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INVESTMENT MANAGEMENT

Counterpoint Global Insights

New Business Boom and Bust

How Capitalism Experiments

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Introduction

A baby's learning after birth is dazzling. Take the acquisition of language as an example. Normal children effortlessly acquire the language spoken around them without special instruction. Before they can learn to read, kids add a new word to their vocabulary every couple of hours that they are awake. By the time they graduate from high school, Americans know about 60,000 words or phrases, or roughly 3 times the number of words in the oeuvre of William Shakespeare.[1]

Learning about the environment is crucial to survival. A child must develop an effective neural network to do so. Nature's solution to the problem needs to be robust, inexpensive, and efficient. But the approach is not intuitive, especially to those who perceive that most solutions are the product of design.[2]

Neurons and synapses are elemental components in your body's neural network. Neurons are cells in the nervous system that connect and communicate with other cells. Synapses provide the structure that allows the neurons to communicate with one another. Your neurons are the nodes and your synapses are the connections in the neural network that is you. The challenge is figuring out how to build a network that allows you to speak your native language fluently and to understand it effortlessly, along with a range of other essential skills.

Exhibit 1 shows the solution that evolution found. The number of neurons does not change dramatically throughout life.[3] What does change is the number of synaptic connections between the neurons. While the timing is different for various brain functions, the pattern is the same: the brain creates a huge number of synaptic connections and then reinforces the ones that are used and prunes the ones that are not used. To put some figures to it, at the peak a toddler has about 1 quadrillion synaptic connections (one thousand trillion), or about 15,000 per neuron.[4] In the pruning phase, a child loses about 200 billion connections a day on the way to having about one-half as many by the age of 10. It's "use it or lose it."

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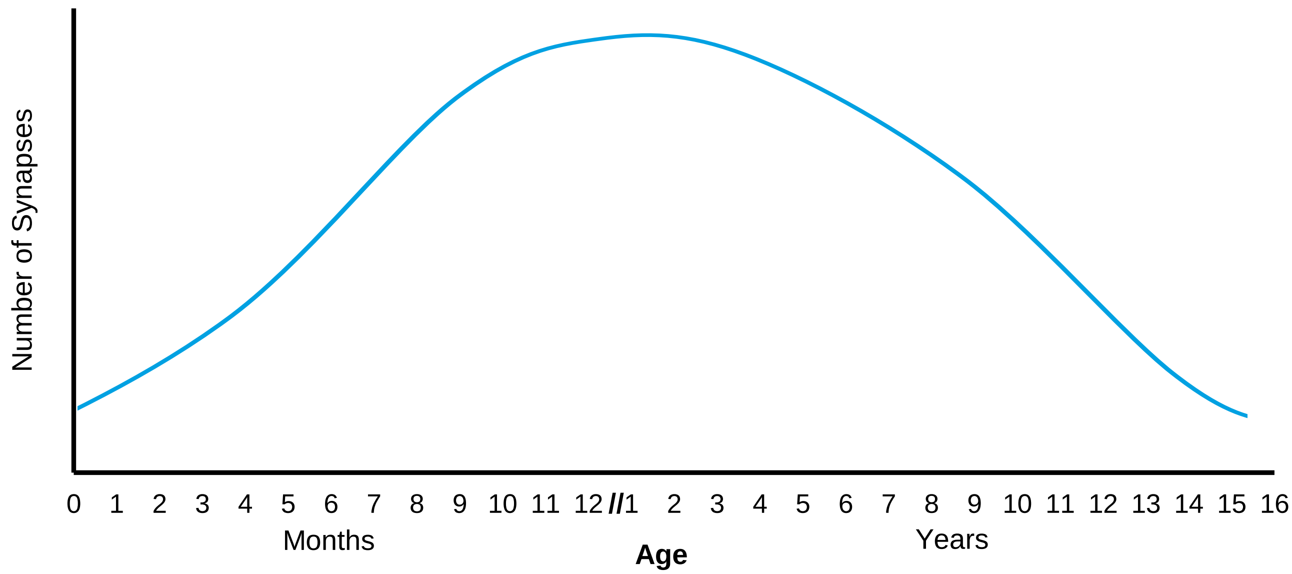
Exhibit 1: Neural Connections in Early Childhood



