The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Profiting from Scarcity

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This is a guest post by Philip Henshaw, known on The Oil Drum as pfhenshaw. Phil has a BS in physics and an MFA in architecture. He has been studying the physics of how natural systems change form for 40 years, first interested in the subject by college physics experiments in how all experiments misbehave. Phil's website is www.synapse9.com.

Economic theory is based on the observed regularities of the past. Some are considered as general principles, or "natural laws" that are expected to never change. From a systems view, though, such laws are emergent properties of the complex system they are regularities of, and prone to change as the system changes form.

Growth systems, for example, invariably change form when they climax, but the present laws of economics describe a complex system that has perpetual growth that never changes form. The question is partly how to tell when such changes might be appearing. Complex systems may vary a great deal without indicating a change in the form of the whole system. What would raise the question is finding events of kinds that are not supposed to occur at all. Present evidence points to depletion of necessary resources as the possible cause of the combined food and fuel price spiral of the past decade.

An example of one such economic law is that scarcities are temporary. In theory, self-interest drives people to either find substitutes, added supplies, or to reduce demand as prices rise, and in those ways scarcity is expected to resolve smoothly.

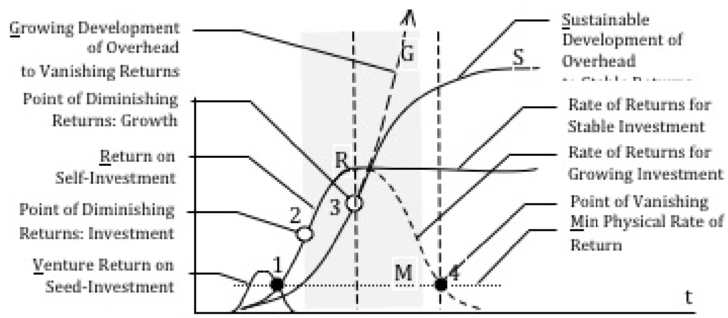
When none of those three things occurs, though, the economy experiences a continuing price spiral with no substitutes or added supplies being found for an extended period. It's a primary indication that the physical system is at a point of inelasticity, and changing design in some way. Then the old "laws" become misinformation about regularities that no longer exist. This is a brief research note on one example, to raise questions.

The economies that are unable to relieve scarcities for their own needs violate their own equilibrium. They create panics as markets display a "law of limitless price" for resources in inadequate supply for which there is rigid demand, instead of the traditional "law of supply and demand". If scarcity develops locally, but substitutes from elsewhere can be found to relieve them, such "price shocks" are natural events that the system as a whole recovers from.

Scarcity is never supposed to happen for an extended period for the whole economic system at once, though. It would imply that the value of investing in finding alternates or increasing supplies has declined to zero, no matter the price. That would violate one of the primary laws of economics, the expectation that increasing investment produces increasing returns.

In micro-economics, and in development generally, it is universally understood that any process of increasing self-investment has increasing returns only to a limit. Past that limit, additional investment produces diminishing returns. Some believe the principle of diminishing returns does not apply to macro-economics, though. The world economy as a whole has never before had slowing growth for an extended period in modern history, leaving the theoretical limitless potential of human invention untested.

Evidence that the economic system as a whole has ended its long period of continual growth, and has instead begun to climax, just as natural systems always do, would have especially far reaching implications for what can be planned on. It relates to what Keynes[1] and Boulding[2] referred to as the “widows cruse” (from the Biblical story, I Kings 17:8–16, of Elijah and the inexhaustible cup, or ‘cruse’ which he gave a hospitable old woman) representing the sustainable path for economies at climax as they experience diminishing returns on investment.



Development Path Options for Natural Resource

Figure 1- Created by Author

What would push a whole self-investment system beyond its point of diminishing returns, broadly, is additions to its energy overhead costs and/or energy resource depletion, resulting in declining whole system EROI[3, 5] and declining physical profitability. As depicted in the Figure 1, a sustainable state is accompanied by a steady level of investment (solid lines).

During the development period, increasing investment results in increasing returns until it begins to have the reverse effect. If continued (dotted lines), returns decline toward a point of vanishing returns as physical income is no longer greater than costs. Where overhead liabilities build up and returns on investment decline, a point is reached where it is “no longer worth it” to operate a system. A time is reached to “call it quits” for all kinds of large and small business plans.

