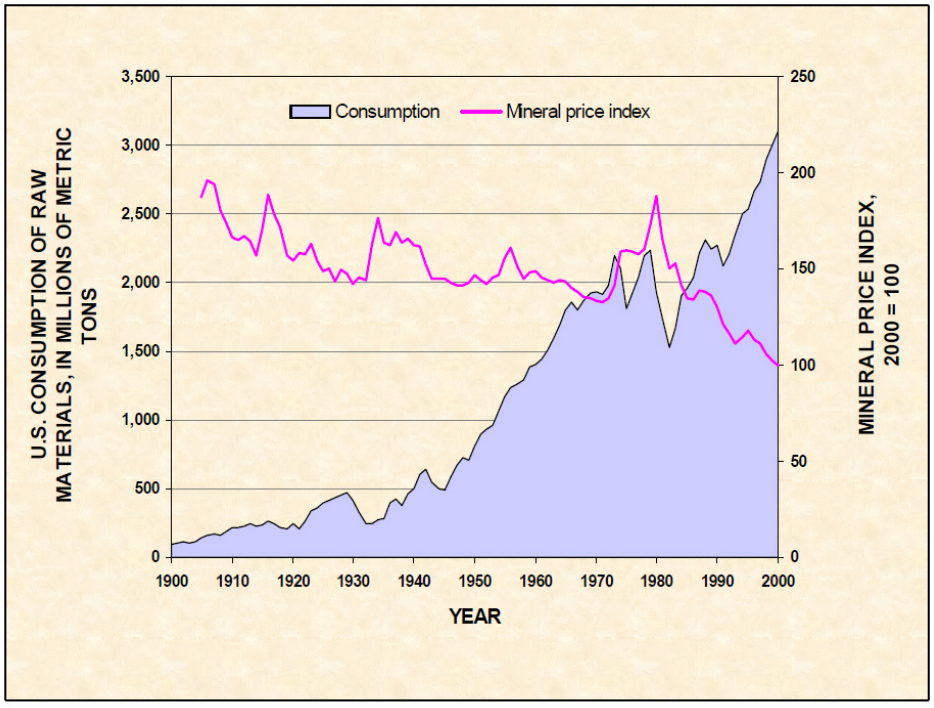
Consequently, globally available, economically viable NNR supplies were sufficient during the 19th and 20th centuries to completely address industrialized humanity's requirements, and thereby provide generally increasing prosperity – i.e., improving material living standards for broadening segments of our continuously expanding global population.

NNR scarcity, to the extent that it existed, was a temporary phenomenon that occurred during the "boom" phases of periodic "commodity boom/bust cycles".

"When demand increases, prices tend to rise and/or producers supply more goods to the market to keep up with the rising demand. When demand increases faster than supply**, temporary shortages exist." [emphasis mine]** – USGS[9]

Sufficient additional economically viable NNR supplies were always available during the 20th century to be brought online to resolve temporary NNR shortages and thereby restore decreasing NNR price trajectories.

Our 20th century NNR experience, which was defined by the counterintuitive reality of generally decreasing NNR price levels despite dramatically increasing NNR utilization (extraction/production) levels, is exemplified by the following USGS graph depicting 20th century US NNR utilization levels and pricing levels.[10]



With respect to 20th century NNR scarcity, the USGS concluded:

"The fact that production of mineral commodities has been able to keep up with or exceed the demand for minerals is, in part, an indicator that based on the past, **scarcity has not been an issue for mineral resources in general." [emphasis mine]** – USGS[11]

And the USGS was correct. During the 19th and 20th centuries, industrialized nations experienced only periodic episodes of temporary NNR scarcity within the context of general NNR abundance, which enabled historically unprecedented material living standard improvement for increasing segments of their expanding populations – our old normal prevailed!

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Abundant and Cheap NNR Inputs → Robustly Increasing Economic Output (GDP) → Continuously Improving Material Living Standards (Per Capita GDP)

Unfortunately, we misinterpreted temporary NNR abundance as permanent NNR sufficiency.

Austerity – Our "New Normal"

Owing to a fundamental shift in global NNR demand/supply dynamics that occurred during the past several decades, there is still "more" in most cases, but there is no longer "enough" in an increasing number of cases. The result is geologically-imposed austerity – our "new normal".

