

Notes

Chapter 1

1. A microsecond is 1 millionth of a second. There are 350,000 microseconds in the blink of an eye. In 2012, some exchanges were measuring trade and message latency at 120 microseconds.

2. Entropy in this context refers to an increase in the Kolmogorov complexity of the price return series as measured by a Kolmogorov or related measure of statistical complexity.

3. Processes causing increased statistical entropy are axiomatically obvious when viewed from the perspective of physical thermodynamic laws, but these traits become interesting when looked at from an adaptive framework with propensities over time.

4. The efficient market hypothesis is still taught with many caveats. It is a broken and dangerous theory. Price reflects all of the beliefs and opinions about expected value, but doesn't reflect actual value.

5. Over the years, weak, semistrong, and other variations of the efficient market hypothesis have been put bravely forward. These variants are equivalent to putting epicycles onto a Euclidian model of the solar system in order to make a beautiful theory stretch over the ugly, awkward truth presented by the data.

6. Risk is formally described as a probable set of expectations or outcomes. Most price movement falls outside of normal statistical measurements of risk and into a realm formally known as uncertainty or ignorance. Unfortunately, the ease of applying basic statistical distributions to future prices, no matter how ill-fitting, hasn't stopped most professional financial

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practitioners from accepting and thereby confusing statistical price risk with real economic value at risk.

7. Most financial asset prices move in patterns approximating a statistical process known as GARCH (generalized autoregressive conditional heteroskedasticity). This concept is derived from an idea put forward on the blog Deus Ex Macchiato at blog.rivast.com on September 3, 2011.

8. This is best avoided by always applying a mental model of the value-creating process using nonprice inputs and asking what limits the process (how high is the sky and why?). The popular Fama-French three and four factor equity models use price momentum as one of the factors.

9. Charles Kindleberger's *Manias, Panics and Crashes* or Edward Chancellor's *Devil Take the Hindmost: A History of Financial Speculation* are excellent books on all-too-common bubbles and crashes.

10. Innovation in finance is almost always disastrous. Pure financial innovation usually involves new ways of temporarily hiding risk. Financial innovation is rarely beneficial in the long term.

Chapter 2

1. Brooks, Daniel R., and E. O. Wiley. 1988. *Evolution as Entropy*. Chicago: University of Chicago Press.

2. Darwin's theory wasn't popular. According to David Hull, a philosopher of science, only 75% of scientists agreed with Darwin ten years after *On the Origin of Species*' publication.

3. "Literary Notices," *Popular Science Monthly*, 2, February 1873.

4. Marshall, Alfred. 1890. *Principles of Economics*. London: Macmillan.

5. Kümmel, Reiner. 2011. *The Second Law of Economics: Energy, Entropy, and the Origins of Wealth*. New York: Springer.

6. Ayres, Robert U. 1987. *Manufacturing and Human Labor as Information Processes*. Edward Elgar.

7. Ayres, Robert U. 2010. *The Economic Growth Engine: How Energy and Work Drive Material Prosperity*. Cheltenham, UK: Edward Elgar.

8. In 1938, overlooked economist John Burr Williams correctly saw organizations as being made of value flows when he wrote, "The value of any stock, bond or business today is determined by the cash inflows and outflows—discounted at an appropriate interest rate—that can be expected to occur during the remaining life of the asset." John Burr Williams. 1997. *The Theory of Investment Value*. Cambridge: Harvard University Press.

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9. International Geary-Khamis dollars 1990.

10. Physicist and Nobel Laureate P.W. Anderson offers a compelling explanation to the limits of reductionism, the emergence of information via symmetry breaking and hierarchies in his excellent paper “More Is Different,” *Science*, 177, 1972, pp. 393–396.

11. Knowledge is the selected information (genetic, etc.) that has been selected and likely to replicate and amplify itself. Knowledge has a propensity for self-amplification. The concept of propensity is taken from Karl Popper’s use of the term, in which finite probabilities are skewed toward an outcome due to a conditional context. Popper’s perspective was that probabilities and finite state determinism are not statistically robust, and that propensities more accurately reflect long-term skews or trajectories. It can be argued that selected knowledge in DNA or INO forms constantly adjust their Bayesian priors as context for their own successful propagation and selection.

Chapter 3

1. Lotka, A. J. 1922. “Contribution to the Energetics of Evolution.” *Proceedings of the National Academy of Sciences*, 8: 147–151.

