The Science of Economic Expansion

Why the Law of Supply and Demand Is Inadequate

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We Need a Proper Economic Science.

Capitalism is the most coherent and beneficial macro-economic system in history, but no science reliably explains it. Marx and Mao saw capitalism as a developmental advance from feudalism, but predicted that capitalism would expand itself into oblivion, and at last wither away into socialism. Without a proper science of economic expansion, who can predict what might happen?

Science is mathematical description of the laws underlying the reality we share, and that determine what can exist and what can happen. All science may be mathematical, but not all mathematics is science. Scientific results must be repeatable and eventually predictable. Irreproducible miracles and the unique subjectivity of any human being are irrelevant to classical science. Contemporary economics lacks controlled experimentation and reliable predictability that would qualify it as science. Apologists cite quirks of human motivation to explain failures to predict, and predict that behavioral and neuro-economics will someday set things right.

Early economists adapted physical science. Adam Smith in 1776 compared his all-important Law of Supply and Demand to Newton's Third Law (of Action and Reaction).[1] In the mid-19th Century, economists inserted economic variables into the Law of the Conservation of Energy,[2] the First Law of Thermodynamics.

Newton's Laws of Motion and the First Law of Thermodynamics are "zero-sum" laws. Matter and energy may move around and transform, but nothing is gained or lost overall. Nothing can be new. Neither law can hope to explain an expanding economy, an expanding universe, or the accumulation of profit.

In theory, economic motivation produces supply and demand as opposing forces. Their struggle rocks an economy like a cradle, or swings it like a pendulum. Supply rises or demand falls; prices fall. Supply falls or demand rises; prices rise. It is no surprise then that supply-demand is a theory of price in which profit is just *"economic inefficiency"*.[3] Competition among Sellers at last stabilizes prices and minimizes profits. Free marketeers take this to mean that the free pursuit of self-interest in a competitive economy maximizes economic efficiency by minimizing profits. Good business (maximum profit) is therefore bad (inefficient) economics.

Free-marketeers further interpret that the liberation of competition allows projecting ethical responsibility onto a mysterious mechanism, the "Invisible Hand

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[1] Copious references include "Isaac Newton's Influence on Adam Smith's Natural Laws in Economics", Norriss S. Hetherington, Journal of the History of Ideas, Vol. 44, No. 3 (Jul.- Sep., 1983), pp. 497-505, University of Pennsylvania Press

[2] *The Economist Has No Clothes* by Robert Nadeau, **Scientific American**, April, 2008

[3] http://www.answers.com/topic/economic-efficiency#ixzz1L8ubcdZu

(IH)" that is Smith's "genius" of the free market. The IH is a vision of the universe as a place of eternal harmony. Adam Smith did not call the IH the gentle hand of Newton's balancing god, but he might as well have. Free market advocates have faith that the genius of the market will provide "checks and balances" among competitive equals that will eventually balance out any egregious maneuver. We have already forgotten that this fantasy collapsed in 2008.

One might compare the free market mechanism to the US Constitution, although without a Bill of Rights to restrain government power. Nevertheless, free marketeers invoke Smith's law as a moral force that keeps a marketplace in balance better than government regulation. They see no need for government to enforce rules of fair play. Their economics is a blood sport in no need of umpires.

We propose to describe a macro-economy not as a rocking cradle or pendulum, but as an engine that works according to the Second Law of Thermodynamics. The Second Law is the only fundamental, non zero-sum law, the only fundamental law of growth and change. According to the Second Law, because no engine can accomplish work with perfect efficiency, at least some energy released from fuel must change into a waste product called "increasing entropy".

We know that a gasoline engine consumes fuel, accomplishes work, and exhausts waste. We propose that a thermo-economic engine consumes currency, performs economic work, and produces profits. The analogy is precise. Currency is fuel. Economic work is the recovery of value; value refers to all labor and material costs-to-market. What can it mean that profits resemble waste?

