CHAPTER ONE

CHALLENGING MY OWN ASSUMPTIONS

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THE NOBEL PRIZE AND STATUS QUO BIAS

On October 9, 2017, The Royal Swedish Academy of Sciences awarded Richard H. Thaler the Sveriges Riksbank Prize in Economic Sciences, otherwise known as the Nobel Prize in Economics.[1] Professor Thaler, a pioneer in behavioral economics at the University of Chicago, has helped transform our understanding of human decision-making. Decades of his work have challenged the traditional notion among economists that humans and financial markets are inherently rational.

In an interview by the University of Chicago's *Big Brains* podcast,[2] Thaler recalls the early 4 a.m. call from Sweden notifying him of his Nobel Prize. "I look at [my] cell phone and it says, 'Sweden.'" He paused and then

chuckled and added, "They tell you the good news. And take great lengths to convince you that this is not a prank." Thaler then goes on to note the call ended with the request: "Drink some coffee because there's a press conference in 45 minutes."

Professor Thaler's work has had a profound influence on me, both as an economist and as an investor. His work on "saving for a pension" and "nudges"—small interventions that help people make better decisions—has added billions of dollars to Americans' retirement savings. Millions of workers now save more for their retirement thanks to auto-enrollment and default features in 401(k) plans, a direct application of Thaler's research.[3]

Another compelling body of his work, some co-authored with fellow Nobel Laureate Daniel Kahneman, helped to further develop and popularize the concept of *status quo bias*. Status quo bias is the tendency for human beings to stick with a current belief or decision, even when new information reveals more likely alternatives. Thaler and his peers have shown that this bias affects decisions as varied as choosing insurance policies and NFL draft picks. In economics, it occurs when forecasters stick with outdated assumptions, reluctant to admit that they might be wrong. My Mom would call that being stubborn. Whatever the label, it blinds us to shifting patterns.

COMFORT IN CONSENSUS, AND THALER'S NUDGE

Status quo bias looms large in forecasting. When asked about U.S. economic prospects over the next decade, I've often echoed the prevailing consensus shared by my industry peers: GDP growth and inflation will hover near 2%. This widespread view assumes a return to the "new normal" world that existed before COVID-19, with low but stable growth, low inflation, and low interest rates.

Having attended conferences for decades, I can tell you that this consensus view is so widely held in professional and academic circles today that it is rarely questioned. It's shared by prominent institutions and government agencies such as the U.S. Federal Reserve Board, the Congressional Budget Office, investment banks, and asset managers. "Why would the United States be any different when that low-growth future seems to have already arrived in Japan and parts of Europe?" the logic goes. Since I have often shared the same view, the consensus has been comforting (I am not an outlier, at risk of being very conspicuously wrong, my inner voice would say!).

Yet Thaler's work nudges me to question this comfort. I am also reminded of what Nate Silver counsels in *The Signal and the Noise* (p. 73, 2012): "Whenever there is human judgment there is the potential for bias. The way to become more objective is to recognize the influence that our assumptions play in our forecasts and to question ourselves about them."

"STATUS QUO" ASSUMPTIONS

I believe the status quo view stems from five entrenched assumptions:

(1) Demographics is destiny.
(2) An aging society invests and spends less.
(3) Globalization has plateaued and may retreat.
(4) High debt levels hinder growth.
(5) Meaningful technological advances are over. The greatest scientific and engineering breakthroughs are behind us.

Of these, the assumption that meaningful technological advances are over is the most disheartening. In *The Rise and Fall of Economic Growth* (2016), economist Robert Gordon explains that technologies introduced since the 1970s have been more "incremental" than those introduced

earlier, a trend that he expects to persist. And when Gordon debates skeptics, he asks a disquieting question:

> "You get to keep everything invented through history up until 2003. All the plumbing, electricity, dishwashers, cars, and phase one of the internet—Amazon, Google, and eBay. Or you give up all that for the last decade of invention, including the iPhone, Android gizmos, Facebook, and every mobile app on which your life depends. What do you choose?"[4]

Indoor plumbing, in other words, or a smartphone? Gordon has a point since the answer seems obvious. (Although I imagine a younger audience may choose differently than I would!)