2. Bejan, Adrian, and Sylvie Lorente. 2008. *Design with Constructal Theory*. Wiley.

3. An erg is the amount of work done by a force of one dyne exerted for a distance of one centimeter. $1 \text{ erg} = 1 \text{ g}\cdot\text{cm}^2/\text{s}^2$.

4. Nicolas and Prigogine. 1977. *Self-Organization in Nonequilibrium Systems: From Dissipative Structures to Order through Fluctuations*. Wiley.

5. Eric D. Schneider, Dorion Sagan. 2006. *Into the Cool: Energy Flow, Thermodynamics, and Life*. Chicago: University of Chicago Press.

6. Kelly, Kevin. 2010. *What Technology Wants*. New York: Viking Adult.

7. Technically speaking, enzymes and bacteria in animal stomachs perform the initial metabolic reducing functions. Without the adapted symbiotically evolved network of the Kingdoms Bacteria and Protista, there would be no animals. Symbiogenesis was originally put forth as an idea by Heinrich Anton de Bary 1831–1888 and re-emphasized by Lynn Margulis. Symbiosis is the living together of “differently named organisms.”

8. Ecological niches can be thought of as networks defined by energy and resource transfer relationships between evolution’s metabolizers.

9. Russian-born American economist Wassily Leontief created the input and output tables that became metrics and methods for calculating national GDP in the 1920s. In an ironic twist of fate, many ecologists are now turning

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to some of the math and methods created by Leontief to assess ecological throughput and energy analysis in the biosphere.

10. Economies not only get more efficient, but they grow. Ecologist Robert Ulanowicz created an important adaptive thermodynamic concept known as ascendancy. Ascendancy includes growth and efficiency of adaptive systems measured in robust physical and informational terms. Economy has its own ascendant traits as indicated in the previous charts.

Chapter 4

1. Note the distinction that making a better mousetrap (adaptation alone) doesn't matter. Selling the better mousetrap for a profitable ROC is what matters, and what drives the selective process allowing ino and knowledge replication.

2. Williams, Wayne. 2012. "10 Interesting Things We've Learned from the Apple vs. Samsung Trial (So Far)." Betanews. http://betanews.com/2012/08/08/10-interesting-things-weve-learned-from-the-apple-vs-samsung-trial-so-far/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed+-+bn+-+Betanews+Full+Content+Feed+-+BN. Camm-Jones, Ben. 2011. "Apple by the Numbers: Sales, Stores, Staff All Grew in 2011." *MAC World*.

3. Quoted in Lamont, David. "What Percentage of Gross Revenues Should Be Allocated to the Marketing Budget?" Marketingsage.<http://marketingsage.com/marketing-budget/>.

4. Adaptation can occur even faster in the economy by swapping and exchanging whole sets of capabilities. Strategic partnerships, acquisitions, and mergers can all be considered symbiotic means of co-opting an entire organization's capability sets.

5. Bak, Per. *How Nature Works: The Science of Self-Organized Criticality*. Copernicus, 1999, p. 60.

6. Bifurcation into changes of form and structure allow for greater system flow and/or efficiency. The term "bifurcation" was created by mathematician Henri Poincaré in 1885.

7. Bejan, Adrian. 1997. *Advanced Engineering Thermodynamics*, 2nd ed. New York: Wiley.

8. Plants and animals also follow basic mathematical rules of scaling and structural change. For instance, the quarter-power law governing body size dictates that as animals get bigger, their life spans get longer, their pulse slows, and they burn energy less rapidly. From Johnson, George. "Of Mice and Elephants: a Matter of Scale." *The New York Times*, January 12, 1999.

Chapter 5

1. Keeley, Larry, Ryan Pikkell, Brian Quinn, and Helen Walters. 2013. *Ten Types of Innovation: The Discipline of Building Breakthroughs*. New York: Wiley.
2. Keeley, Larry, et al. 2013. *Ten Types of Innovation*, p. 83.
3. To understand this perspective more empirically in ecology and economics read Ulanowicz, Robert E. 1997. *Ecology, The Ascendent Perspective*. New York: Columbia University Press.
4. Wright, T. P. 1936. "Factors Affecting the Cost of Airplanes." *Journal of Aeronautical Sciences* 3 (4): 122–128.
5. Utterback, James M. 1996. *Mastering the Dynamics of Innovation*. Boston: Harvard Business Review Press, p. 222.
6. Henderson Rebecca, and Kim Clark. 1990. "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly* 35 (1): 9.
7. Uncertainty is being used in the Knightian sense in which no probability can be assigned due to an inability to properly characterize the nature or likelihood of traditional risk or outcomes.