Why Our "Old Normal" No Longer Applies – Ever-increasing NNR Scarcity

NNR scarcity exists when the economically viable NNR supply available to a society is insufficient to completely address the society's NNR requirement, which is defined as the NNR quantity necessary to generate the mix and levels of goods and services required to provide the society's "expected" level of societal wellbeing (the material living standard enjoyed by its population).

Because NNRs are finite and non-replenishing, global NNR scarcity was inevitable. The persistent utilization of finite and non-replenishing natural resources, especially at levels required to perpetuate our industrial lifestyle paradigm, is unsustainable by definition. Our quest for global industrialism during the past several decades merely expedited the onset of epidemic NNR scarcity by causing a fundamental shift in global NNR demand/supply dynamics.

- On the "demand side", our global NNR requirements are historically unprecedented and are increasing at historically unprecedented rates. Whereas approximately 1.5 billion people occupied industrialized and industrializing nations until the late 20th century, that number increased nearly instantaneously by the beginning of new millennium to over 5 billion, most of whom have yet to even remotely approach their full NNR utilization potential; while

- On the "supply side", NNR supplies are increasingly constrained – i.e., NNR discoveries/deposits are fewer in number, smaller in size, less accessible, and of lower grade and purity. NNR exploration, extraction, production, and processing technologies are failing to keep pace with lower quality NNR supplies, and are therefore experiencing diminishing marginal investment returns – i.e., each incremental unit of technology investment yields smaller quantities of economically viable NNRs.

Our historically unprecedented and ever-increasing global NNR requirements are manifesting themselves within the context of increasingly expensive, lower quality NNR supplies. The unfortunate consequence associated with this "demand/supply imbalance" is that the earth cannot physically support humanity's current – much less continuously increasing – NNR requirements going forward.

In fact, by 2008, immediately prior to the Great Recession, global NNR scarcity had become epidemic. Sixty three (63) of the 89 NNRs that enable our modern industrial existence – including aluminum, chromium, coal, copper, gypsum, iron/steel, magnesium, manganese, molybdenum, natural gas, oil, phosphate rock, potash, rare earth minerals, titanium, tungsten, uranium, vanadium, and zinc – were scarce globally.[12]

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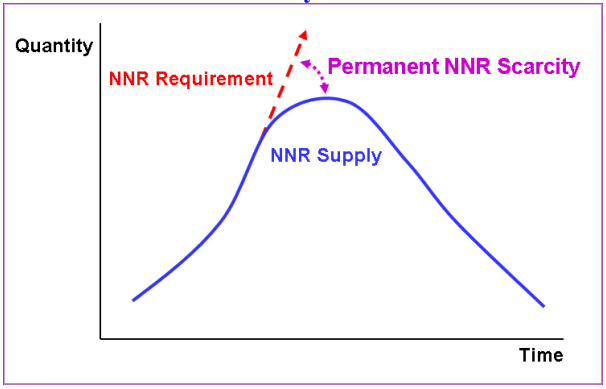
At the time this report is being written in August 2012, the vast majority of these NNRs are:

Permanent NNR Scarcity



- Permanently scarce globally – i.e., economically viable supplies will never again be sufficient to completely address our global requirements, or
- Experiencing increasingly severe and protracted episodes of temporary scarcity and will soon become permanently scarce globally as well.

(Note that permanent NNR scarcity occurs well before the annual NNR supply level reaches its peak.)

Humanity's Predicament – the Genesis of Our "New Normal"

Ironically, since the inception of our industrial revolution, we have been eliminating – persistently and increasingly – the finite and non-replenishing NNRs upon which our industrialized way of life and our very existence depend.

Because the natural resource utilization behavior that enables our current "success" – our industrial lifestyle paradigm – and that is essential to perpetuating our success, is simultaneously undermining our very existence, neither our natural resource utilization behavior nor our industrial lifestyle paradigm is sustainable.

This is humanity's "predicament".

2012 Global NNR Scarcity Analysis – Evidence of Our "New Normal"

During the mid/late 20th century (1960-1999), a barrel of oil cost $19 on average; during the years prior to the Great Recession (2000-2008), the average price of a barrel of oil had increased to $47; and during the years immediately following the Great Recession (2009-2012), the average price of a barrel of oil had further increased to $75.

During the same three time periods, the average price of a metric ton of copper increased from $3,085, to $3,715, to $6,281; the average price of a metric ton of iron ore increased from $36, to $57, to $113; and the average price of a metric ton of potash increased from $114, to $185, to $401. (All prices are adjusted for inflation.)