To be fair, some writers challenge this "status quo" view. However, the challenge concerns future inflation, not growth. Several recent books conclude that we are entering a higher-inflation world. In *The Great Demographic Reversal*, Charles Goodhart and Manoj Pradhan argue that slowing population growth will lead to a resurgence in inflation.[5] Nouriel Roubini (2022) points to demographics and a retreat in globalization as the source. Ray Dalio, in his 2018 book *Principles for Navigating Big Debt Crises*, warns of high U.S. debt levels and a sizable decline in the value of the U.S. dollar.[6,7] On the other hand, former U.S. Treasury Secretary Larry Summers (2014) argues that an aging population could lead to stagnation and lower inflation.[8]

A WARNING FROM HISTORY

The "status quo" view assumes perfect balance in the years ahead. Yes, we may see a "little bit" of a growth boost from new technologies, but we could also expect a "little bit" more of a drag from demographics and government debt. These megatrends will net out evenly in the end, producing over the

next 10 to 15 years the same growth and inflation that we've seen over the past twenty. A sort of middling Goldilocks scenario, I suppose.

Yet doing my best to channel Professor Thaler, I remind myself of a warning from history worth emphasizing. When big megatrend shifts happen, they rarely "balance out." Megatrends are more like tectonic plates grinding against each other rather than a seesaw balancing itself. When technology and other megatrends collide, one side typically prevails.[9] Regimes change. The consistent pattern is not consistency, for megatrends are rarely in balance for long. An economist's theoretical notion of "equilibrium" or "steady state" rarely exists outside of the classroom.

The 1920s, the 1950s, and the 1990s did not offer a "little bit of growth" or "a little disruption"—they were periods of rapid innovation and disruptive transformation. Growth was neither balanced nor steady; the trend shifted, sometimes abruptly. And the financial markets followed. Contrast that with the 1970s. They were not a period of a "little slowdown" and a "little inflation." Productivity stagnated while inflation soared despite more Baby Boomers and women entering the workforce. In the end, the 1970s were not a continuation of the 1960s. There were no planes over Skagway. The outcomes shifted again because the megatrends shifted.

THE CHALLENGE IN DETECTING FUTURE SHIFTS

Forecasting regime shifts is no easy feat. Traditional economic models focus on short-term demand fluctuations, treating megatrends like fixed constants. This simplification tends to ignore how megatrends—demographics, technology, globalization, and fiscal debt—account for nearly all GDP and stock market fluctuations over the period of three years or more.

A MORE EXPANSIVE FRAMEWORK

This book is about breaking through some of these limitations. Inspired by complexity science, this book introduces a new framework that treats the economy—and megatrends in particular—not as a static model but as what it truly is—a *dynamic system* in which changes in megatrends produce responses in other economic drivers.[10] If we are to paint a realistic picture of our economic and financial future, then small changes in one area of an interconnected ecosystem must have the potential to ripple across the whole.[11] Azeem Azhar, in his book *The Exponential Age*, stresses that such ripple effects and "feedback loops" can make profound, sudden changes in the broader economy.

To build this framework, I tried to overcome three hurdles. First, I compiled millions of high-frequency data points to push U.S. economic statistics back to the 1890s. This helps us capture some of the most consequential developments in economic history—the Great Depression; the rise and fall of U.S. government debt during the 1940s and 1950s; the diffusion of rare general-purpose technologies such as electricity and the internal combustion engine; the ebb and flow of globalization and demographics before World War II. Second, our empirical framework is not stuck in the past, but rather adapts to change. Like a machine-learning algorithm, it naturally adjusts to the ebb and flow of certain relationships and the fact that today's service-based economy and financial markets differ from those of the past.