Chapter 6

1. The book *Hidden Champions of the Twenty-First Century: The Success Strategies of Unknown World Market Leaders* by Hermann Simon (2009, Springer) provides excellent insight into smaller-sized specialty firms that globally dominate niche markets in this way.
2. It should be acknowledged that Kodak was an innovator in digital technology, creating the QuickTake digital camera with Apple in 1992.

Chapter 7

1. OK. The Elvis Chia pet doesn't exist yet, but the Daffy Duck and Bugs Bunny ones do.
2. "Spaces" in this context is used within the mathematical concept of potential constrained area or location potential solution variables may occupy. The survival space for an elephant could be plotted on the dimensions of the viable body mass relative to its ambient environmental temperature.
3. There are 10 trillion human cells in the average person; each human cell holds roughly 23,000 genes. Human cells are organized into 220 types

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to form the body's organs and systems. The human body is also home to a huge microbiome of 100 trillion bacteria cells with an estimated +3,000,000 genes. The human body could be considered to have its own ecology spread across the flora and fauna of the gut out to every available surface with each cell located only five cells away from the circulatory system.

4. For the mathematically inclined, the best way to plot the filled-in boundaries is as a bounded Voronoi tessellation.

5. Paradigm here is being used in Thomas Kuhn's true original sense of the word, not the "new and improved" cheapened version thrown around by consultants.

Chapter 8

1. James M. Utterback. 1996. *Mastering the Dynamics of Innovation*, 2nd edition. Harvard Business Review Press.

2. Krug, Steve. 2005. *Don't Make Me Think: A Common Sense Guide to Web Usability*. Indianapolis, IN: New Riders Publishing.

3. The architecture of the automobile has evolved to achieve greater capacity for energy throughput per unit of cost, all while increasing in system structural complexity. This increased system complexity has delivered improved engine performance per unit of mass and overall system efficiency, while the quality delivered on many dimensions of value has increased as relative cost has declined. These aspects of adaptive system evolution will be discussed later, during further explorations into the trends of accumulated knowledge, increased energy throughput density, and adapted trends in economic and ecological evolution.

4. Moore, Geoffrey, Paul Johnson, and Tom Kippola. 1999. *The Gorilla Game: Picking Winners in High Technology*. HarperBusiness.

5. Innosight report, 2012. Richard N. Foster, coauthor of *Creative Destruction* and author of *Innovation: The Attacker's Advantage*.

6. Warren Buffett famously practiced allocation discipline when he refused to invest in capital improvements for the textile manufacturing business of Berkshire Hathaway, correctly realizing the returns on capital to this fading sector would be low or negative.

Chapter 9

1. The term "cash cow" was used by the Boston Consulting Group (BCG) to refer to a high-margin slow-growth firm or business unit. Applying the

term to a cluster is a reference to the cluster's competitive traits and maturity. Some firms within the cash cow cluster will likely have cash cow characteristics associated with the familiar BCG usage of the term.

2. Seven years is a subjective number, but generally there is an advantage to thinking longer term than other investors. The inability to see beyond seven years correctly knocks out many fast capability-cycle industries and firms from consideration unless one is paying significantly below book value as a margin of safety.

3. Meeker, Mary, and Brian Fitzgerald. 2003. *The Technology IPO Yearbook: 9th Edition—23 Years of Technology Investing*. Morgan Stanley Equity Research, North America.

4. Van Valen, L. 1973. "A New Evolutionary Law." *Evolutionary Theory* 1: 1–30.

5. Steward, R.C. 1977. "Industrial and Non-Industrial Melanism in the Peppered Moth *Biston betularia* (L.)." *Ecological Entomology* 2 (3): 231–243. doi:10.1111/j.1365-2311.1977.tb00886.x

6. Baker, Nardin L., and Robert A. Haugen. "Low Risk Stocks Outperform within All Observable Markets of the World." Paper, April 12, 2012.

7. The flawed overattribution of business outcomes to CEOs is highlighted well in the important book *The Halo Affect* by Phil Rosenzweig (Fresh Press, 2007). This attribution flaw assigning mythical power to CEOs is a contributing factor to the vulgar overpayment of many corporate CEOs.