The simple fact is that we cannot grow our global economy and improve our global material living standards on $75 oil, $6,281 copper, $113 iron ore, and $401 potash like we did on $19 oil, $3,085 copper, $36 iron ore, and $114 potash.

It should come as no surprise, especially for those of us living in the industrialized West, that our NNR-dependent national economies have been sputtering and our material living standards have been deteriorating during the early years of the 21st century.

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Analysis Overview

The 2012 Global NNR Scarcity Analysis (Analysis), an update to the Global NNR Scarcity Analysis presented in **"Scarcity"**, compares the trends and trajectories between our old normal and our new normal with respect to each of the following criteria:

- NNR "demand/supply" dynamics (NNR requirements, supplies, prices, and demand);
- Global economic output (GDP); and
- Global material living standards (per capita GDP).

Analyzed NNRs The Analysis considers 16 NNRs for which the World Bank maintains pricing data from the year 1960 to the most current month, June 2012 in this case (exceptions are coal, 1970-2012; steel, 1979-2012; and potash, 1970-2012). Included in the Analysis are the following NNRs:

- Fossil Fuels: coal, natural gas, and oil.
- Metals: aluminum, copper, iron ore, steel, lead, nickel, platinum, silver, steel, tin, and zinc.
- Non-metallic Minerals: phosphate rock, potash, and urea (nitrogen).

These 16 NNRs are representative of the broader NNR base (89 NNRs were analyzed in **"Scarcity"**) and provide a good proxy for global NNR supply, pricing, and scarcity trends and trajectories. (Note that ongoing NNR analyses are necessary as new data become available.)

Analysis Period – (1960–[June] 2012) The Analysis considers three time intervals:

- Mid/Late 20th Century (1960-1999/2000),
- Pre Great Recession (2000-2008), and
- Post Great Recession (2008/2009-2011/2012).

Data Sources Data utilized in the Analysis were obtained from the following sources:

- 20th Century NNR Price, Supply, and Utilization Trajectories – US Geological Survey.
- 2000-2010 Global NNR Supply (extraction/production) Trajectories – US Geological Survey.
- 1960-2012 Inflation Adjusted Global NNR Price Trends – World Bank and US Energy Information Administration.
- 1960-2011 Global Economic Output (inflation adjusted global GDP) Trajectories – World Bank.
- 1960-2011 Material Living Standard Improvement (inflation adjusted global per capita GDP) Trajectories – World Bank.

Key Assumptions The following assumptions underlie the Analysis:

- If global NNR supplies are abundant—i.e., sufficient to completely address our global requirements—NNR price level trajectories remain flat or decline over time.
- If global NNR supplies are scarce—i.e., insufficient to completely address our global requirements—NNR price level trajectories increase over time.
- The post-recession, scarcity-related trends associated with the 16 analyzed NNRs are consistent with the post-recession, scarcity-related trends associated with the broader NNR base.

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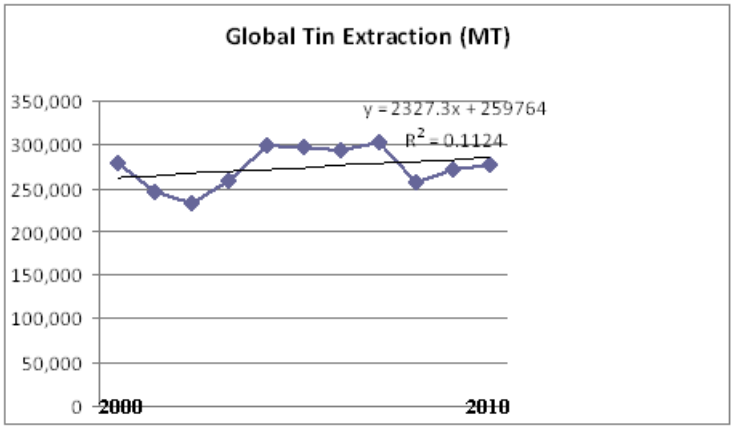
Analysis (Trends and Trajectories)

Global NNR Supply (Extraction/Production) Level Trajectories

Notwithstanding periodic NNR supply level decreases caused by "commodity boom/bust cycles" and geopolitically induced supply restrictions, annual global NNR extraction/production levels and overall NNR supply levels generally trended upward during the 20th century.[13] There were "more" of nearly all NNR types between the years 1900 and 2000 (exceptions being toxic NNRs such as arsenic, asbestos, and mercury).[14]