Whatever it means, we can note that some fancy-mathematical, financial maneuvers burn a lot of money and yield a lot of profit, but do scant economic work. There are financial products that require little labor or materials to bring to market, and so recover few costs, while taking huge risks. We call all of these NVA profits, or Non-Value Added Profits. We propose an NVA Tax on those profits to regulate the risk and counter the damage to society when these risks inevitably "go bad". Note that NVAT applies to profit, not to price. There is no inherent reason aggressively to tax profits that recover value.

Calling profit "economic inefficiency" compares it to friction preventing the supply-demand mechanism from perpetual-motion, perfect balance. In a theoretical state of perfect price competition, profit would reduce to "normal profit", the minimum necessary to make running a business worthwhile. Profits beyond normal are called "economic profits".

Supply-demand price reckonings build in normal profits as cost. "Normal" profits are thus *un-eliminable inefficiency*, like the residual friction that slows down a pendulum. Sneaking in normal profits as cost hides a crucial, elementary fact: inefficiency requires fuel to overcome. There is no notion of economic fuel in supply-

demand; motivation is all. Motivation might describe why someone starts an engine, but an engine works according to universal physical laws.

Even though business prospects for profit as the blessed fuel of enterprise, inefficiency cannot be fuel. Inefficiency eats up fuel. Inefficiency requires new fuel to replace what has been used. And, there is no supply-demand fuel.

Instant communication, mega-databases, superfast computation, and canny mathematical chicanery have combined to foment a newfangled, value-less chaos that only a proper science might grasp. Such a science would account for innumerable Buyers and Sellers, and their individual transactions. There is accepted mathematical theory that quantifies interactions among billions of entities called statistical mechanics. Its results confirm the Second Law of Thermodynamics.[4]

The Enlightenment and the Free Market

Recent US history makes it difficult to ignore that unregulated free marketism produces a society more like fairy-tale feudalism than like democracy. Our new class system draws support from perception of the rich as charismatic princes whose wise investments create employment. The truth is that free market economics rewards some, demolishes others, and protects no one. "Due process of law" and "equal protection from discrimination" are the *habeas corpus*, "get-out-of-jail-free cards" of civil liberty that level the social power-playing field. These protections do not exist in free market economics.

Today's free market advocates market their success by rebranding wealth as "job creation". Former Bain Capital partner Edward Conard in 2012 published a book arguing that a steep wealth "gradient" between rich and poor motivates the most talented and charismatic risk-takers to generate jobs.[5] Poverty is not bad, because it generates genius. Where would the poorer 99% of the population be without the likes of Henry Ford and Mark Zuckerberg to create work for them? Perhaps the religiosity latent in free market economics appeals to the real American Dream, that god might anoint anyone as the next Steve Jobs.

Nothing really justifies this argument. The Great Depression was not an era of innovation. Henry Ford succeeded during prosperity. Steve Jobs was never poor. Mark Zuckerberg went to Harvard. It is more likely that economic growth rather than poverty generates the opportunity platform for innovation.

Why Nations Fail offers a more plausible view.[6] "Extractive institutions" that allow an elite to serve itself first may lift an economy (like China's) out of poverty,

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[4] Thanks to Robert P. Wolf, Prof. Emeritus, Physics, Harvey Mudd College, Claremont, CA.

[5] E. Conard, "Unintended Consequence: Why Everything You've Been told about the Economy Is Wrong". (June 2012)

[6] *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* by Daron Acemoglu and James Robinson. (Deckle Edge, 2012)

but may also sow the seeds of violent revolution. "The foundations of prosperity are political struggle against privilege", summarizes a reviewer.[7]

Let us turn to history to see how we got here.

By the 17th Century, Copernicus, Galileo, and Newton had used mathematics to describe the universe as a friction-free, perpetual motion mechanism in no need of god (or fuel) to keep moving. The acceptance of these ideas in the 17th and 18th Centuries was the European Enlightenment. The Pope objected to the new objectivity however, because (like modern government regulation inhibiting business innovation) a lawful, regulated universe might preclude miracles. This was still the era when doctrine insisted that god is perfect and circles are perfect, so that planets must travel in circular orbits.