8. Warren Buffet has been known to carry a set of nontransitive dice to challenge opponents with. Nontransitive dice have a winning strategy assuming one knows the competitor's dice choice in advance. According to Janet Lowe's book *Bill Gates Speaks: Insight from the World's Greatest Entrepreneur* (Wiley, 1998), Warren Buffett offered Bill Gates the chance to play a game with the dice. Bill asked to see the dice first and then correctly suggested Buffett select a dice first. It seems billionaires think strategically about game theory and when not to compete.

9. Southwest and other budget or niche airlines are held up as counterexamples to this. The fact remains that, taken in aggregate, the airline cluster has destroyed net shareholder value.

10. Book value is a helpful starting point to value a firm. Book value is calculated as the Assets – Liabilities. Goodwill is a useful accounting fiction often used to reflect acquisition costs over book value. After the original goodwill entry is made its value is highly subjective and dependent on the asset's value-generating capability more than its accounting treatment and balance sheet representation.

Chapter 9

11. For those interested in the how and why of biological and economic systems acting as transmission mechanisms for adaptive innovations, Richard Dawkins's, *The Selfish Gene* (Oxford University Press, 1989), Eric D. Schneider and Dorian Sagan's *Into the Cool* (University of Chicago Press, 2006), or Kevin Kelley's *What Technology Wants* (Penguin Books, 2011) are highly recommended.

12. Super brands demonstrate the concept of positioning, put forth by 1980s marketing gurus Al Ries and Jack Trout in their book *Positioning: The Battle for Your Mind* (McGraw-Hill, 2000). The thinking was that each product category had one to three important brands that could be recalled by consumers. Other brands faded into noise. Many brand managers recognized this as true and a proliferation of category bifurcation has ensued ever since in which ever more specialized clusters are targeted to niche needs, whether the needs are real or imagined.

13. See's Candy is used as an example due to its familiarity to value investors and readily available write-ups by Warren Buffett, for those interested in further research.

14. It is worthwhile to read Charlie Munger's book *Poor Charlie's Almanack* (The Donning Company, 2005), where he explains Lollapalooza and shares many other important lessons.

15. Lowe's mega hardware stores started filling in the economy and combined with The Home Depot, filling the entire economic cluster. As the carrying capacity limit was approached, margins and growth declined, reflecting a more mature cluster when looked at from the scale of economy.

16. *Built from Scratch: How a Couple of Regular Guys Grew The Home Depot from Nothing to \$30 Billion* (Crown Business, 2001), by Bernie Marcus and Arthur Blank is a useful book on The Home Depot written by its founders.

Chapter 10

1. Marn, Michael V., Eric V. Roegner, and Craig C. Zawada. 2003. "The Power of Pricing." *The McKinsey Quarterly* 1: 26–39.

2. Coke (KO) focuses on branding and manufacturing concentrated syrup. The syrup is then sold to bottlers and distributors.

3. As of 2013.

4. Price to earnings ratio. The reciprocal provides an earnings yield.

5. Price to book value ratio.

Chapter 11

1. Value delivered must be perceived as greater than competing choices.
2. http://www.interbrand.com/Libraries/Press_Release/BGB_Press_Release_FINAL.sflb.ashx
3. Ries, Al, and Jack Trout. 2000. *Positioning: The Battle for Your Mind*. New York: McGraw-Hill.

Chapter 12

1. To be fair to CEOs, many activist shareholders and lawyers happily sue and win over actions that depress share prices and so CEOs are forced to play this role, due to the public's gross misunderstanding of short-term price changes versus the long-term nature of value creation.
2. Abbot Payson Usher, an economic historian at Harvard, advocated an economic model of growth based on a smooth gradual rate of innovative progress in contrast to the radical innovation espoused by Schumpeter. (Abbot Payson Usher. 1929. *A History of Mechanical Inventions*. New York: McGraw-Hill.)
3. Blaise Pascal. 1670. *Pensees*, 3rd edition. À Paris, chez Guillaume Desprez, rue Saint Jacques, à Saint Prosper. M. DC. LXX.
4. For insight into the power of intrinsically motivated performance psychology read Carol Dweck's book *Mindset*. (Carol Dweck. 2006. *Mindset: The New Psychology of Success*. Random House.)
5. Many firms argue they will use an IRR hurdle rate approach that covers ROE, but in many cases the target IRR hurdle used is below 15 percent or isn't declared in filings or reports to shareholders.
6. It should be noted that in risk-taking industries like insurance and banking, the risk cycle is longer than the typical annual ROE or revenue growth metric. This means careful analysis should be given to these sectors because they are structurally prone to short-term adverse selection, with dangerously destructive managers showing the best numbers during boom times.