Finally, and most importantly, the framework better connects the dots by incorporating the three key dimensions of the economy and financial markets—(1) megatrends, (2) cyclical factors, and (3) financial returns—and the causal interactions among them in a multidimensional system. This model is not a magic bullet, but I believe it is a material step forward

in forecasting the range of future economic and market events. These megatrends include, but are not limited to, the following:

- **Technology:** I distinguish between two types of technology: *Innovative Technology*, which automates and augments existing human work (like power tools or the assembly line), and *Transformative Technology*, which enables new industries and transforms economic life and society (like electricity and the internal combustion engine that powered the first flight above Skagway).
- **Demographics:** I explore the impact of changes in population growth, including immigration, and the age distribution of the population.
- **Fiscal deficits and debt:** I review shifts in the balance between government spending and revenues and distinguish between fiscal deficits arising from temporary events (e.g., war or recessions) and chronic deficits that compound over time.
- **Globalization:** I assess trends in global trade (e.g., imports, exports, tariffs, and supply chains) and the exchange of knowledge and ideas across borders.
- **Energy transition:** The framework accounts for changes in earth's surface temperatures over time, a proxy for potential changes in climate.
- **Geopolitical risk:** I attempt to account for some of the historical and potential future ups and downs in geopolitical risk, such as the rising trade tensions between the United States and China, to assess what that may mean for our future.

I integrate these forces in an empirical framework that reveals how megatrends affect the "Big Four" economic and financial outcomes: real GDP growth, inflation, interest rates, and stock earnings yield (a measure of stock market valuation).[12] This analysis can enhance not only medium-run forecasts but also real-time estimates for the economy and financial markets.[13]

PERCEPTION VS. REALITY

Taking these insights into effect, this framework paints a different empirical reality of how megatrends have—and will—impact the U.S. economy and markets. As you can see in the table, the framework challenges some common beliefs that I (and, as I suspect, others) have held at some point. I will share more context on these realities throughout this book.

This book's data-driven framework challenges some common beliefs (see Table 1.1).

Table 1.1 Perception vs. Reality

Perception or Belief	Empirical Reality
Demographic trends are a major driver of inflation.	Simply not true. Demographic trends, such as population growth or aging of society, have no strong causal association with inflation.
Weak demographics and high debt levels guarantee dismal economic growth, as in modern-day Japan.	While such conditions can be a headwind to growth, the average historical correlation of either population growth or debt levels with future growth is near zero. Innovation is more important, often surging while demographics slowed or debt rose.
An aging society spends less and lowers rates of innovation as skilled workers retire.	Simply not true. Older consumers do not spend less as they age, although what they spend on changes (i.e., healthcare). An aging workforce can lead to higher rates of capital investment by businesses, a foundation of innovation.
Globalization has been a major driver of disinflation of the past few decades. Its reversal would usher in a higher-inflation world.	Increasing globalization did help lower inflation through lower import prices, although its effects have been fairly modest and uneven. In the United States, this is because imported goods represent less than 10% of consumer spending.