In the late 18th Century, Adam Smith coined free market economics in the Enlightenment spirit. Business could now seem more natural and scientific than venally willful, and profit could seem not necessarily a product of sin. The Enlightenment was not however an effective antidote to arbitrary religious perception. The Enlightenment merely polarized religion and science as the adversaries we know today. Classical science is as absolutist as religion; religion and science are alike enough to compete for socio-psychological "market share", for example alternating as good and evil characters in fiction, drama, and politics.

The Enlightenment only created antagonism between religion and science, dooming them to jealous suspicion of each other. Neither can satisfy humanity. Both fail to address the foundational problem of experience: asymmetric time. Religious time is "Eternity". Newtonian time is reversible. Neither accounts for time that moves into the future and leaves us with memories we call the past. The past exists for us mortals as Information, and the future as Uncertainty.

Eternity is without beginning or end, and so outranks time, death, and the laws of physics. Eternity thus implies hierarchy. A god-king outside of time can intervene in history, perhaps according to a divine plan. Time on earth might just be preparation for a return to eternity, or for reincarnation.

Unlike the religious universe, the Newtonian universe is not hierarchical. Instead, it is a condition of equal applicability and exactly reciprocal influence. Newtonian time is predictably circular or reversible, a universal present moment from which past and future look identical. No new Newtonian things can happen. One can prove such is so; solving Newton's equations of motion with either positive or negative time yields the same result. If the Laws of Motion were not perfect predictors of absolute repetition, the sun would not rise everyday as expected.

Hierarchy including religion can however harbor the idea of *law as equal applicability*. Look at hierarchy as though looking at a tall building. Each floor is

[7] Paul Collier, "The Observer" in The Guardian Newspaper, March 10, 2012.

above (or below) another. The windows at each level can appear identical, however. Similarly, religion can include ideas such as the Ten Commandments, a set of laws that applies to people who are all on "on the same level".

If law exists *in utero* within religion, then the Enlightenment delivers the conception of law into the light. Newton's Laws arise like an oppositional child to challenge the hierarchical universe. They exist however as two sides of a coin; they cannot be seen together.

Smith's sentimental economics puts the divine, Invisible Hand and the science of Newton together face to face. Unfortunately, science education is inadequate to alert people that these cannot work together in the same model. The free market appeals nevertheless both to fundamentalist religionists and distinguished economists, and intimidates almost everyone else into silence.

We propose to complete Adam Smith's agenda by putting hierarchy and law together into a simple coherent world-view that is suitable for economics, and beyond. If Smith knew the science that we know, this is what he would have done.

The Division of Knowing (unpaved road; proceed cautiously)

Separating knowledge into "faith-based" and "scientific" divides how we know into "subjective" and "objective". We propose to re-label subjectivity and objectivity as *hierarchical* and *interactive* ways of knowing. We can then as if algebraically substitute **hierarchy for subjectivity**, and **interaction for objectivity**.

Hierarchy and interaction are friendlier terms than are subjectivity and objectivity, or religion and science. The latter pairs are never on speaking terms. Hierarchy and interaction are perceivable as complements, or even as marriage partners. If one is vertical and the other horizontal, together they form x- and y- axes.

Subjectivity is knowing according to "how one feels". Faith in religion is subjective; faith requires no logical evidence, only confirming emotion.

Subjectivity is the perception of hierarchy, and **the perception of hierarchy elicits subjectivity**. Consider the emotional thrill of sincere patriotism at a military parade or of meaningful worship.

"Subject" is from roots, "thrown under". One is the subject of a monarch; one is subject to illness. Subjectivity is passive. One is subject to emotions; "passive" and "passion" are from roots meaning "to suffer", or "to be acted upon". (The Easter story is *The Passion* because Jesus could not escape being acted upon.)