In general, the limit is real but beyond available information to define, and often unexpectedly discovered, as in bankruptcies. When a whole economic system displays diminishing returns, it prompts the analyst to look for possible thresholds of vanishing returns that would predict collapse. That such reversal and failure points are theoretically sure to exist for any process of development using physical resources, makes looking for such limits a good question to ask in response to evidence of unexpected inelasticity.

Natural diminishing returns is what happens when a person is shining his shoes or combing his hair, and the first strokes accomplish a lot and then later ones accomplish very little. Every resource, whether obtaining supplies of a physical material, or improving a technology for using them, displays its limit by the decreasing productivity of increasing physical investment.

The investment response to any diminished resource is often to substitute new techniques to maintain productivity. That means that diminishing returns may also be expressed as increasing complications in finding substitutes, emerging conflicts of interest or unresponsiveness for related resources in making those substitutions.

An example is the broad present experience in professional “sustainable design” and in “sustainable development”. Designers now find a very large increase in the complexity of coordinating many different designs and systems at once is needed for success. These are all features of the broad meaning of the 2nd law of thermodynamics and how it applies to the “cost of energy” for any physical process of “making things happen”, and as what the subject of thermodynamics[a] generally refers to.

One of the most curious things about the debate over the natural limits to growth, though, is the general lack of professional study of signs of significant change in the nature of economies, partly due to a belief that economic laws don’t change. The point when diminishing returns for added investment is reached is actually the end of the compound growth period. For us, a 30 year overshoot of speculative financial expansion, apparently absence real investment potentials to satisfy investors, may have disguised our passing the real point of physical diminishing returns on investment long ago.

Watching for such turning points should be our natural means of ‘steering’ our own theories. It should be our main way to discover the natural limits of our own models, not just for one point of view on the debates over planning and policy, but for all points of view. Not watching closely to see when nature is upsetting our theories implies we are treating our theories as being our reality, giving us no perspective for questioning them.

It should be possible, then, to consider our theories as only a form of information to help us understand where nature is taking us. Discovering behaviors in the economy that violate the long trusted laws of economics would then test its assumptions. With the right information, people are very responsive to ending increased effort when they experience diminishing results, and promptly adjust their efforts for all kinds of things.

What’s first needed is a means of noticing things not following the old rules. The problem seems to occur when we have little experience except for knowing the rules to follow. We can then get the wrong signal, as when following old rules in an environment where the rules have changed.

For example, if one only looks at the profits involved, having prices rising faster than costs might signal increasing investment opportunity. If the reason for rising prices is fundamental scarcity due to over-investment in the physical resource, then accelerating that fundamental scarcity by increasing investment is quite counterproductive, even if locally profitable.

The problem being hinted at here is that relying on profiting from scarcity to be a growth industry and to pay for increasing overhead costs for other things, is a strategy that may abruptly collapse. It would be unfortunate to be banking on short-lived strategies to finance things like converting the world economy to sustainable technologies and avert climate change, for example.

If our larger economic problem is profiting in the false profit of making things scarce, we’re talking about a physical development trap potentially more threatening than peak oil, climate change, and the financial breakdown combined. The projected profits needed to invest in mankind's needs may simply not materialize at all. Development of all kinds alters its environment and creates conditions that upset the apparent “rules of the past” giving false guidance unless a person is watching for the signs of reversing directions of the environments own responses to us.

One of the hidden but most important of all principles of natural systems is that every physical system that begins with growth, alters its environment in a way that brings an end to its own growth. When that approaches, it is not the past regularities of the system or the equations one had developed trust in that are important, but the limits of the physical system and what new regularities may develop.

One of the recent economic behaviors an economy is never supposed to exhibit is the way the prices of food and fuel (our primary necessities of life) began a rapid exponential divergence from their prior stable level for the 6 years from 2002 to 2008. They increased at ~25%/yr, until the world economy collapsed. They seemed to be following some altogether new "law of unlimited price" instead of the usual "law of supply and demand". That's not supposed to happen.

When demand exceeds supply, the increase in price is supposed to stimulate increasing supply and lower the price again. The opposite is what actually occurred, investment increasing and prices rising faster. That produced a progression of successively more radical changes in global price relationships.