Chapter 13

1. I encourage readers interested in learning more about evolutionary contingency to explore Stephen Jay Gould's writings on it.

2. All economic and ecological organized systems fail and get replaced by other organized forms. In books like *How Nature Works: The Science of Self-Organized Criticality* (Copernicus, 1999), the late theoretical physicist Per Bak showed how power law relationships occur across most complex systems, including ecologies, wars, and biological extinction events. Power law relationships are also seen in growing systems' structural properties, capabilities, and flow capacities via the Constructal theory put forth by Bejan.

3. Stephen Jay Gould. 1990. "Wonderful Life: The Burgess Shale and the Nature of History." 7.

4. The Human Development index focuses on measuring human potential in terms of health and education capabilities that are individually realized in an economy.

5. Counterintuitively, easily extractable oil or minerals may not contribute to economic development across an economy's human condition as measured in infant mortality, literacy rates, and life expectancy. This situation is referred to by development economists as the resource curse, whereby easily extractable and controlled resources such as minerals or fossil fuels form a narrow dominant segment of an economy that may be controlled and extracted exclusively for elites to retain patronage and power networks. Corrupt extractive regimes controlling this extractable wealth may not lead to knowledge creation and broad human development across an economy.

6. Karl Popper, in a lecture delivered to the London School of Economics in 1988 entitled "Towards an Evolutionary Theory of Knowledge," discussed innate animal behaviors that conferred a positive survival bias to be knowledge. This knowledge could be innate and visceral responsive or a conditioned and learned response conferring competitive survival advantage to the possessor of the knowledge or capacity for learning and retaining knowledge.

Popper then elaborated how information measured statistically or mechanically in Shannonian forms was uninteresting, but that an interesting subset of information, namely knowledge, was information organized such that it might itself alter or allow for an informationally reproductive cycle.

The argument put forth was that genetic information contained the knowledge required to replicate itself in the future through means of various expressed mechanisms such as protein expression and higher level biological functions all the way up to human behavior and the capacity for storing symbolic information (memory and language).

7. *Why Nations Fail* (Crown Business, 2012) by Daron Acemoglu and James Robinson provides an excellent history of extractive versus inclusive models of economy and the outcomes for social development and material economic progress they foster. *Why Nations Fail* compares extractive

regimes using historical and contemporary examples ranging from Latin America to the original American colonies. Most economies are organized mixes of these with predominant features defined by politics and culturally normative behaviors.

8. For those looking into the relationship between the Gini coefficient and entropy metrics, Thiel's index (http://utip.gov.utexas.edu/papers/utip_14.pdf) or Atkinson's research metric (<http://www.sciencedirect.com/science/article/pii/S0022053170900396>) may be of particular interest.

9. Negative growth can occur when resources are actually wasted as value is destroyed by the economy or SPICE (Social, Political, Innovation, Cultural, or Ecological) factors. Value destruction can include domestic resource wastage or external foreign direct investment (FDI) and monetary aid intended for development extracted by a polity of enfranchised elites.

10. The costs of low GDP show up in increased infant and child mortality, reduced life expectancy, and many other health and socioeconomic factors. The lost human potential associated with poverty and under-education hinders knowledge and economic development and innovation for humanity.

11. This aid and development debate is best characterized by Jeffrey Sachs, who wants to apply more input resources to development, versus William Easterly, who advocates studying local causes and local actors' real needs against outcomes. William Easterly's insightful book *The White Man's Burden* (Penguin Press, 2006) is recommended reading for those interested in understanding development that really helps the poor. MIT economist Esther Duflo does commendable work on researching the outcomes and social payoffs the poor receive from development aid using randomized trials.

12. Examples of economic systemic brittleness associated with corruption or failed services often show up poignantly during natural disasters which are ecological system stressors. Earthquakes in countries or regions with corrupt or dysfunctional building permitting and land titling suffer greater damage. Failure in delivering water and utilities increases death rates associated with water-borne diseases such as cholera epidemics during floods or other crises. According to economist Amartya Sen, widespread famines are exclusively the result of market failures related to corrupt or extractive economic policies such as those seen during the potato famine in Ireland and parts of India during the period of English rule.

