The Science of Financial Bubble Cycles

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This essay is about zero-sum versus non-zero-sum thinking. The ideal balance of supply-and-demand at the heart of economic science is zero-sum. Profitable transactions are obviously not zero-sum, and so economics functions without a systematic theory of profit. *There is no well-developed theory of profit in contemporary, economic science*. The result is that economic science cannot deal well with profit bubbles. A new, non-zero-sum approach can address the nature and remediation of profit bubble dynamics, and as it does, can improve economics as a science.

Adam Smith, the father of economics, was a son of the 18th Century, European Enlightenment and its revelation of the universe as a set of physical laws. His Law of Supply and Demand recapitulates Newton's Third Law of Motion, which is the zero-sum principle, "Every action has an immediate, equal and opposite reaction". Smith took the Third Law to imply that an economy is like a cradle, gently rocking back and forth between supply and demand, settling toward an equilibrium of stability and prosperity. Reassured that a natural law (such as might exist in the mind of god) acts as an invisible hand to keep markets in balance, Smith believed that individuals of different religions and nations could pursue economic goals cooperatively, competitively, and without guilt.

Identifying economics as "Newtonian" is all very well, but since profitable transactions are not zero-sum, Newtonian principles cannot possibly, fully describe economics. It need not surprise that Newtonian economics is concerned with pricing, supply, and competition, but not with profit.

Non-economists may be surprised to learn that supply-and-demand describes an ideal economy as "perfectly efficient", which means in perfect balance, and so profit-free. To deal with the real world, economists calculate using a fudge factor called "normal profit". This is the least profit sufficient to interest some one in owning a business. Because profit takes an economic system away from ideal, Newtonian equilibrium, economists dismiss profit as *"economic inefficiency"*.

Financial (not economic) "market efficiency" is the idea that if all investors had the same information, then all investors would receive the same returns on investment. Supply-and-demand can hardly operate to protect this equilibrium. Instead, the drive for "insider knowledge" would appear to be the fundamental operator in finance, with only law-enforcement holding it back.

A theory of opposed efficiency and profit makes enemies of business success and sound economics. The enmity drives a political war between business and the government regulation meant to protect efficient, free-market competition. The drama distracts from noticing that present economics cannot predict unusual events. Newtonian events are predictable: *there are no unusual Newtonian events*. There are however frequent, unexpected economic events. Economists blame their failure to predict trouble on the irrational behavior of consumers, and hope for economic answers from behavioral science. Isaac Newton wrote in the 17th Century. An economic approach inferred from more recent physical science will help economists make sense of their world.

Profit appears in Newtonian economics much as friction does in 19th Century thermodynamic science: as *ultimately irreducible inefficiency*. This suggests that an analogy of economics and thermodynamics will explain more than an analogy only with Newton's laws of motion.

Newton's laws describe orbiting planets in perfectly efficient, perpetual motion. Any pendulum or gyroscope that demonstrates Newton's laws cannot be perfectly efficient. Earthly mechanisms lose heat energy to friction. Anything not in perfectly efficient motion requires replacement fuel to keep going. There is nothing like fuel in Newtonian economics that replaces economic "energy" lost to "profit inefficiencies". And yet, it is obvious that an economy needs new buyers to resupply the energy called dollars that powers economic engines to drive business cycles. Mathematical, Newtonian economics is blind to all of this.

The Second Law of Thermodynamics appeared in the 19th Century to address the nature of fuel and of steam engines. Fuel releases heat energy to do work as it flows from hot to cold, toward equilibrium. Some heat must be wasted, however. The mathematical, Second Law introduces a

quantity called entropy that tracks the heat that dissipates toward equilibrium with the expanding universe whenever *anything happens that uses fuel* – which is just about *everything* that happens. Increasing entropy is "time's arrow", the only quantity that increases overall as the universe ages. Increasing entropy makes the Second Law the only overall, *non-zero-sum* principle in the universe.

The Second Law presents a hitherto unappreciated, rational basis for building economic science around a theory of profit. If economic transactions must produce profit, then profit must have some relation to increasing entropy. If profit is related to increasing entropy, then profit must be something of an inflationary waste product. Face it. The convention that identifies profit as "economic inefficiency" says as much: *profit is a waste product*. We do not condemn or mock profit. Thinking of profit this way serves to tell us how to control profit bubble dynamics.

Increasing entropy is maximal at thermodynamic equilibrium, when fuel is used up and no more energy can convert to work. This is unlike the supply-and-demand equilibrium that reflects a harmony of the spheres and that portends a stable and prosperous, fairy-tale economy. Thermodynamic equilibrium is a state of death that portends economic paralysis. Our recent credit crisis was an approach to "thermofinancial" equilibrium.

We can solve the problem with a new, "reframing" idea. To associate profit with entropy means that we need not idealize profit as the fuel of value creation. We may decide instead that creating value *sequesters* profit. Industry and agriculture harness "free energy" stored in fossil fuels and newly arrived from the sun. *Producing new value creates order and lowers entropy* at least locally, and so can sequester profit. Using value creation to sequester profit prevents financial entropy from inflating profit bubbles beyond the elastic, carrying capacity of the economic system.

But wait; there's more. The 20th Century, mathematical theory of information gives profit a whole new meaning. In Information Theory, entropy represents the randomness that takes letters out of alphabetical order, which is necessary to do to construct individual messages. Considering profit as mathematical (Shannon) entropy, profit is a capacity for meaningful, individual economic initiative -- that aggressive finance squanders. Our problem is not capitalism, but finance.

Profits that value creation does not recycle (sequester), but that financial manipulations multiply, are "non-value added" (NVA) profits. NVA profits tend to balloon into meaningless, high-entropy bubbles of economic waste. These will burst, and drive a system toward thermofinancial equilibrium, when huge amounts of stored asset value disappear overnight, and no one can say where all the money has gone. Regardless of what it might be good for, supply-and-demand cannot cope with accelerating, supercomputer-driven, high-entropy finance.

Many nations use "value added taxation" or VAT. A "non-value added tax" or NVAT on profits (not sales) would redress the failure to sequester profits. Financial products scoring a high NVA will be commensurately taxable. Balancing profit and value will temper bubble-formation dynamics and financial fluctuations.

Unfortunately, the "Power Elites" in banking and finance may not wish to solve the bubble problem. The government protects those too-big-to-fail operators of the Bubble Machines, who know how to benefit from both the up and the down sides of bubble cycles. It is immaterial to most, and advantageous to others to maintain the illusion that supply-and-demand can entirely account for economics. We regard Newtonian economics as like a religious statue on an automobile dashboard that occupants believe may protect them from the laws of physics.

There are two proffered remedies for thermofinancial equilibrium and recession. We can use deficit, government spending to prime the pump of buyer demand, refueling the economic engine and incurring debt to be repaid in more prosperous times. Or, we can reduce government spending either in spite of, or *in order to* transfer wealth to the rich from the poor and middle classes.

"Big spenders" do not know how to justify what they advise because they share the scientific ignorance of the "budget-cutters". Both sides think of economics as a perpetual motion machine guided by an invisible hand. A thermodynamic perspective highlights the venality of the bubble game. But without a full scientific argument to rebut the pious propaganda promoting bubble behavior as proper, the bubbles will boil out of the pot, and scald us all.