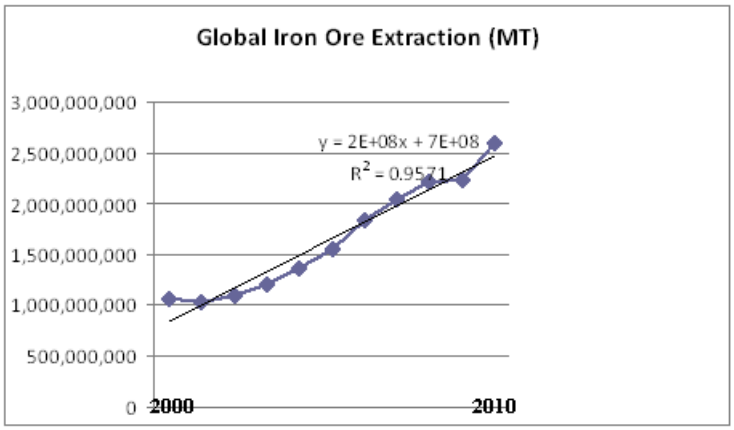
Had this 20th century NNR supply trend persisted into the new millennium, annual NNR supply levels would have continued their upward trajectories from the year 2000 forward. And, based on global NNR extraction/production data for the years 2000 through 2010 (most currently available data), this was the case for all 16 of the analyzed NNRs.[15]

Tin – Annual Global Metric Tons Extracted



Of the 16 analyzed NNRs, annual global tin extraction levels exhibited the slightest upward trajectory between the years 2000 and 2010, while global iron ore extraction exhibited the greatest upward trajectory during the period.[16]

Iron Ore – Annual Global Metric Tons Extracted



Significant Finding In the case of each analyzed NNR, there were "more" globally available, economically viable supplies during early years of the 21st century.

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NNR Price Level Trends

Notwithstanding periodic price increases caused by "commodity boom/bust cycles" and geopolitically induced supply restrictions, NNR price levels remained relatively low during the 20th century (specifically during the 1960-1999 period); and actually trended downward in the majority of cases.[17] These relatively low and generally decreasing NNR price levels prevailed despite the fact that NNR supply (extraction/production) levels trended upward in the vast majority of cases during the 20th century.

Had 20th century price level trends persisted into the new millennium, NNR prices would have continued their downward trajectories from the year 2000 forward, and average 21st century NNR price levels would have been lower than average 20th century price levels. With very few exceptions, this was not the case.

Inflation Adjusted Average NNR Prices			
NNR	**1960-1999**	**2000-2008**	**2009-2012**
Fossil Fuels			
Coal (2005 USD per MT)	42	50	84
Oil (2005 USD per barrel)	19	47	75
Natural Gas (Global Index: 2005=100)	27	83	84
Metals			
Aluminum (2005 USD per MT)	1,776	1,937	1,771
Copper (2005 USD per MT)	3,085	3,713	6,281
Iron Ore (2005 USD per Dry MT*)	36	57	113
Lead (2005 US Cents per Kg)	86	105	177
Nickel (2005 USD per MT)	8,107	15,602	16,564
Platinum (2005 USD per Troy Oz)	452	897	1,295
Silver (2005 US Cents per Troy Oz)	772	802	2,125
Steel (Global Index: 2005=100)	69	83	112
Tin (2005 US Cents per Kg)	1,227	839	1,732
Zinc (2005 US Cents per Kg)	122	160	170
Nonmetallic Minerals			
Phosphate Rock (2005 USD per MT)	52	75	131
Potash (2005 USD per MT)	114	185	401
Urea [Nitrogen] (2005 USD per MT)	174	202	293

Data Source: World Bank and US Energy Information Administration

In 15 of the 16 analyzed cases, the exception being tin, average NNR price levels during the pre-recession period (2000-2008) exceeded average price levels during the mid/late 20th century (1960-1999).[18]

And, with the exception of aluminum, average post-recession (2009-2012) NNR price levels exceeded both average mid/late 20th century (1960-1999) price levels and average pre-recession (2000-2008) price levels – in most cases dramatically![19]

Significant Finding While "more" globally available, economically viable supplies existed with respect to each of the 16 analyzed NNRs during the early years of the new millennium, "enough" globally available, economically viable supplies existed in only one case – aluminum. Only in the case of aluminum were globally available, economically viable supplies sufficiently abundant to drive average post-recession prices back down to 20th century levels.