13. The territories and colonies referred to are the early U.S. colonies, which make an excellent example of the developing world's development success. Hernando de Soto's *The Mystery of Capital: Why Capitalism Works in the West* (Basic Books, 2000) tells the story well.

Chapter 14

1. Most economics books state incorrectly that money functions “as a store of value,” ignoring the fact that most forms of money are mostly electronic blips, bulk metals, or pieces of paper with pictures of old men and government buildings on them. Money isn’t a store of value; it is believed to be a store of value. That is, it is a representational belief system which functions best when it believed to be a store of value. Most forms of money have almost zero value if the belief system in them fails. This includes physical gold, which has limited functional utility based on its physical properties.

2. Spanish dollars circulated among the thirteen colonies easily and were legal tender in Virginia.

3. Preston, Martin, and Lita Epstein. 2003. *The Complete Idiot’s Guide to the Federal Reserve*. New York: Alpha.

4. Furness, W. H. 1910. *The Island of Stone Money: Uap of the Carolines*, and Anthropologist Scott Fitzpatrick NPR interview, Dec 10, 2010.

5. Friedman, Milton. 1991. *The Island of Stone Money*. Stanford, CA: Hoover Institute Working Papers in Economics, pp. E-91–93.

6. The U.S. Federal Reserve has a dual mandate of maximizing employment and maintaining price stability. Generally it is believed that the Fed targets a stable 2 percent inflation rate. These dual goals are supposed to ensure optimal long-term economic growth.

7. Central banks primarily only purchase government debt and the most secure assets in order to maintain “faith” in their assets. During World War II to 1951 the Fed bought treasury bonds, never allowing their yield to exceed 2.5 percent. Recently the U.S. central bank has bought mortgage-backed securities among other things. During an equity crisis in 1998, the Hong Kong central bank purchased shares outright. Central banks also speculate in the value of their own currencies, such as the Bank of England’s trading disaster in 1992.

8. Housing is ultimately a positional good and has a historical 3:1 income to value ratio. The \$6.6 trillion factor is calculated using the median home value to income ratio variance from this historic average.

9. Metabolism is derived from the ancient Greek meaning “change” and “out-throw,” which seems suitable for evolution’s many expressed forms across physical, ecological, economic, and symbolic domains.

10. Note that China’s inflation has ranged from –2 percent to +8 percent during its amazing 2000–2012 growth period.

11. Interestingly there isn’t a known single cause associated with the Permian extinction. Theories include meteorite impact, vulcanism, methane hydrate releases, climate change, or a mix of these things.

12. Calculated using real 2005 dollars.
13. Zimbabwe's main stock index was up over 12,000 percent in 12 months in 2007.
14. Hanke, Steve H., and Nicholas Krus. 2012. "World Hyperinflation." Cato working paper #8. The world record holder for hyperinflation is Hungary, from August 1945 to July 1946, which saw prices doubling every fifteen hours measured in Pengos.
15. *When Money Dies: The Nightmare of Deficit Spending, Devaluation, and Hyperinflation in Weimar Germany* (Kimber, 1975) by Adam Fergusson provides an excellent view of hyperinflation from unique inside perspectives.
16. For comparison, in 2012, the United States had a debt to GDP ratio close to 1.1:1.0; Japan's is 2.0:1.0. Economic scholars Carmen Reinhart and Kenneth Rogoff estimate that a ratio of 0.9:1.0 is a dangerous tipping point for debt levels in their book, *This Time Is Different: Eight Centuries of Financial Folly* (Princeton University Press, 2011).
17. 1986 Cruzado, 1987 Bresser, 1989 Summer, 1990 Collar 1, 1991 Collar 2, 1995 Real.
18. "How Fake Money Saved Brazil," NPR radio, Oct 4, 2010, Robert Siegel and Mary Louise Kelly with Chana Joffe-Walt: <http://www.npr.org/templates/transcript/transcript.php?storyId=130329523>.
19. It has been argued by Charles P. Kindleberger that the Federal Reserve was hampered by the loss of its chairman Benjamin Strong in 1928. Kindleberger argues that without Strong the Fed's actions and inactions in the 1930s amplified the money (credit) contraction and related value flow problem.
20. <http://eh.net/encyclopedia/deflation/>.
21. Ayres, Robert, and Benjamin Warr. 2009. *Economic Growth Engine: How Energy and Work Drive Material Prosperity*, p. 34. Edward Elgar.
22. It should be noted that a handful of developing countries are inclusive economies making strides, but too many are perpetual poverty traps suffering from extractive patronage-based versus rule of law political regimes. Often these regimes are indirectly facilitated or supported by well-meaning multinational development projects. Without local political change these extractive governments can deplete any and all external resources poured into them. Wasted human potential and suffering is an ongoing tragedy, which will likely be resolved with domestic political change and a wider understanding of the costs of corruption and extractive politics.
23. This occurred with canal mania in the 1790s, railway shares in the 1840s, large-scale diffusion of automobiles, telephones, and electricity, creating unprecedented industrial growth in the 1920s, and of course Internet/telecom shares in 1995–2000, to name a few.