Source: Based on Ross A. Thompson and Charles A. Nelson, "Developmental Science and the Media: Early Brain Development," American Psychologist*, Vol. 56, No. 1, January 2001, 5-15.*

This process of overproduction and pruning appears wasteful, especially considering that the brain uses about 20 percent of the body's energy. But scientists have shown that this approach creates a network of neurons that functions well in a wide range of potential environments.[5] In effect, the swell in synaptic connections prepares the child for lots of possible paths, and the pruning matches the mind with the circumstances that prevail in the child's world.

Burgeoning industries commonly follow the same pattern as they develop. The increase in synaptic connections is analogous to new companies, each entering the industry with a novel approach or technology to address the business challenge. The marketplace is the environment, which "selects" the products or services that best fit the industry's needs. The decrease in connections is analogous to the exit of companies.

We discuss this pattern for companies, describe why investors should care, and offer some current examples of where this pattern of entry and exit is playing out.

Pruning for Performance and the Product Life Cycle

Let's start with some classic examples of this pattern. Exhibit 2 shows the development of the U.S. automobile and personal computer (PC) industries. The auto industry started around 1895, saw a massive rate of net entry until about 1910, and then saw a substantial rate of net exit through 1941.[6] The PC industry started in the mid-1970s, climbed to a peak number of companies in 1987, and saw a decline in total companies through the mid-1990s.[7] Researchers have documented a similar outline of industry evolution for dozens of industries.[8]

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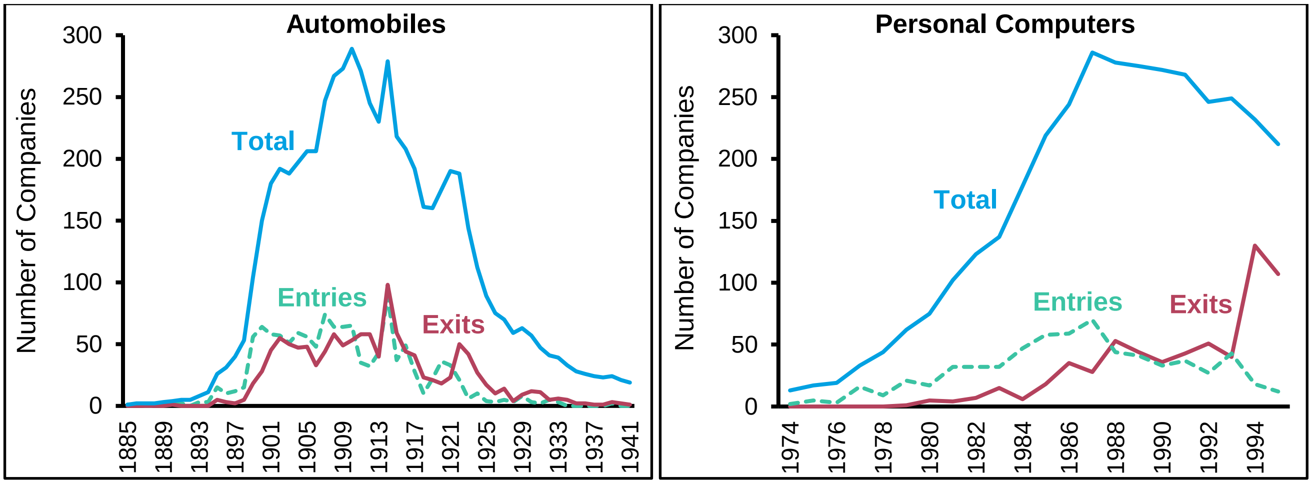
Exhibit 2: Entry, Exit, and Total Companies in the U.S. Automobile and PC Industries



