

PREFACE TO THE SECOND EDITION

During the half-decade since *Doing Capitalism* first went to press, the Three-Player Game has continued to evolve, indeterminate and problematic as ever. This is the term I use to characterize the complex, reciprocal interactions between the state, financial capitalism and the market economy. Out of this dynamic, successive technological revolutions have transformed the conditions of life over more than 200 years.

As originally conceived, the primary purpose of the book that follows was to explore how the evolutionary process of economic growth driven by technological innovation has depended upon the constructive, although often unwitting, collaboration of mission-driven state actors and financial speculators. Much of the most recent iteration of this process I lived as a working venture capitalist, while drawing on my education in the economics of John Maynard Keynes to grasp how state investment motivated by national security could trigger a productive bubble in the capital markets and radically accelerate the new economy in which we are all learning to live.

The book comprises four parts. The first two offer a chronicle of how I simultaneously learned how the game works and how to play it. They serve as an on-ramp to the frontier of innovation, where progress is achieved through Darwinian processes of trial and error, subject to intense competitive pressure under conditions of uncertainty – even ignorance – about the consequences of action and the returns on investment.

Part I, “Learning the Game,” recounts my introduction to the dual instrument for hedging against the inescapable uncertainty of

investing at the technological frontier: Cash and Control, in pursuit of positive cash flow from operations as the definition of corporate happiness. When bad things happen, unequivocal access to cash buys the time required to find out what is going on, and sufficient control enables corrective action. And positive cash flow from operations liberates the enterprise from reliance on the problematic availability of external capital. Part II, “Playing the Game,” provides a case study in the construction of one critical component of the digital revolution, a movement subsidized and sponsored by the US Department of Defense through its early years, and driven to maturity by the great financial bubble at the end of the twentieth century.

The second two parts of the book explore in depth these two institutional forces that have historically combined to generate a succession of “new” economies. Part III, “Understanding the Game: the Role of Speculation,” reviews the persistent recurrence of financial bubbles wherever markets in assets of whatever kind exist, and the struggles of economists to explain such phenomena. It illustrates their occasional but necessary role in overcoming coordination failures in time: when only speculation could fund the creation of assets whose economic value could only be evaluated after the fact. Part IV, “Understanding the Game: the Role of the State,” shows how market failure – even the systemic failure of the global market economy in the Great Depression – could not of itself legitimize corrective state action at sufficient scale. Only political missions that transcend economic calculation – national development, national security – could provide that legitimacy. In each case, I confront relevant strands of economic theory with history to identify both the destructive irrelevance of much of mainstream theory and the promising new economic ideas visible in the immediate aftermath of the Global Financial Crisis and the onset of the Great Recession.

Why this new edition? Five years from publication, events challenge the lessons learned and expounded in this book. At the micro-level of venture-backed start-ups, private funding of “Unicorns” burning literally billions of dollars of cash has seemingly eliminated positive cash flow from operations as other than a needless constraint on limitless growth. Availability of such finance has provided an alternative to the public equity markets, access to which through initial public offerings has been constrained since the end of the Internet Bubble in 2000. With central banks underwriting the painfully slow recovery from the Great Recession by unprecedented monetary policies

that have driven the risk-free rate to zero or even negative levels, investors have been offered a unique environment and compelling motivation for speculation. At the same time, the digital revolution itself has taken on a life of its own, no longer dependent on state sponsorship but rather attacking the authority of the state at multiple levels and along multiple dimensions. So we are obliged to extend our understanding both of financial speculation and of the role of the state to grasp the radical reconfiguration of the Three-Player Game.

The view from inside the Innovation Economy of Parts I and II also remains relevant. First of all, the succession of contingencies that conditioned my own career in the Innovation Economy cumulatively offers an education in grappling with the inescapable uncertainties of investing at the frontier. All who seek to understand how technological innovation becomes economically operational are on notice to absorb these facts of life. There is no substitute for learning by doing in the venture business, and these chapters report what I learned from what I did.

Second, the lived experience of learning how to dance on a platform constructed by the state – by the US Department of Defense, to be precise – and then surfing the bubble of financial speculation that accelerated the digital revolution illuminates how we got here, to this new digital economy. But it also starkly dramatizes what is missing as we contemplate the challenge of building the needed, next new economy, the low-carbon green economy from whose construction the United States has largely absented itself, at least for the time being. Finally, it casts light on the challenges that China faces as its leadership strives to move it from follower to leader of the Innovation Economy, even as the United States so moved in the twentieth century.