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Global Economic Output (GDP) Trajectories

Global economic output (GDP) increased at a 3.81% compound annual rate during the mid/late 20th century (1960-2000).[20]

Had the 20th century global economic growth trajectory persisted into the new millennium, global economic output (GDP) would have increased at approximately 3.8% per annum, and might have exceeded 4%, given the emergence of newly industrializing nations such as China, India, and Brazil. This did not occur.

Compound Annual Growth Rate (CAGR) in Global Economic Output (GDP)		
1960-2000 CAGR	2000-2008 CAGR	2008-2011 CAGR
3.81%	2.90%	1.56%

Data Source: World Bank

The compound annual growth rate in global economic output (GDP) actually decreased to 2.9% during the pre-recession period (2000-2008), and further decreased to 1.56% during the post-recession years (2008-2011).[21]

Significant Finding As the vast majority of NNRs became increasingly scarce and expensive globally during the pre-recession years, the annual growth rate in global economic output (GDP) decreased. As these NNRs became even more scarce and expensive during the post-recession years, the annual growth rate in global economic output (GDP) decreased even further.

Global Material Living Standard (Per Capita GDP) Improvement Trajectories

Global material living standards, as proxied by per capita global GDP, improved at a 2.01% compound annual rate during the mid/late 20th century (1960-2000).[22]

Had the 20th century global material living standard improvement trajectory persisted into the new millennium, global material living standards would have continued to improve on the order of 2.0% per annum, or possibly at a greater rate, given the significant material living standard improvement associated with increasing segments of newly industrializing nations such as China, India, and Brazil. This eventuality did not come to pass.

Compound Annual Growth Rate (CAGR) in Global Material Living Standard (Per Capita GDP) Improvement		
1960-2000 CAGR	2000-2008 CAGR	2008-2011 CAGR
2.01%	1.66%	0.40%

Data Source: World Bank

The compound annual growth rate in global material living standard improvement (global per capita GDP) actually decreased to 1.66% during the pre-recession period (2000-2008), and further decreased to 0.4% during the post-recession years (2008-2011).[23]

Significant Finding The trend in global material living standard improvement paralleled that of global economic growth.

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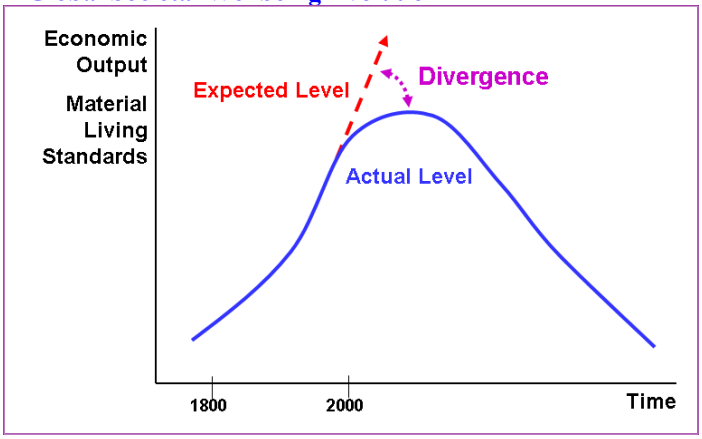
Global Societal Wellbeing Evolution



As the vast majority of NNRs became increasingly scarce and expensive during the new millennium, both the annual growth rate in global economic output (GDP) and the annual growth rate in global material living standard improvement (per capita GDP) diverged from their expected levels and decreased continuously.

Assessment – Expectations Versus Reality

Given the environment of general NNR abundance that prevailed during most of the 20th century, our expectations regarding 21st century NNR availability, 21st century economic growth, and 21st century material living standard improvement consisted of simple extrapolations of our 20th century experience.

Unfortunately, our expectations have been not realized. Our old normal transitioned – unexpectedly and nearly instantaneously – to our new normal at the dawn of the new millennium, as billions of additional NNR users worldwide generated historically unprecedented requirements for earth's increasingly constrained NNR supplies.

NNRs Given that our current global "demand/supply" dynamics – i.e., our ever-increasing NNR requirements juxtaposed against the earth's increasingly constrained NNR supplies – will almost certainly persist going forward; upward trending NNR price trajectories will almost certainly persist as well.