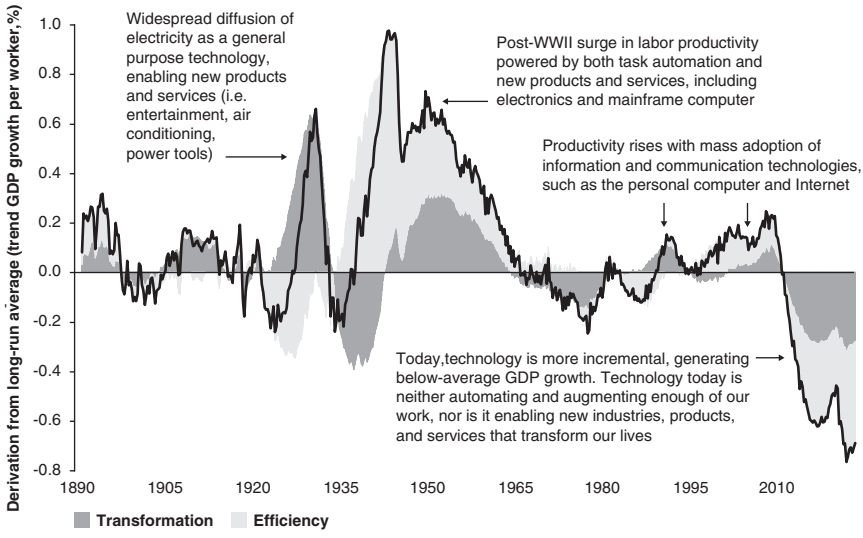
Larger government deficits lead to higher interest rates and bond yields.	Not necessarily, and the historical correlation in the United States is close to zero. This is because financial markets pay attention to why deficits are rising and differentiate between the drivers. (Recession? Temporary or permanent?) When deficits are persistently structural and expected to continue, inflation expectations and interest rates can rise, however.
High government debt levels smother future GDP growth.	Although debt must be repaid, there is no strong causal link between higher debt levels today and lower future economic growth. Our framework better captures how U.S. fiscal deficit spending affects future growth and inflation.
Since the global financial crisis, U.S. trend growth is lower primarily due to slowing demographics.	Not true. The lack of task automation and "power tools" for workers is a root cause, subtracting the most from U.S. economic growth in at least 130 years.
Today's inventions are more marginal than those of the past, and this is unlikely to change. Great ideas are harder to find.	The first part of that statement is true, but past is not prologue. AI possesses the three necessary characteristics of an emerging general-purpose technology according to our framework, raising the possibility of higher-than-expected future growth.
AI will lead to massive unemployment by displacing many jobs.	Highly unlikely. This belief confuses task automation with job automation. Most jobs are comprised of dozens of critical tasks, some of which will be augmented by AI or unaffected by AI (i.e., physical tasks). AI does, however, have the possibility of bringing the greatest change in a generation to the majority of occupations in terms of the shift in tasks of human work.
In an era of technological change, technology-concentrated "growth" stocks outperform the broader stock market.	Not necessarily. In fact, the diffusion of general-purpose technologies has been associated with "value" stocks outperforming for long periods (typically after the initial market euphoria over the technology subsides) as companies in a wider range of industries adopt the technology, boosting their profitability. New technology entrants, through creative destruction, can also erode the returns on equity of technology companies.

TODAY'S TECHNOLOGY PARADOX, EXPLAINED

Technological change is the megatrend that will have the biggest impact on our future. Recent data are discouraging. Since the Great Financial Crisis in 2008–2009, productivity growth has plumbed 50-year lows (see Figure 1.1). Despite the ubiquity of smartphones and social media, these technologies have done little to transform worker productivity, particularly in service sectors like healthcare, education, and finance. The mainstream view is that this struggle will persist. Productivity will remain stuck in low gear. Status quo.

Figure 1.1 A lack of automation and transformative technologies help explain lower average U.S. growth.