The Three-Player Game Reconsidered

In the context of today's disruptions, it is essential to recognize that the Three-Player Game can have very different outcomes, as I wrote in the Introduction to the first edition:

From this dynamic and unstable configuration of political, economic and financial forces ... has emerged a world in which state investment in fundamental research induces

financial speculation to fund construction of transformational technological infrastructure, whose exploitation, in turn, raises living standards for everyone dependent on the productivity of the market economy. But the three-player game is also responsible for a world in which bubbles and crashes in the financial system spill over and liquidate both the employed and their employers, generating appeals to the political process for redress and relief. In yet another version, we find ourselves in a world where “malefactors of great wealth” – to invoke Theodore Roosevelt’s epithet – are able to exploit the political process in order to preserve and protect their exploitation of the market economy.¹

So two overlapping sets of institutions – markets and the political process – compete in the allocation of resources and the distribution of the income and wealth generated by their application. Those who win in one arena have the opportunity to assert their power in the other; contrariwise, the losers in one can seek redress through participation in the other. Of course, the potential that the losers in the market would use the political process to redistribute the market’s outcomes motivated resistance to extension of the franchise for generations – centuries. But history records that the economically and financially powerful have had at least as much success in bending the political process to their advantage.²

The five years since initial publication have shown the profound relevance of this way of comprehending the world, even as the Three-Player Game itself has come under extreme stress. We begin with the relationship between the state and the market economy. Even as the dust was settling from World War II, a set of intellectual entrepreneurs and their backers drawn from business leadership in the market economy and a segment of financial capitalists set about delegitimizing the state as an economic actor in the Anglo-American world. By the time of Reagan and Thatcher, they had largely succeeded, even while the Cold War offered continued legitimacy to the role of the American government in allocating resources despite that ideological victory. And its

¹ William H. Janeway, *Doing Capitalism in the Innovation Economy: Markets, Speculation and the State* (Cambridge University Press, 2012), pp. 4–5.

² For an up-to-date account of this last dynamic at work in the United States, see L. M. Bartels, *Unequal Democracy: The Political Economy of the New Gilded Age*, 2nd edn. (Princeton University Press, 2016).

consequences were muted through the 1990s and the first years of the new century while the “great moderation” in macroeconomic performance marched side by side with the “super bubble” in the financial system to its dénouement in 2008.

When the fiscal interventions that collectively put a floor under the economic consequences of the Global Financial Crisis of 2008–2009 gave way to austerity across the developed world, only extraordinary monetary ease by the leading central banks continued to underwrite the painfully slow recovery from the Great Recession. What’s more, hesitant growth in aggregate demand was compounded by the combined effects – economic and political, real and perceived and feared – of globalization and digitalization. Yet government responses to economic conditions were constrained almost everywhere. In the United States, the one signal initiative, the Affordable Care Act (a.k.a. “Obamacare”), triggered the Tea Party tempest of opposition.

Populist expressions of frustration, most notably the British vote for Brexit in June 2016 and Trump’s narrow election victory in November of that year, cast a spotlight on a central strategic irony of these five years. First, although still largely ignored in both academic and popular accounts of the Crisis, it was the radically enlarged scale of the state that combined with active central banks to limit the economic contraction. In 2008, the public sector’s share of national income ranged from 35 to 50 percent, defining big-state capitalism,³ versus only 10–15 percent at the time of the Global Financial Crisis of 1931–1933. And so unemployment in the Great Recession peaked at 8–10 percent in the richest countries, versus 25–30 percent the last time around. Yet – and here is the irony – virtually everywhere in the western, developed world, the economic role of the state and the legitimacy of the politicians who direct it came under attack.