Continually increasing prices like these would naturally be expected to upset financial expectations and add to what caused the financial collapse. Clearly such a price spiral also is a sign of profound inelasticity in the global economic system as well.

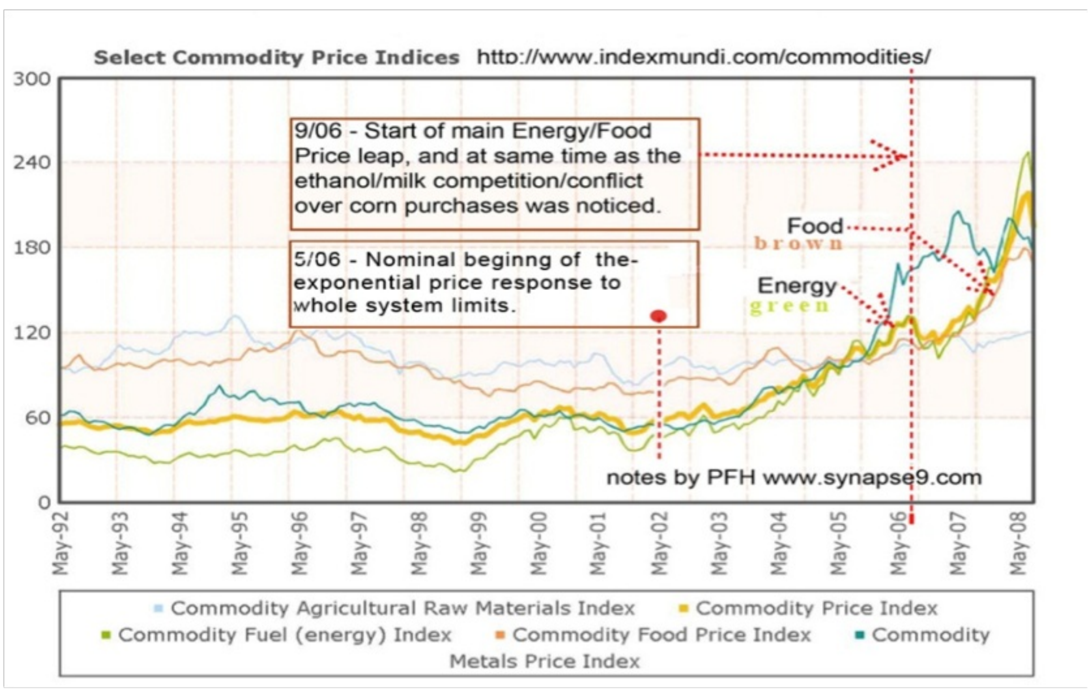


Figure 2

The exponential shape of the curve strongly suggests there was an emergent system of multiplying feedbacks operating, of some sort, that a person would need to discover to know what was really happening. What is clear is that the limit of the system driving the run-away price spiral was the global collapse. The list of linked physical/economic causes for it would surely be long, but the problem is how to characterize them simply enough to make them comprehendible.

If this is a sign of fundamental diminishing returns on investing in the earth, what you would expect to be the cause are that food and fuel demand are both increasing and now competing for the same resources for the first time, while those resources themselves are being degraded making the investments in them more costly. At the same time the total overhead cost for operating society, which I call SROI[4] , has also been systematically increasing.

My speculation is that the curves of increasing societal cost and decreasing resource productivity[5], or EROI, might have crossed, making the net productivity of the system as a whole fall below its sustainability threshold. The emergence of a strain like that, on resources for which there is inelastic demand, would be a natural 'snag' in adjusting supply and demand, and seem quite adequate to explain the end of speculative increases in real estate prices, and become the direct cause triggering the collapse of finance rather than just a contributing cause.

Surely there were a great many things going on at the same time. That's one of the mysteries of nature's complexly well-organized systems. Systems that act as a whole are made of disconnected parts that work together as if they had 'ESP'.

One of the particular financial mechanisms that might have played a role is speculation. Speculative investment funds moved out of real estate to look for something else with a natural mechanism to keep pumping up the returns, in this case apparent physical scarcity relative to whole system necessities.

A movement from real estate to commodity speculation probably did create a surge of speculative demand and an additional restraint on supply. The combination of the additional speculative demand for raw commodities was an additional restraint on supply adding to the other strains that made the unresponsive markets vulnerable to speculation in the first place. The flight of speculation from real-estate would have also have further weakened the prices for real estate.