Because hierarchy is "vertical", it implies the perception of **rank** order. *Different rules apply at different ranks*. As a result, **A** may affect **B** more than the reverse. A god affects life on earth, and a boss affects workers more than the reverse. A scripted, dramatic role affects an actor more than an actor may interpret the role. A better football team may defeat a poorer, but this is not hierarchy, because both teams accept the same rules of play.

Because *hierarchy* implies unequal influence, **subjectivity is not zero-sum perception**. Laws of conservation do *not* apply. Subjectivity may imply creativity, destruction, and Hollywood endings that defy logic and physical laws.

Objectivity is interactive. One knows the world objectively as one interacts with it. Objectivity is thus as "horizontal" as subjectivity is "vertical". Unlike god and human, observer and object operate according to the same knowable, universal laws. Because subjectivity is un-interact-able with, objectivity dismisses it.

"Object" is from roots meaning "thrown against", like particles that bounce off of each other. Interaction implies exactly reciprocal effect, as in Newton's, "every action has an immediate, equal and opposite reaction". **Interaction and** therefore **objectivity are zero-sum**. Playing by the same rules, one football team defeats another. Winning is +1 and losing is -1; their sum is zero.

The scientific world-view perceives physical law to operate as if democratically among the particles and forces of nature. No particle is anything in particular; no force is magical. Everything that exists interacts according to mathematical rules that spread impartially across existence.

Political democracy is also horizontal perception. In democracy, individuals may interact freely; all are entitled to the protection of the law from forces greater than themselves, including the influence of religion and of the state.

We Have Met the Future, and "They Is Us".

The Enlightenment froze religion and science in place as hierarchical and interactive ways of knowing. Because neither deals with irreversible, asymmetric time, neither can be a satisfying system of universal explanation.

Hierarchy is a condition of unequal influence, A over B. *Asymmetric time is also a condition of unequal influence*. The past affects the present more than the future affects the present. Or, one can say that the past affects the future more than the future affects the past. Different rules affect "the past" and "the future". We cannot travel into the past; all we have to do to travel into the future is to wait.

Recognizing time asymmetry brings hierarchical perception into science.

But, what is the science? There was no accounting for asymmetric time until mid-19th Century, when it became time to harness steam engine power to the industrial age. Suddenly fuel mattered. When it was obvious that one could not use the same fuel twice – that there was no perfect energy recirculation – some people recognized that time must go one way, and not the other. This was progress.

The intellectual result was the Second Law of Thermodynamics, the Law of Laws that none may contradict. The Second Law is unique among the fundamental laws. All others are zero-sum, laws of conservation. The Second Law is about the

net loss of order and creation of chaos. Nothing can be new without increasing entropy. Waste happens.

Fuel stores energy as atomic or molecular order. The Second Law describes how engines extract work, as fuel ignition releases energy from order. No use of fuel creates new order perfectly efficiently; even the most elegant action wastes energy, and so creates overall more disorder than order. The losses of order inherent in converting heat energy into work is what makes each release of energy irreversible. *Increasing entropy* measures the waste – the energy lost to order forever.

Time is also a non zero-sum quantity. The universe is older and fainter every day (as it burns up fuel), and so are we. Time and space expand together; the universe is older and bigger today than yesterday. As the only quantity that increases everywhere *with* time, increasing entropy is known as the "arrow of time".

Ludwig von Boltzmann put it:
"Gravity defines the sense of up and down,
and increasing entropy defines the sense of forward time".

The realization that order and chaos are as fundamental and as quantifiable as matter and energy was the vital progress that led in the 20th Century to the development of the mathematical Information Theory and the computer age. Thermodynamic science indirectly broke enemy codes during World War II, and empowers your smart phone to talk to you today.

Information entropy marks the entry into mathematical science of the individual agent as a language-maker, the same individual whom we elsewhere identify as the economic consumer whose actions generate profit, and invent the future.