Source: Autos: Wikipedia contributors, "List of defunct automobile manufacturers of the United States," Wikipedia, The Free Encyclopedia*, https://en.wikipedia.org/w/index.php?title=List_of_defunct_automobile_manufacturers_of_the_United_States&oldid=1087965710 and Wikipedia contributors, "List of automobile manufacturers of the United States,"* Wikipedia, The Free Encyclopedia*, https://en.wikipedia.org/w/index.php?title=List_of_automobile_manufacturers_of_the_United_States&oldid=1088463190; PCs: Mariana Mazzucato, "The PC Industry: New Economy or Early Life-Cycle?"* Review of Economic Dynamics*, Vol. 5, No. 2, April 2002, 318-345; Counterpoint Global.*

Steven Klepper was an economist at Carnegie Mellon and a leader in this field. This pattern of boom and bust is known as the product life cycle. Klepper identified and described six regularities in this evolutionary process:[9]

1. As an industry is born it is common for the number of entrants to rise and then fall over time. The total number of competitors is ultimately small.[10]

2. The output of the industry continues to grow even as the number of producers falls from the peak.

3. The market shares of the competitors are unstable at first, but eventually stabilize.[11]

4. The diversity of versions of competing products coincides with the growth of entrants. The number of innovations peaks in the growth phase and falls thereafter.

5. Product innovation is the focus early in the cycle. Process innovation is the focus late in the cycle.

6. When the number of entrants is on the upswing, most product innovations come from new entrants.

Klepper, along with Michael Gort, an economist, examined 46 industries and measured the average time it took to pass through the various stages, including the growth in net entry, low to zero net entry near the peak of competition, and negative net entry.[12] The early phases last longer on average than the late ones. Further, we can observe that the diffusion of new innovations is happening faster today than it did in the past.

In his book, *Mastering the Dynamics of Innovation,* James Utterback, an emeritus professor of management at MIT, describes three phases in this recurring pattern.[13]

The first is the fluid phase where there is a lot of experimentation with product design and the nature of the business model. The outcome is unclear, and the emphasis is on the performance of the various competing products. Companies tend to be led by entrepreneurs. This phase is akin to the rise in synaptic connections where a wide range of outcomes is possible.

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The second is the transitional phase where the market has settled on a product design and the focus shifts to process innovation. Investors use the term "product-market fit" to describe when the product coalesces with the needs of the market. In effect, the customers prune subpar alternatives and reinforce the product that best serves their needs. Consideration of complementary assets is also important because new companies are also embedded in a business ecosystem. Autos with internal combustion engines need roads, gas stations, and mechanics that can fix them. The emphasis is on how best to bring the product to market given the environment.

Finally, there is the specific phase where the pace of product and process innovation is slow because most competitors have adopted the industry's best practices. Companies here may be susceptible to disruptive innovation, where new business models, a form of process innovation, allow for entrants to compete for specific segments of the market.[14]

Neural development and the product life cycle follow a similar pattern because they are effectively addressing the same task of discovering what is useful in a new environment. The solution in both cases is to try out a lot of alternatives and winnow down what does not work.

Investor Takeaways from the Pruning Process

Understanding this pattern of innovation can help investors in a number of ways. To begin, it is very useful to understand which phase an industry is in. One straightforward way to do this is by measuring the number of entries, exits, and total number of firms in the industry. This fits with the first of Klepper's stylized facts. Failure rates are high in the early phase and drop substantially once the process is largely complete. Exits are the result of going out of business, which is bad for shareholders, or of being acquired by another company, which is often not as bad.

Investors should also be aware of the interplay between financial and technology markets.[15] Here's the basic story. Financial capital tends to flow in as it becomes clear that a potential new industry is emerging. In many cases, the companies associated with the innovation receive inflows that lift asset prices to levels that are unsupported by the fundamentals. Financial capital then flees, leaving asset prices that are fair to undervalued. Finally, the financial and technological markets come into alignment.