As a result, an increasing number of NNRs will become permanently scarce globally – i.e., while there will always be plenty of NNRs in the ground, there **will not be enough economically viable NNRs** in the ground to completely address our future requirements.

Increasingly rare instances of future NNR surpluses will result not from over-production (abundant economically viable NNR supplies), but from demand destruction (contracting NNR demand due to increasingly high NNR prices).

Global Economic Output Given that future NNR price level trajectories will continue to trend upward in most cases, future global economic growth will almost certainly continue to trend downward. That is, our annual global economic output (GDP) levels will increase temporarily at a decreasing rate over the near term, peak in the not-too-distant future, and enter terminal decline within the next decade or so. (Please see the Global Societal Wellbeing Evolution diagram.)

As a result, our global economy, which failed to recover from the Great Recession in 2010, 2011, and 2012, will never experience a complete recovery. And our national economies, many of which are already showing signs of stress, will experience increasingly poor performance:

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- The economies associated with the weaker, less competitive European nations – including Portugal, Ireland, Italy, Greece, and Spain – are currently in a state of terminal decline;[24]
- Economic growth in the remainder of the industrialized West – including Japan, the UK, Germany, and the US – is faltering;[25] and
- The economies in newly industrializing nations such as China, India, Brazil, South Korea, and Indonesia are growing at decreasing rates.[26]

Material Living Standards So long as global economic growth continues to slow, our material living standards will continue to moderate as well. (Please see the Global Societal Wellbeing Evolution diagram.)

Populations in the industrialized West will see their material living standards deteriorate continuously going forward; and people in newly industrializing nations who aspire to Western material living standards will see their aspirations increasingly frustrated.

Weaker and less competitive industrialized nations in the West are already experiencing deteriorating material living standards[27], especially among their middle class population segments. The real wealth[28] surpluses generated by these nations' economies are no longer sufficient to support their existing middle class populations, much less continuously expanding middle class populations.

Increasingly Scarce and Expensive NNR Inputs → Slowing Economic (GDP) Growth → Moderating Material Living Standard (Per Capita GDP) Improvement

The persistent global economic malaise that we have experienced since the Great Recession is symptomatic of the fact that our actual level of global societal wellbeing has diverged permanently from our expected level – i.e., both our global economic output (GDP) level and our global material living standards (per capita GDP) are in the process of "rolling over".

Implications of Our "New Normal"

The Great Recession was not simply another temporary economic downturn, from which we in the industrialized world will recover by "stimulating" our national economies with borrowed money, printed money, and manipulated (artificially low) interest rates.

The Great Recession was caused by a permanent ecological (geological) phenomenon – ever-increasing global NNR scarcity. The Great Recession marked the permanent transition from our old normal of ever-increasing, NNR-enabled prosperity to our new normal of ever-increasing, geologically-imposed austerity.

Implications associated with this historically unprecedented turn of events include:

- Abundant and cheap NNRs were the enablers of our old normal, increasing prosperity – i.e., the robust economic growth and continuously improving material living standards that most of us who are living today in industrialized nations still consider to be "normal".

- As an increasing number of NNRs are becoming increasingly scarce and expensive, our NNR-enabled prosperity is being displaced by our new normal, geologically-imposed austerity, which is characterized by ever-increasing economic deterioration, material living standard degradation, political instability, and social unrest.

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- Because the underlying cause associated with our transition from prosperity to austerity is ecological (geological), not economic or political, our incessant barrage of economic and political "fixes" – fiscal and monetary "stimulus" – is misguided and inconsequential. Our national economies are not "broken"; they are "dying of slow starvation" for lack of sufficient economically viable NNR inputs.

- Our industrial lifestyle paradigm, which is enabled by enormous quantities of finite, non-replenishing, and increasingly scarce NNRs, is unsustainable – actually, physically impossible – going forward.

- Global humanity's steadily deteriorating condition will culminate in self-inflicted global societal collapse, almost certainly by the year 2050. We will not accept gracefully our new normal of ever-increasing, geologically-imposed austerity; nor will we suffer voluntarily the horrifically painful population level reductions and material living standard degradation associated with our inevitable transition to a sustainable, pre-industrial lifestyle paradigm.

Our Next Normal – Catastrophe

Absent continuous and extraordinary economically viable NNR discoveries of literally every type – especially fossil fuels, major metals, and fertilizer components – humanity's unraveling will almost certainly devolve into global societal collapse by mid-century.