24. Real cost refers to an inflation adjusted cost. Nominal cost is the displayed or quoted price of an item. Real (inflation adjusted) purchasing power of income is typically used to show how an economy's internal price relationships change after a period of price inflation.

25. Relative price is the item's comparative price to similar or substitute quality goods.

26. This assumes debt and associated monies at the macroeconomic level are sustainable and bear a reasonable relationship to value and wealth within the economy on a go-forward basis. Large debt to excess value-creating abilities can be unsustainable, leading to defaults, political or monetary instabilities, or even collapses.

27. This is a yield curve.

28. A familiar example of monoculture and monocrop failure is the Irish potato famine. Thirty percent of the Irish people depended on potatoes for food. A blight wiped out the crop, killing 1 million people and forcing another estimated 1 million to leave the island. These changes caused Ireland's population to shrink an estimated 20 to 25 percent in seven years from 1845 to 1852.

29. Asset bubbles involve the creation of excess money acting as a direct claim on an asset class used to purchase more of the same asset, pushing up the asset class's price far beyond value. Cheap money and price re-inforce each other, as people confuse price with the value-creating ability of the asset class. The creation of money (usually debt) allocated to the asset feeds a mania of senseless price increases until the whole charade collapses in a panic, destroying the created money and often depreciating the real value of the original asset because of resource over allocation. If the money created debt or equity is not forgiven or destroyed, the ongoing debt service relative to the "under-water" post crash assets, drains other forms of money flow from the economy as the underlying assets go "under-water." This aggregate far money contraction creates recessions as value flows shrink to service the now relatively expensive money, measured in debt to asset ratios.

30. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World* (Island Press, 2006), by Brian Walker and David Salt, is an excellent learning resource for learning about ecological resilience.

31. Cash means immediately transactable currency and not so-called cash equivalents. In 2007 many found out that cash equivalent money market instruments and auction rate securities liquidity disappeared just as it was needed most. Like so many financial innovations, the extra yield measured as a few basis points turned out to be junk. The instant convertibility of cash is a valuable financial option costing a few basis points of forgone allocation to near cash equivalents.

Chapter 14

32. Low rates of inflation may strengthen a firm's goodwill, depending on the source of the firm's goodwill. A strong brand and distribution network advantage allows for relative premium pricing versus other goods. During inflationary periods this premium pricing may efficiently expand value, but not the balance sheet representation of the goodwill asset. The goodwill stays fixed in nominal terms on the balance sheet even while its contribution to ROC margins and intrinsic and book value increase as the moat works its magic. The nature of value and the accounting conventions associated with goodwill can be at odds with each other. If the firm is not a fad and has a genuine branded moat, then marketing costs going forward may shrink as a percentage of per-customer revenue. This means richly expanded returns on working capital.

Chapter 15

1. ICI Factbook, 2012; http://www.ici.org/pdf/2012_factbook.pdf.

2. The outcome will depend on the index rebalancing strategy, a detail often left out of "beta" conversations dealing with entering and exiting firms in the index.

3. The truth in academic economics comes in shades of gray. Beta depends on how things are weighted and so on, and most research is U.S.-based or suffers economy-wide survivorship bias. Like the bogus equity risk premium concept, don't look at beta too closely or it melts into a big mess.

4. This model ignores the slight effects of momentum.

5. Trading in HHH stopped on December 23, 2011.

6. Not all countries will be effective economies for an index approach. The economy in question must follow the rule of law with minimal corruption and not be subject to capricious taxation or regulatory powers. The economic governance and legal systems are also required to be fair and independent for equity shareholders for such an approach to be valid.

Chapter 16

1. Phillip Ball. 1999. *The Self-Made Tapestry: Pattern Formation in Nature*. Oxford: Oxford University Press.