Profit Invents the Economic Future

Supply-demand is inadequate because it implies that the universe is zero-sum, which it is not. The more we try to stuff the universe into a zero-sum suitcase, the more the suitcase overflows. That stuff has to accumulate somewhere. In economics, wealth accumulates where very few people can get to it. This result is pure science. It bears no necessary relation to virtue, liberty, or talent.

Barter exchange is zero-sum. A cow and a horse may exchange places, but nothing changes overall. Each barter exchange exists in its own present moment.

A profitable transaction is not zero sum, so profit must have some relation to increasing entropy and forward time. Free marketeers say as much by defining profit as inefficiency. A profitable exchange is by definition *successful,* in that another transaction may inherently *succeed* or follow it, and expand upon it. (Transactions that lose money are not "successful" for very long.) So, we say that profit introduces forward time into economics.

Time is therefore not money. Time is profit. But, forward time is increasing entropy, which is waste, not fuel. What can this mean about profit?

A model economic engine extracts work from currency that ignites at a point of sale and releases energy to flow across a gradient from warmer Buyer to cooler Seller. Accepting that time is profit and that profit is time suggests developing a "thermo-economics" to address the relation of profit to increasing entropy. Such a study might compare the flow of currency from warmer Buyer to cooler Seller to the flow of heat, and connect Buyer-Seller currency flow to profit generation.

This comparison is not far fetched. It may be startling to learn that we do not need to measure economic temperature precisely. *Any temperature scale that rises (monotonically) from absolute zero that we may imagine and estimate is valid in thermodynamics*. We just need to know which side of a difference is hotter than the other. (The universal economic motivation is to cool off, which is a pleasure.)

Because relativity to absolute zero is all that we need, we can imagine a subjective scale of Buyer desire, and still treat Buyer-Seller transactions objectively. In "Beyond Supply and Demand"[8] we propose a temperature scale of economic desire or *libido*. Buyer economic temperature is the microeconomic equivalent of the macroeconomic, Consumer Confidence Index.

The first thermo-economic implication is that economic success starts with employing the consumer, even if government is the employer. Employed people are consumers whose purchases immediately employ other consumers; investment produces employment much more slowly and less directly.

Profit cannot be the same as fuel. That profit resembles increasing entropy suggests that profit may be recycled into new product value much as manure fertilizes a field. Recent history confirms that un-recycled profits are toxic.

Remedies

From all accounts, economic officials at high level meetings addressing the global financial collapse of 2008 realized that something fundamental had shifted.[9] The law of supply-and-demand and its Invisible Hand had restored nothing. No theory existed to light the path beyond *ad lib* remedies.

Without using the names however, these officials identified "thermoeconomic equilibrium" or "heat death" as they reported that a financial bubble had burst, that economic work had ceased, and that no one could say where all the money had gone. Their fix was thermoeconomic. The fastest and biggest money deal in the history of economics came to pass - a fuel injection of massive sums to the banking system ($2.3+ trillion by some estimates). The solution was only very partial – be-

[8] *Beyond Supply and Demand: Entropy and Information in Economic Science"*, Goldwater and Jonath, www.profitandentropy.com

[9] Included: Paulsen, Gaertner, and Bernanke *On the Brink* by Henry M. Paulson, Jr. www.HachetteBookGroup.com 2010.

cause it was very partial to the financial classes. Allocation of new economic fuel to consumers was much less generous and direct than to the banks.[10]

This top-down stimulus did show immediate, short-term benefits. Unfortunately, the banks used their bailout money not to pump the economy, but to fix their various financial ratios. In contrast by 2011, because of its huge stimulus spending on employment, the economy of China was on a fast track to recovery.

Can creative innovation replace economic fuel injection as a stimulus? Some extoll the power of the inventive, human mind to lift us out of collapse. They cite farmers who rebound from drought by cutting costs and saving seed,[11] and refer to Benjamin Franklin's, "a penny saved is a penny earned". But when ideas enter the world, they must conform to laws of physics.