Source: Author's calculations



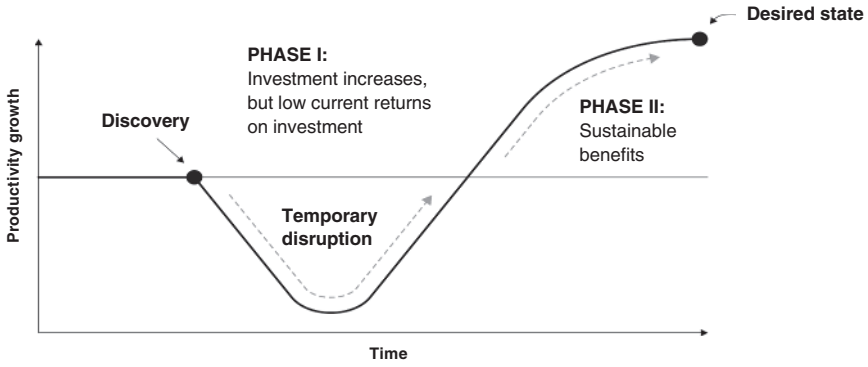
DETECTING TECHNOLOGY SHIFTS: THE BLIPS ON THE RADAR

But what if I told you that we could have some sense, in advance, of whether that was to remain the case? A prime benefit of our framework is that it provides a proverbial radar detector that can tell us whether our future will be an extension of the recent, discouraging past or a moment when a technology like the de Havilland DH-4 airplane creates new possibilities. This radar detector is unable to identify the specific technology or its exact manifestation, but it gives us a sense of the approaching innovation's shape and size, much like a blip on a radar screen.

The unique data and framework in the megatrends model are designed to capture such signals. These signals are not secret and they can be noisy. They are based on how millions of companies invest every day, how technology spreads, and where new ideas come from.

Transformative technologies—what economists call *general-purpose technologies* (GPTs)—change work and life. They raise economic growth for generations. Our framework recognizes that these rare technologies transmit unique signals long before they produce higher GDP growth. Whether it was investment in electricity or the personal computer, the financial statements of businesses hinted at the power of these transformative technologies long before their payoff emerged in the form of higher profits, revenues, and thus GDP. This pattern is a *J-curve*, a term coined by the venture capital industry. The dynamics, famously discussed by economic historian Paul David, as well as Nobel Prize winner Robert Solow, are depicted in Figure 1.2.[14] This pattern explains why our radar can detect signals from the economic and financial future before we see the persistent effects on GDP or inflation.

Figure 1.2 Productivity declines, then surges, as the *J-curve* unfurls.
Source: Author's calculations



THE J-CURVE OF ELECTRICITY AND THE PC

In 1882, Thomas Edison opened the first commercial power station in New York City. Yet by 1900, fewer than 5% of factories used electric power. It wasn't until the 1910s that most cities installed streetlights and commuter railways, factories built out the assembly line, and homes were wired for appliances. Signals from investment and hiring patterns hinted at a more prosperous future in the 1910s, but not until the Roaring 1920s did electrification drive record productivity growth.

And again, in the 1980s and early 1990s, we could detect signals of a coming boom long before the emergence of the so-called "New Economy." In 1983, *TIME Magazine* named the personal computer the "Man of the Year," inspired in part by IBM's PC Model 5150, introduced in 1981. Microsoft Windows 1.0 debuted in November 1985, though usage remained limited to financial budgeting in spreadsheet software like Lotus

1-2-3. In the early 1990s, IT spending accelerated with Microsoft's commercially successful Windows 3.0. The improved graphical user interface and its integration with more software applications facilitated a doubling in the number of personal computers sold between 1990 and 1992.

Patterns in the labor market and capital investment were changing, but trend growth had yet to budge. *The Economic Report of the President* published in 1992 failed to mention the Internet, even though AOL already offered dial-up Internet services, including email, to users of Windows and Macintosh computers. Yet U.S. Federal Reserve Board Chairman Alan Greenspan saw this transformation coming by observing some of the same signals that we harness in our framework. During the mid-1990s his intuition of a coming pick-up in productivity proved correct. In 1998, he gave a speech on the "New Economy," noting "There doubtless has been, in recent years, an underlying improvement in the functioning of America's markets and in the pace of development of cutting-edge technologies beyond previous expectations."[15]

When Chairman Greenspan delivered these remarks to business school faculty at the University of California, Berkeley, the U.S. economy had transitioned from an expected growth rate of 3% to more than 4%. The stock market soared for an extended period. Inflation remained low, and the nation's debt level fell. The surge consistently surprised the economic consensus, which was more focused on slowing demographics and trade tensions. Chairman Greenspan had already picked up signals of a changing future on his own radar display, just as we do with our framework.

NOT ALL TECHNOLOGIES RESHAPE AN ECONOMY

Many technologies have been adopted quickly over the past 50 years, from microwave ovens and cable TVs to smart phones and social media.