In the fluid phase, investments in companies have payoffs similar to options. A financial option is the right but not the obligation to invest in a stock at a set price within a predetermined time. About one third of options expire worthless. In the aggregate, these investments in the early phase appear to generate a return similar to, or below, that of the broader market.[16]

But similar to the venture capital industry, the distribution of the returns to shareholders is heavily skewed, with a small number of companies generating outsized gains and the majority losing money for shareholders.[17]

Importantly, the influx of financial capital is essential to developing the industry because it funds experimentation. It appears inefficient in retrospect once the market has sorted the winners and losers. But this evolutionary process is similar to what happens with the synaptic connections: the generation of options is followed by selection for what is most appropriate for the environment.

Another investor takeaway relates to the assessment of competitive advantage. Market share stability is one of the ways to test for competitive advantage.[18] The premise is that if an industry's market shares are highly unstable then it is unlikely that one or more companies within the industry have a sustainable competitive

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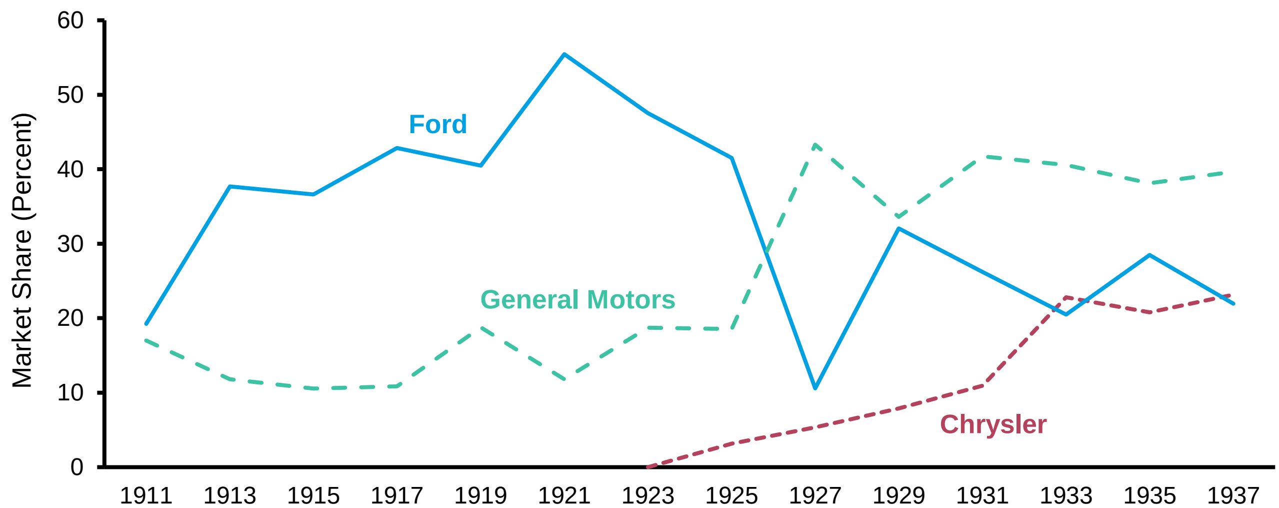
advantage. Further, an expanding list of companies that have any share of the market suggests limited barriers to entry. A thoughtful assessment of barriers to entry is central to a proper analysis of competitive advantage.[19]

The degree of market stability tends to mirror the stages of industry development, consistent with the regularities that Klepper identified. Market shares are very unstable in the fluid phase. For example, General Motors, Ford, and Chrysler swapped rankings in market share in the U.S. automobile industry multiple times between 1925-1935 (see exhibit 3). Market shares settle down in the transitional phase, after the market has separated the early winners from the losers.[20]