His maxim is credible only in the reversible, Newtonian ethos of Franklin's era. Economic progress depends upon coining new pennies, not on tax cuts. Economic recovery models that resist the contribution of adequate stimulus offer no realistic way to pull the economy back from equilibrium, and restart it.[12]

In the asymmetrical, non-reversible macroeconomic world, *a penny saved is not enough*. A farm is not a perpetual motion machine; farming requires new energy from the sun. Any recovery model that supplies no new economic energy can only erode further the economic well-being of the middle class to the cynical pleasure of those who consider themselves Masters of the Universe.

Introducing the NVAT

Profits that arise from productivity and that are promptly recycled into value recovery do not need much financial regulation. We shall find that profits from finance are more subtle to understand, because of their participation in the dangerously accelerating, increasing entropy of hyper-expanding profit bubbles.

Events since 2008 demonstrate that compounding profits purely financially (such as from bogus mortgages) leads to a trading frenzy of "value-less profits" that inflates profit bubbles, and leads to events like our most recent meltdown. When bubbles burst, only the richest people still have cash. Each new bubble-burst cycle increases the feudalistic wealth gap in favor of the super-rich.

We suggest our solution here. Many nations use value added taxation or VAT. We would use a Non-Value Added Tax or NVAT to address failed profit recycling. Many financial products will score a high NVA and be commensurately

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[10] See http://money.cnn.com/news/storysupplement/economy/bailouttracker/

[11] Brian Wesbury, Chief Economist, First Trust (Personal correspondence.)

[12] The combination of deficit spending necessary for victory in WWII, followed by large increase in marginal tax rates, fueled the economy out of the Great Depression and into the huge, sustained growth of the 1950s and 1960s.

taxable. Statisticians and econometricians now perform such value-added analyses for applications far more complicated than financial transactions.[13]

Thermoeconomics would eliminate reams of "gotcha" government regulations. Our model is keen only to distinguish profit-with-value from the profit-without-value that drives toward collapse. Careful application of NVAT will reduce chaos-forming pressures in financial markets. Any NVAT collections would create a financial disaster recovery fund.

Imagine that such an NVA Tax were in place prior to the blow-up of the housing market. Any profits made from trading in the negligibly value-added, bundled mortgage securities market would have been taxed at the highest rates, say 90+%. This would not outlaw such trading vehicles; it would just make the Government (the Public) a partner in their "upside" potential by collecting revenue to ameliorate against any "downside" caused by collapse.

The NVAT is very different from financial transaction taxes based on price, such as the Tobin tax[14] or Spahn tax,[15] suggested during the past several decades to curb excesses in the currency market. NVAT differs from the Bank tax suggested to be levied against balance sheets. It also differs from a Financial Activities Tax (FAT) on the sum of bankers' excessive remuneration and bank profits (without regard to their value-added content).[16]

A problem common among financial taxation ideas other than NVAT is that implementation depends upon on ideology and politics. Its basis in thermoeconomics means that NVAT brings the clout and simplicity of science to the discussion.

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[13] William L. Sanders "Comparisons Among Various Educational Assessment Value-added Models" SAS Institute, Inc. White Paper, October 16, 2006 *Accessed June 25, 2011*

[14] James Tobin (July/October 1978). "A Proposal for International Monetary Reform". *Eastern Economic Journal*: 153–159.

[15] Paul Bernd Spahn (June 16, 1995). "International Financial Flows and Transactions Taxes: Survey and Options". University of Frankfurt/Main; Paper originally published with the IMF as Working Paper WP/95/60.. Retrieved 2010-01-13.

[16] International Monetary Fund (April 16, 2010). "A FAIR AND SUBSTANTIAL CONTRIBUTION BY THE FINANCIAL SECTOR INTERIM REPORT FOR THE G-20". International Monetary Fund; Excerpt and LINK TO FULL REPORT as a PDF - republished online by Global Print Monitor on April 22, 2010. Retrieved 25 June 2011.