Technological Disruption and the State

The structural fragility of the Three-Player Game was demonstrated during the 1930s. That fragility is again evident in the

³ This is how Hyman Minsky characterized the political economy that emerged from World War II: see p.180.

haphazard response to the second great globalization. And here lies a second irony. Globalization, both in the late nineteenth century and over the past generation, has been enabled by technological innovations that have radically reduced frictions in the cross-border movement of goods and services and people and capital. The same technologies – be they steamships and the telegraph or the internet in its commercial and social forms – that unequivocally increase the efficiency with which resources are allocated challenge the political system’s ability to buffer the increased flows that they enable.⁴

However, even while international trade and migration are targets of populist outrage, the primary engine of economic and social disruption is coming from within, from the maturation of the digital revolution that itself has been the result of the most productive collaboration in human history between state investment and financial speculation. Specifically, the decline in manufacturing jobs has continued at a rapid pace, from the United States to Germany, as the developed world continues to absorb the effects of China’s full-bore entry into the world economy. But automation, not “bad trade deals,” was responsible for the vast majority of job losses in manufacturing.⁵ And, beyond manufacturing, inequalities of income and wealth rebounded with the stock market after 2009, especially in the United States.⁶

Failure of the state to play its post-World War II role in underwriting the demand side of the economy raises the need for critical review of its historic and strategic role in financing the scientific research that ultimately drives the supply side. Here, too, political paralysis in Washington and general commitments to austerity have dominated. For two key examples, funding of the National Institutes of Health slowed markedly during the fiscal years leading to 2015 and remained flat at about \$31 billion (declining in real terms in the context of modest

⁴ See Dani Rodrick, *The Globalization Paradox: Why Global Markets, States and Democracy Can’t Coexist* (New York: Norton, 2011) and William H. Janeway, “The Retreat from Hyperglobalization,” November 28, 2016. Available at <https://medium.com/the-wtf-economy/the-retreat-from-hyper-globalization-680c0c529649>.

⁵ See Brad DeLong, <https://www.project-syndicate.org/commentary/manufacturing-jobs-share-of-us-economy-by-j-bradford-delong-2017-05>.

⁶ T. Piketty, E. Saez and G. Zucman, “Distributional National Income Accounts: Methods and Estimates for the United States,” NBER Working Paper 22945 (December, 2016).

inflation) until Congress approved a roughly 6 percent increase for fiscal year 2016.⁷ And the annual budgets of the Energy Department’s Advanced Research Projects Agency (“ARPA-E”), which could have been the point of the spear in an appropriately massive state-sponsored response to climate change, have never exceeded a meager \$300 million since inception.⁸

All this is to say that, even before the Trump Administration took office, the US federal government had markedly reduced its participation in the Innovation Economy. One initiative, however, deserves mention. The initial fiasco surrounding the launch of the Affordable Care Act’s online portal, www.healthcare.gov, on October 1, 2013, generated a crisis response now legendary within the IT community.⁹ In turn, that response was institutionalized in the US Digital Service, dedicated to “using design and technology to deliver better services to the American people.”¹⁰ But note: here the federal government was playing catch-up with the digitalized private sector, not leading the wave of innovation as it had done from the first projects to construct computers through the conception and launch of what became the internet. Even so, as of this writing, the fate of the USDS remains, at best, uncertain.¹¹

Unfortunately, there is no uncertainty about the attitude of the Trump Administration with respect to science and its relevance to public policy-making. A simple comparison of two websites – that of the Office of Science and Technology Policy (“OSTP”) in the outgoing Obama Administration¹² and that of OSTP more than six months into the Trump Administration¹³ – provides definitive, graphic evidence.

⁷ National Institutes of Health, “Actual Total Obligations by Center, FY 2000–2016.” Available at [https://officeofbudget.od.nih.gov/pdfs/FY17/Actual%20Obligations%20By%20IC%20FY%202000%20-%20FY%202016%20\(V\).pdf](https://officeofbudget.od.nih.gov/pdfs/FY17/Actual%20Obligations%20By%20IC%20FY%202000%20-%20FY%202016%20(V).pdf).

⁸ ARPA-E Budget. Available at <https://arpa-e.energy.gov/?q=arpa-e-site-page/arpa-e-budget>.

⁹ See, for example, <https://www.wired.com/2014/06/healthcare-gov-revamp>.

¹⁰ <https://www.usds.gov>.

¹¹ See, for example, “Should We Be Worried about the Future of the U.S. Digital Service?” Available at <http://mashable.com/2017/04/24/the-future-of-the-us-digital-service/#YBZUQpohJiq2>.