They change daily life. But just because something is widely adopted does not necessarily mean it significantly boosts growth and American living standards. High adoption rates are often conflated with a technology's economic impact. The former doesn't guarantee the latter. Economic impact only relates to adoption if the adoption leads to greater innovation in how we work and unlocks new transformative products and business opportunities. A great illustration of this is Apple's iPod versus its iPhone. The iPod was a commercial hit but not nearly as transformative as the iPhone, which eventually rendered its predecessor obsolete and vaulted Apple into one of the world's most valuable companies.

Over the past several years, AI has grabbed society's attention despite it being well known in technology circles for years. In a short period, AI is now mentioned around the world—as captured by Google's wonderful Books Ngram Viewer—as often as the words *social media* and *electric*. Electricity today is old news, but it was transformative a century ago. But social media is ubiquitous too, and it is tough to argue it has had widespread economic impacts.

From an economics perspective, Google word counts alone cannot tell us if AI will turn out to be *marginal* for broad-based economic growth (like social media has been) or if AI will become a general-purpose technology that *transforms* our work and lives. We need more reliable indicators. Specifically, we need those radar signals that Chairman Greenspan tracked to help us see the ranges of AI's future J-curve.

THE COMING TUG-OF-WAR

This book's framework harnesses those radar signals to project a range of future economic and financial market outcomes through 2040. The rest of

this book discusses the basis for—and the implications of—these varied projections. The next four chapters discuss how four megatrends—technology (AI), globalization, demographics, and fiscal debt—should affect our economic and financial future. Chapter 7 presents the diagnosis for the U.S. economy and financial markets.

The coming decades will be defined by a tug-of-war between transformative technologies like AI and burdens related to an aging population and rising fiscal deficits. The outcome is unlikely to be the "status quo" that many expect. Instead, two scenarios emerge:

- **AI transforms, productivity surges**: Productivity accelerates given profound changes in how we do our jobs, driving faster growth and improved standards of living.
- **AI disappoints, deficits drag**: Rising fiscal deficits and demographics overwhelm more tepid AI innovation, leading, unfortunately, to a blend of stagflation and stagnation.

This book quantifies the probabilities of these scenarios and their implications for economic growth, inflation, and stock and bond returns. By understanding these forces, we can better prepare for the future—one that will likely differ from the recent past.

I will also attempt to move beyond the dry statistics that economists can be so enamored with. I will attempt to paint a stylistic picture of what daily life could feel like in these two scenarios for, say, a 30-year-old or a 65-year-old, including real-world questions such as these:

- How may the costs of living change?
- Will it be easier or harder to "get ahead" versus what our parents may have experienced?

THE TRIANGLE OF TRANSFORMATION

While this book's economic assessment may be unconventional, the potential future changes in work and society could prove more profound. I will explore three dimensions in what I call the *Triangle of Transformation*—technology, work, and society's unmet and even unrecognized needs. Every time that technological change has meaningfully advanced, from the printing press to penicillin, society has experienced remarkable and unexpected changes beyond changes in GDP growth.

Consider an example of electricity's powerful impact on almost every domain of daily life, the defining characteristic of transformative technology. As David E. Nye notes in *Electrifying America*, "At home, a young child could not be trusted to regulate gas lighting but could be left alone with electric light, increasing the child's control over the visual environment and encouraging reading. Partly for this reason, the library loaned out eight times more books per inhabitant in 1925 than it had in 1890."[16]

Imagine then how electricity transformed education. A light bulb could provide an additional hour of studying at night for a school-aged child. Over the course of middle school, that equated to *more than another semester of schooling*. All from the simple incandescent light bulb. Electricity did not directly change teaching, but it did enable advances in learning in unappreciated ways.

If AI and other technologies are to prove transformative, like electricity was, they will have to enable meaningful improvements across all three dimensions of our triangle. That means AI will need to boost growth and American living standards beyond simply work automation. AI also must enable *new* services and applications that have their own knock-on effects. We'll consider the potential of several technologies in the marketplace and

labs today—ranging from robotics and autonomous vehicles to battery storage and advanced biomedical treatments—through our Triangle of Transformation.