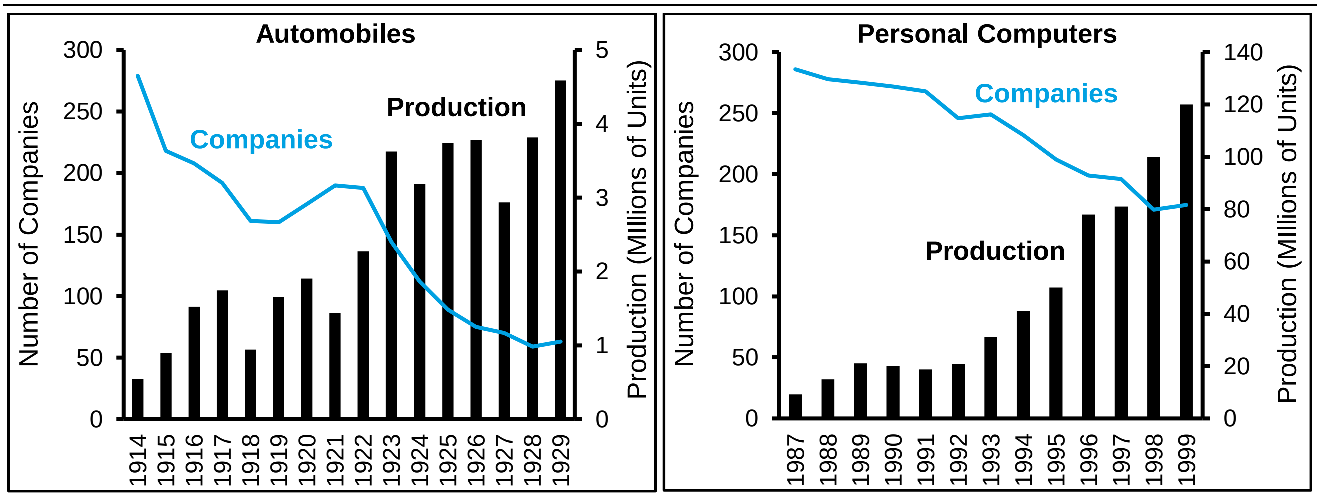
A fourth takeaway for investors is that the industry's output continues to increase even as the total number of companies decreases. This means that a smaller number of companies are taking a greater share of a larger market. Exhibit 4 shows this pattern for the U.S. automobile and PC industries.

Exhibit 3: Market Share for the U.S. Automobile Industry, 1911-1937



Source: "Report on Motor Vehicle Industry," Federal Trade Commission*, June 5, 1939 and Counterpoint Global.*

Exhibit 4: Fall in Companies and Rise in Production in the U.S. Automobile and PC Industries



Source: Auto companies: Wikipedia contributors (see exhibit 2); Auto production: NBER Macrohistory: I. Production of Commodities, Series 01107a, see: www.nber.org/research/data/nber-macrohistory-i-production-commodities; PC companies: Mariana Mazzucato, "The PC Industry: New Economy or Early Life-Cycle?" Review of Economic Dynamics*, Vol. 5, No. 2, April 2002, 318-345; PC production: Jeremy Reimer, see https://jeremyreimer.com/rockets-item.lsp?p=137; Counterpoint Global.*