¹² <https://obamawhitehouse.archives.gov/administration/eop/ostp>.

¹³ <https://www.whitehouse.gov/ostp>.

The Status of the Digital Revolution

Beyond the federal government and across the world, the digital revolution has taken on a life of its own, as discussed in the new Chapter 12 of this second edition. In fact, as Uber and Airbnb establish themselves as exemplars of the “sharing economy,” the relationship has inverted: now the need is for responsive but responsible amendment of established regulatory frameworks for the provision of services in the real, physical economy, and in the terms of employment of those who deliver them. The digitalization of work and its management by algorithm is driving that radical liberalization of labor markets, long sought by the advocates of free markets, to unsustainable extremes. Contrariwise, the formation of guilds of Uber drivers and Facebook-Friend collectives among Wal-Mart employees may be the first signs of an endogenous response to the ultimate commoditization of labor by algorithm.

In fact, the digital revolution is barely half-done. Once again, it has taken fifty years to deploy its transformational fixed and mobile broadband networks, just as it took roughly the same time to construct the railways and the electricity grids of previous technology-driven new economies. And the layers of abstraction required to insulate users from the complexity of the network infrastructure are just now becoming demonstrably available by way of the increasingly thick and rich “cloud” that delivers computing resources of all sorts and the mobile apps that provide access to them.

As with those prior revolutions, we may expect that it will take another fifty years to realize the full economic and social consequences of digitalization.¹⁴ While the speed with which innovations can be deployed globally has undoubtedly accelerated, definition of the underlying inventions that will become economically significant is likely to be subject to the same latency – constrained by the human imagination, not by machine learning – that delayed introduction of retail mail order to the railway economy. Any realized acceleration may be attributed to the absolute increase in the humans that are doing the imagining and the enhanced ease with which they can communicate with each other.

¹⁴ For a uniquely informed and perceptive evaluation of that transformation, see T. O’Reilly, *WTF: What’s the Future and Why It’s Up to Us* (New York: Harper Collins, 2017).

The Productivity Puzzle

Such considerations put the current productivity puzzle into perspective. Here is the puzzle: even while digital connectivity has become ubiquitous, the growth in reported productivity has slowed markedly with only a transient surge during the Internet Bubble of the late 1990s. But the slowdown has been markedly uneven. A range of measurement issues infest the quantification of the increasingly virtualized, increasingly service-oriented economy. Separately, recent research by the Organisation for Economic Co-operation and Development (OECD) has documented that – across industry sectors, in services as in manufacturing, throughout the developed world – the “best” firms, the top 1–5 percent in performance, have stayed on trend.¹⁵ The “rest,” the lagging 90+ percent, have fallen further and further behind. As William Gibson put it: “The future is already here, it’s just not evenly distributed.”

Something like this seems to have happened during the age of electrification: average productivity growth in US manufacturing slowed markedly from the end of the nineteenth century into the 1920s, precisely when that generation’s great speculative boom was funding the deployment of regional electricity grids.¹⁶ Here is a possible explanation. Prior to the availability of the “just-plug-it-in” network, those who wanted the benefits of electricity had to buy their own generators and motors and hire their own electrical engineers. Henry Ford could, but the rest had to wait. And in the 1930s, the USA experienced the most rapid growth in manufacturing productivity in its history as the firms that survived the Crisis of 1929–1933 found ready access to the transformational technology of their day.¹⁷

¹⁵ D. Andrews, C. Criscuolo and P. N. Gal, “The Best versus The Rest: The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy.” Available at http://www.oecd-ilibrary.org/economics/the-best-versus-the-rest_63629cc9-en.

¹⁶ P. David, “The Dynamo and the Computer: An Historical Perspective on the Modern Productivity,” *American Economic Review*, 80 (2) (May 1990), pp. 355–361. A recent summary of the issues and possible explanations is provided by E. Brynjolfsson, D. Rock and C. Syverson, “Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics,” National Bureau of Economic Research Working Paper 24001 (November, 2017).

¹⁷ A. J. Field, *A Great Leap Forward: 1930s Depression and U.S. Economic Growth* (New Haven, CT: Yale University Press, 2011).