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Just as portfolio managers and financial advisors need to quantify the risks and rewards of a security or asset class to make informed decisions, we must consider the probabilities of different futures as we find ourselves gazing up at the sky like our forebears in Skagway, Alaska. This book offers a framework to do so, empowering investors to navigate uncertainty with greater clarity and more confidence.

Change is coming. Let's prepare.

NOTES

1. https://www.nobelprize.org/prizes/economic-sciences/2017/press-release/, nobelprize.org.
2. Economist's Journey to Nobel: Big Brains podcast with Richard Thaler, University of Chicago News.
3. Thaler, R. H., and Benartzi, S. (2004). Save More Tomorrow™: Using Behavioral Economics to Increase Employee Saving. *Journal of Political Economy*, *112*(S1), S164–S187. https://doi.org/10.1086/380085.
4. Copeland, M. V. (2013). "Your iPhone or Your Toilet: Which Would You Pick?", Robert Gordon. WIRED. February 27, 2013. https://www.wired.com/2013/02/your-iphone-or-your-toilet/.
5. Goodhart, C. A. E, and Pradhan, M. V. (2020). *The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival*. Cham, Switzerland: Palgrave Macmillan.
6. Roubini, N. (2022). *Megathreats*. Little, Brown.
7. Dalio, R. (2022). *Principles for Navigating Big Debt Crises*. Simon and Schuster.
8. Summers, L. (2014). "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound", Business Economics, 49(2), National Association for Business Economics.

9. The consensus view effectively assumes lukewarm advances in AI-based automation (in contrast to some of our discussion in Chapter 2), while *also* assuming minimal inflationary or growth headwinds from rising structural fiscal deficits should technology disappoint (in contrast to our discussion in Chapter 5).
10. In technical terms, my framework treats these supply-related megatrends that determine long-run growth and inflation-adjusted interest rates as endogenous and time-varying. Importantly, these trends are not assumed constant in the future (as is conventionally done) but rather capture critical transitional dynamics expressed in any formal economic growth model. Most conventional macroeconomic analyses may incorporate one "supply" shock; our framework uniquely identifies eight and permits dynamic "feedback loops" from one megatrend to another. For the interested reader, more details can be found in the appendix.
11. See for instance Thurner, S., Klimek, P., and Hanel, R. (2018). *Introduction to the Theory of Complex Systems*. Oxford: Oxford University Press.
12. The appendix provides a high-level overview of the Vanguard Megatrends Model™, the framework that generates the insights and projections discussed here. Additional sources and links are provided for the interested reader.
13. If one needs further convincing, consider the events in the U.S. economy since COVID. Economic growth, inflation, and the stock market have been highly influenced by megatrend shocks, including immigration (megatrend: demographics), consumer excess savings and fiscal stimulus (megatrend: structural fiscal deficits), supply chains and tariffs (megatrend: globalization), and swings in productivity (megatrend: technology). Our framework finds shifts in megatrends, rather than Federal Reserve policy, as the primary factor in the so-called soft landing of the U.S. economy in 2024.
14. David, P. (1990). "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Review*, 80(2), 355–361. See also, Brynjolfsson, E., et al. (2021). "The Productivity J-Curve," *American Economic Journal: Macroeconomics*, 13(1), 333–372. In a 1987 *New York Times* book review, Robert Solow noted that one "can see the computer age everywhere but in the productivity statistics." The so-called J-Curve is thus sometimes referred to as Solow's paradox.
15. Greenspan, A. (1998). "Question: Is There a New Economy?" www.federalreserve.gov. The Federal Reserve Board. September 4, 1998. https://www.federalreserve.gov/boarddocs/speeches/1998/19980904.htm.
16. Nye, D. E. (1992). *Electrifying America: Social Meanings of a New Technology, 1880-1940*. Cambridge, MA; London: The MIT Press, page 17.