Over the next decade or so, increasing global NNR scarcity will induce a series of increasingly frequent and severe economic recessions punctuated by increasingly anemic attempted recoveries, a trend that will be especially problematic for the NNR-deficient – but highly NNR-dependent – nations in the industrialized West.

The previously improving material living standards associated with industrializing nations will stagnate; and the previously stagnant material living standards associated with industrialized nations will converge toward those of industrializing nations.

Our situation will continue to deteriorate, despite our ongoing attempts to "fix" it with irrelevant economic and political expedients. NNR scarcity will devolve into increasingly severe temporary NNR supply shortages, as earth's increasingly constrained NNR supplies fail by increasingly wide margins to completely address our global requirements.

As our economic output (GDP) levels and material living standards continue to decline, we will resort increasingly to conflict at the global, national, regional, and ultimately local levels to obtain the incremental NNRs and derived goods and services required to perpetuate our faltering national economies and our deteriorating individual livelihoods.

Escalating natural resource wars will further reduce our declining economic output levels and material living standards, as war related destruction disrupts our critical natural resource supplies and our critical societal support systems such as water storage/distribution, food production/distribution, energy generation/distribution, sanitation, healthcare, transportation, communications, and law enforcement.

As global NNR supply shortages become increasingly acute, NNR-dependent industrialized nations will be unable to maintain the economic output levels necessary to fund their ballooning debt service, social entitlement, and social services obligations—nor will they be able to obtain additional credit with which to offset their declining real wealth generation capabilities. Western economies – especially those with large debt obligations, fiscal deficits, and balance of payments deficits, such as the US – will experience cascading defaults.

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As global NNR supply shortages become permanent, our bankrupt and war ravaged global industrial mosaic will be unable to provide societal essentials—clean water, food, energy, shelter, clothing, and infrastructure—at levels sufficient to support our increasingly angry, confused, and desperate populations. Already deteriorating social order will devolve into chaos.

By the year 2050, all industrialized and industrializing nations, irrespective of their economic and political orientations, will collapse, taking the aid-dependent, non-industrialized world with them.

Permanently Scarce and Prohibitively Expensive NNR Inputs → Economic Collapse → Global Societal Collapse

Ironically, we Homo sapiens are both the unwitting perpetrators and the hapless victims of our self-inflicted "predicament" – i.e., our industrial lifestyle paradigm is enabled by natural resource utilization behavior that simultaneously undermines it.

Regrettably, our predicament will be resolved, soon, through self-inflicted global societal collapse – i.e., we will resort increasingly to conflict as the means by which to allocate remaining increasingly scarce NNRs, RNRs, and derived goods.

Endnotes

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8. **"Economic Drivers of Mineral Supply"**, USGS, pages 10 and 61.
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10. **"Economic Drivers of Mineral Supply"**, USGS, page 78; NNRs included in the USGS index are cement, clays, lime, phosphate rock, salt, sand and gravel, crushed stone, copper, gold, iron ore, lead, and zinc.
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16. "Historical Statistics for Mineral and Material Commodities in the United States"; USGS.
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25. **"National GDP Growth (inflation adjusted)"**, example countries: US, UK, Japan, and Germany; World Bank.
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28. All real wealth is derived from the following sources:

- In the water – fish and other aquatic life forms;
- On the ground – livestock and other animal life forms;
- In the ground – crops and other plant life forms; and
- Under the ground – fossil fuels, metals, and nonmetallic minerals (NNRs).

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Chris Clugston Bio

Since 2006, I have conducted extensive independent research into the area of “sustainability”, with a focus on nonrenewable natural resource (NNR) scarcity. NNRs are the fossil fuels, metals, and nonmetallic minerals that enable our modern industrial existence.

I have sought to quantify from a combined ecological and economic perspective the extent to which America and humanity are living unsustainably beyond our means, and to articulate the causes, magnitude, implications, and consequences associated with our “predicament”. My research culminated in the publication of ***Scarcity – Humanity’s Final Chapter?*** (Please see www.nnrscarcity.com for additional information.)

My previous work experience includes thirty years in the high technology electronics industry, primarily with information technology sector companies. I held management level positions in marketing, sales, finance, and M&A, prior to becoming a corporate chief executive and later a management consultant.

I received an AB/Political Science, Magna Cum Laude and Phi Beta Kappa from Penn State University, and an MBA/Finance with High Distinction from Temple University.

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