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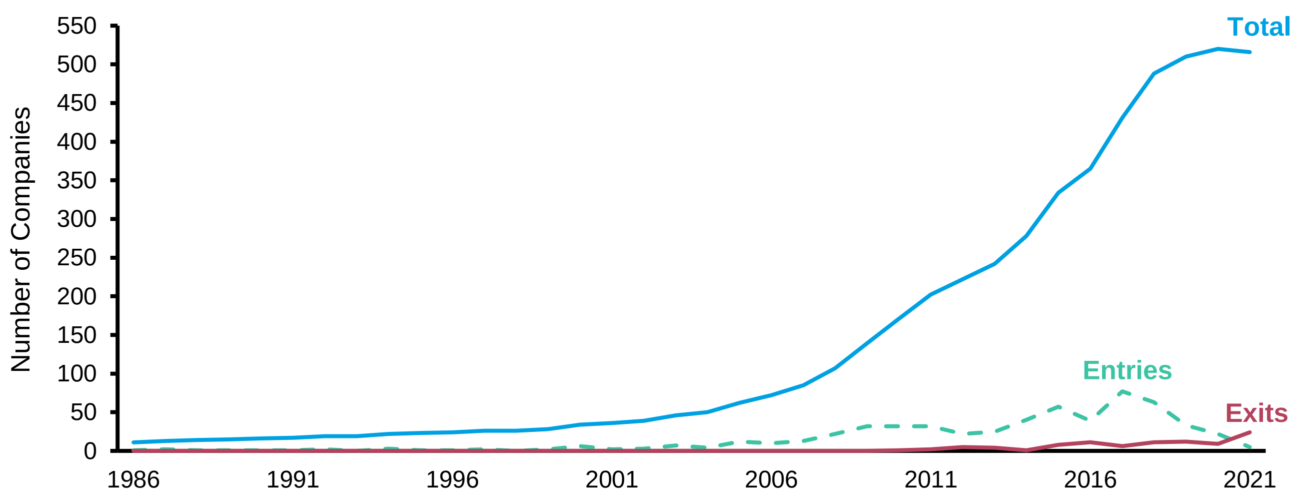
Process innovation tends to be most significant during the transition phase. As a result, the unit price of the good often declines during this period.[21] A lower price promotes additional adoption. This can be the sweet spot for investors, as the market has selected the survivors and growth is in its early phases.

Pattern recognition is important for investors but often tricky to implement because humans tend to see patterns even where none exist.[22] This process of overproduction and pruning has played out in billions of brains and dozens of industries. And it is happening today.

The Beginning of Boom and Bust

We currently see this pattern in a few areas. One example is the electric vehicle market (see exhibit 5). We count a little more than 500 companies in the industry when we include automobile and truck manufacturers (both new entrants and traditional manufacturers of vehicles with internal combustion engines diversifying into the electric vehicle industry), makers of batteries and other key components such as powertrains, and companies that provide technology for charging. While the COVID-19 pandemic had an impact on the entry and exit data, we appear to be in a phase where new entrants exceed exits.

Exhibit 5: Selected Electric Vehicle Companies, 1986-2021



Source: PitchBook and Counterpoint Global.

Cryptocurrencies also share this form, albeit at an earlier phase than electric vehicles. A cryptocurrency is a digital token that is created and maintained through a computer network via blockchain technology and therefore does not operate through a centralized authority. Cryptocurrencies are one component of the infrastructure necessary to support decentralized finance, which combines open-source building blocks to reduce friction and centralized control in the traditional financial system.

Exhibit 6 shows that there were just under 9,000 cryptocurrencies at year-end 2021 and that the rate of entry remains robust. To date, more than 2,400 cryptocurrencies have exited, either as the result of failure or fraud. The vast majority of the existing cryptocurrencies are likely to fail as well.

It is also worth noting that two cryptocurrencies, Bitcoin and Ethereum, represent almost two-thirds of the total market value of all cryptocurrencies and that the market capitalizations of cryptocurrencies follow a power law.[23] Bitcoin largely operates now as a store of value and, to a lesser degree, as a payment network. Ethereum extends the Bitcoin applications as it allows for smart contracts, which reside on the Ethereum blockchain and define interactions.[24]