The tragedy of the commons is just that. Our rules don't tell us where the breaking points of our rules are, and even well lubricated markets have breaking points, and can give people faithfully following the old rules that have ceased to apply the entirely wrong signal.
It is fairly clear that our centuries of economic growth are now also upsetting a great variety of other environmental systems, and we don't quite understand how or what to expect. The ancient rule "nature always recovers" is now not holding up for us in a great many ways and in a great many places.

It seems to me that the time has come for us to reexamine the rules which we assume underlie our economic system. Physical resources seem to have reached limits, driving up their physical cost for a system built for readily available and inexpensive resources. If we don't start noticing now, when will we?

Notes

[a] As a note for generality, thermodynamics was originally defined only in terms of the energy equations of controlled machines as a way to describe the limits of their being controlled. For systems for which there may be no equations, but still use energy and need to satisfy the same kinds of limits, the broadest way to look at the same subject is in terms of the natural limits to their learning curves. You may not know why, but if as you buff your shoes the shine is not getting any brighter, that asymptote to the improvement indicates the thermodynamic limit of the "elbow grease" being applied. If the learning curve levels off too soon, it might save you a lot of effort or signal you to switch techniques more quickly. The stages of any learning curve, once it starts, is first experiencing increasing returns for the effort and then decreasing returns.

In general there are signs of that point of reversal (the neutral point on the curve) and the point of refusal near the end, long before they arrive. The following general diagram of the start-up and shut-down phases of any learning process shows how changes of direction tend to have leading signs of leading signs.

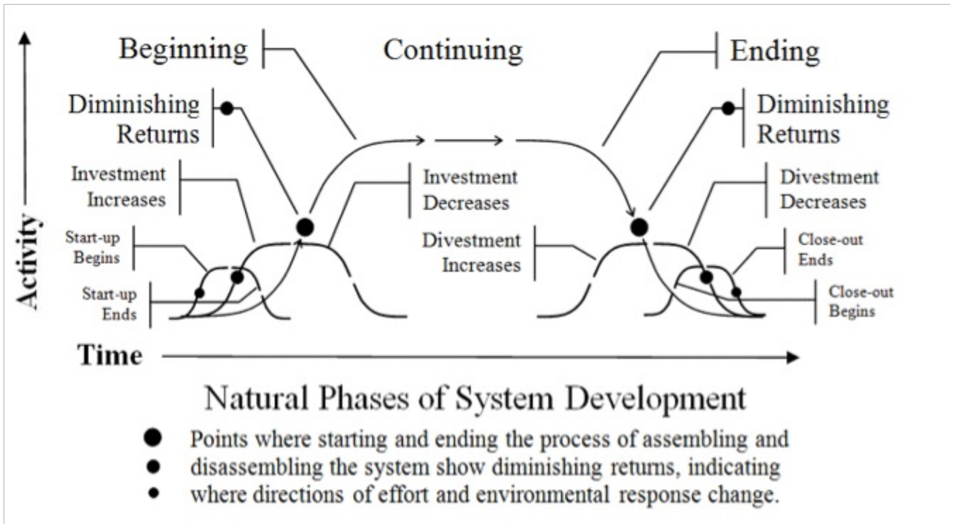


Diagram created by author; accepted for publication in the Encyclopedia for the Earth

[1] J.M. Keynes. Treaties on Money and The General Theory – Chapter 16

[2]Kenneth Boulding. A Reconstruction of Economics – Chapter 17

[3]Energy Returned On Energy Invested, EROEI for energy is the ratio of physical returns to the physical costs to obtain resources, called ROI in general. The ROI ratio increases as resources are discovered and declines as they are depleted. It needs to be high for resource extraction in order to absorb societal overhead costs of resource use. That TROI (total ROI) needs to remain marginally greater than one for the sustainability of the whole system.

[4]P.F. Henshaw. 2009. "Simple System EROI". Research note www.synapse9.com/issues/SimpleSysEROI.pdf

[5]Charles Hall et all. 2009. "What is the Minimum EROI that a Sustainable Society Must Have?" Energies http://www.mdpi.com/1996-1073/2/1/25/pdf