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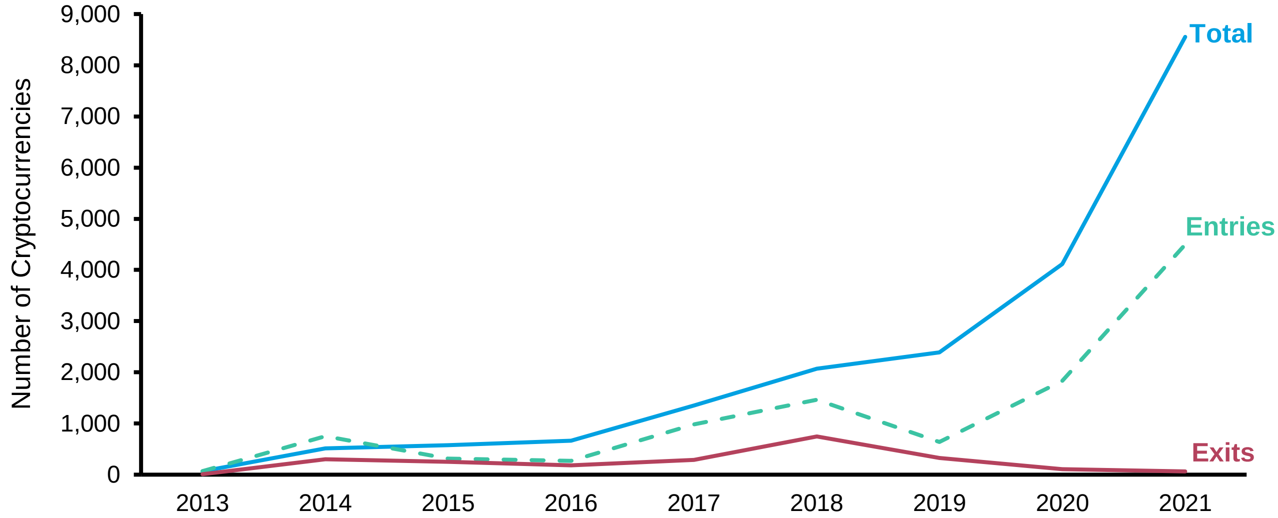
Exhibit 6: Number of Cryptocurrencies, 2013-2021



Source: Total: CoinMarketCap, see https://coinmarketcap.com/historical; Exits: Coinopsy, see www.coinopsy.com/dead-coins; Counterpoint Global.

Both of these areas are in the early phase, which means that investors have to recognize that many, if not most, of the entrants will fail. Much of the capital that will flow into these sectors will earn substandard returns but will facilitate experimentation and product innovation.

As the market sorts the winners from the losers, there should be substantial opportunity for the companies that achieve product-market fit. While difficult to handicap, some companies will rise to the top and flourish amid the shakeout.

Conclusion

An engineer confronted with a problem in a novel environment would be tempted to fashion a specific solution. But studies of the pattern of synaptic connections of children, as well as the emergence of industries, show that the overproduction of options and pruning of those that are not useful is a tried-and-true way to solve the problem.

This pattern is particularly noteworthy in capitalistic economies because of the interaction between financial and technology markets. Capital flows are often very strong as a new industry develops. This money fuels vital experimentation, but since most ideas fail the investments behind them fare poorly. Capital markets are generally less enamored with the industry when exits exceed entrants, but at that juncture fewer companies capture more market share of a growing industry.

Investors are well served to understand this general pattern and to consider where it is in the process of playing out. Examples today include the markets for electric vehicles and cryptocurrencies.

Please see Important Disclosures on pages 10-12

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Endnotes

[1] Steven Pinker, *The Language Instinct: How the Mind Creates Language* (New York: HarperCollins, 1994), 150-151.
[2] For example, see Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and The Meanings of Life* (New York: Simon & Schuster, 1995).
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[4] Alison Gopnik, Andrew Meltzoff, and Patricia Kuhl, *The Scientist in the Crib: What Early Learning Tells Us About the Mind* (New York: First Perennial, 2001), 186-187.
[5] Saket Navlakha, Alison L. Barth, and Ziv Bar-Joseph, "Decreasing-Rate Pruning Optimizes the Construction of Efficient and Robust Distributed Networks," *PLOS Computational Biology*, July 28, 2015 and Willem E. Frankenhuis and Dorsa Amir, "What Is the Expected Human Childhood? Insights from Evolutionary Anthropology," *Development and Psychopathology*, Vol. 34, No. 2, May 2022, 473-497.
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[9] Steven Klepper, "Entry, Exit, Growth, and Innovation over the Product Life Cycle," *American Economic Review*, Vol. 86, No. 3, June 1996, 562-583. For related work, see Steven Klepper and Elizabeth Graddy, "The Evolution of New Industries and the Determinants of Market Structure," *RAND Journal of Economics*, Vol. 21, No. 1, Spring, 1990, 27-44; Steven Klepper, "The Capabilities of New Firms and the Evolution of the U.S. Automobile Industry," *Industrial and Corporate Change*, Vol. 11, No. 4, August 2002, 645-666; Rajshree Agarwal and Michael Gort, "The Evolution of Markets and Entry, Exit and Survival of Firms," *Review of Economics and Statistics*, Vol. 78, No. 3, August 1996, 489-498; Steven Klepper, *Experimental Capitalism: The Nanoeconomics of American High-Tech Industries* (Princeton, NJ: Princeton University Press, 2016); Timothy Dunne, Mark J. Roberts and Larry Samuelson, "Patterns of Firm Entry and Exit in U.S. Manufacturing Industries," *RAND Journal of Economics*, Vol. 19, No. 4, Winter 1988, 495-515; Harry Bloch, "Innovation and the Evolution of Industry Structure," *International Journal of the Economics of Business,* Vol. 25, No. 1, February 2018, 73-83; and Paolo Calvosa, "Entry, Exit and Innovation Over the Industry Life Cycle in Converging Sectors: An Analysis of the Smartphone Industry," *International Journal of Business and Management*, Vol. 15, No. 12, 2020, 151-168.
[10] Sometimes the industry starts with lots of companies.
[11] For a good illustration of this regularity for the U.S. automobile industry, see Mariana Mazzucato, *Firm Size, Innovation and Market Structure: The Evolution of Industry Concentration and Instability* (Cheltenham, UK: Edward Elgar Publishing, 2000), 28-29.
[12] Gort and Klepper, "Time Paths in the Diffusion of Product Innovations."
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[14] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Companies to Fail* (Boston, MA: Harvard Business School Press, 1997).
[15] Perhaps the best book on the topic is Carlota Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (Cheltenham, UK: Edward Elgar Publishing, 2002). That said, Perez focuses on technological revolutions that are larger in scale than the development of industries and products.
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69-84. These risky bets appear to be the result of investor preferences rather than investor beliefs. For a neat approach to separating those possibilities through study of markets for sports betting, see Tobias J. Moskowitz and Kaushik Vasudevan, "Betting Without Beta," *SSRN Working Paper*, May 2, 2022.

[17] Gregory Brown, Robert S. Harris, Wendy Hu, Tim Jenkinson, Steven N. Kaplan, and David Robinson, "Private Equity Portfolio Companies: A First Look at Burgiss Holdings Data," *SSRN Working Paper*, March 3, 2020.

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[19] See P. A. Geroski, *Market Dynamics and Entry* (Oxford: Basil Blackwell, 1991) and Paul Geroski, *The Evolution of New Markets* (Oxford: Oxford University Press, 2003).

[20] Mazzucato, *Firm Size, Innovation and Market Structure*, 28.

[21] Boyan Jovanovic, "Michael Gort's Contribution to Economics," *Review of Economic Dynamics,* Vol. 1, No. 2, April 1998, 327-337.

[22] Jason Zweig, *Your Money and Your Brain: How the New Science of Neuroeconomics Can Help Make You Rich* (New York: Simon & Schuster, 2007), 57-61.

[23] In this case, when you plot the rank by size on the horizontal axis and the market capitalization on the vertical axis (both using a logarithmic scale), the result is a trendline that is straight and can be expressed with an equation that has a discernible exponent (or "power," hence the term "power law"). The practical implication is that a small number of cryptocurrencies have very large market capitalizations, and a large number of cryptocurrencies have very small market capitalizations. See Ke Wu, Spencer Wheatley, and Didier Sornette, "Classification of Cryptocurrency Coins and Tokens by the Dynamics of their Market Capitalizations," *Royal Society Open Science*, Vol. 5, No. 9, September 2018.

[24] Campbell R. Harvey, Ashwin Ramachandran, and Joey Santoro, *DeFi and the Future of Finance* (Hoboken, NJ: John Wiley & Sons, 2021), 1-21.

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