Similarly, today, those who want to exploit the unique attributes of the digital economy – above all, its generation and capture of data available to be mined for meaning by the new techniques of machine learning – have had to build and manage their own data farms and hire their own data scientists. Now Amazon and Microsoft and Google – the leaders in cloud computing – are competing to offer “analytics in the cloud,” “machine learning in the cloud” and, yes, “artificial intelligence in the cloud.”

Yet there is another dynamic process of disequilibrium at work. Reported average productivity growth will improve as the “rest” gain access to these tools of the maturing digital economy. During my working lifetime, the value to be captured from computing moved from hardware to software. Now, as correctly anticipated by Tim O’Reilly, who has served as the most prescient guru of the industry and its impact for a generation, it is moving from software to data. Those at the frontier of machine learning testify that “more data” is to be valued above “better algorithms,” for it is more data that makes algorithms better, thus enabling more valued services and the capture of yet more data.

Here is an organic engine of positive feedback that means the “best” can continue to accelerate, increasing market share and profit potential. Already there is evidence of this phenomenon, not only in the fact that the digital platform companies – Alphabet (Google), Amazon, Apple, Facebook, Microsoft – are the most valuable companies in the world and dominate the markets they serve. It is also itself contributing to income inequality, with the productivity of these “superstar firms” showing up in relative inter-firm compensation versus the lagging “rest.”¹⁸ Reflecting the technological and economic reach of these firms – from the essential infrastructure of the digital economy to control of the data it generates – sooner or later modes of regulatory response are to be expected: in fact, the European Commission has already taken the activist lead.¹⁹

¹⁸ D. Autor, D. Dorn, L. F. Katz, C. Patterson and J. Van Reenen, “The Fall of the Labor Share and the Rise of Superstar Firms,” MIT Working Paper (2017). Available at <https://economics.mit.edu/files/12979>.

¹⁹ European Commission, “Antitrust: Commission Fines Google €2.42 Billion for Abusing Dominance as Search Engine by Giving Illegal Advantage to Own Comparison Shopping Service,” June 27, 2017. Available at http://europa.eu/rapid/press-release_IP-17-1784_en.htm.

The Return of Financial Speculation . . . With a Difference

Unlike the US Government, the second source of capital for funding innovation at the frontier is again actively engaged, but with an important difference. The unprecedented speed with which the new leaders of the digital economy have reached unprecedented scale has generated another phenomenon, itself unprecedented in the annals of financial speculation: the Unicorn Bubble. The flow of funds from passive institutional investors to private companies has been at a scale that approaches the flow of funds to the liquid spawn of the Internet Bubble in the late 1990s. Yet these investors today are valuing their *illiquid* investments at premiums to broadly comparable public equivalents.

From the perspective of entrepreneurs and the venture capitalists who have backed them, this flood of funding from passive institutional investors appears to be the best of all possible, of all imaginable, worlds. It comes without the regulatory baggage of the public equity markets and, thus, more than compensates for the fact that access to those markets has been highly constrained since the end of the Internet Bubble of 1998–2000. And it has freed the recipients from the discipline I promulgate in the pages that follow, the discipline of “positive cash flow from operations” as the source of “corporate happiness.” That, of course, is why thoughtful practitioners such as Bill Gurley, co-founder of the leading venture capital firm Benchmark Partners, have expressed strong concern about the excesses that the Unicorn Bubble has generated.²⁰

The Unicorn Bubble has been motivated by FOMO, “fear of missing out.” Its targets have generally been ventures that address potential users numbered in the hundreds of millions if not billions, providing digitally enabled services previously impossible to construct or deliver – ventures like Uber or Airbnb. Building businesses with the potential to rival Alphabet (Google) or Facebook in scale and valuation, indeed, requires access to billions of dollars.

It is worth pausing to note how fundamental a change this represents from the world in which I practiced as a venture capitalist. I have added a “Post-script to Part II” that discusses in detail the transformation of the enterprise software industry as a domain for venture investment. No

²⁰ See, for example, “Benchmark’s Bill Gurley Says He’s Still Worried about a Bubble.” Available at <https://www.recode.net/2016/9/12/12882780/bill-gurley-benchmark-bubble-venture-capital-startups-uber>.

longer a field for building sustainably successful new businesses, investing in enterprise software start-ups is properly considered to be funding research and development for established acquirers. This is a worthy economic goal, one that has been the model from the outset for venture capitalists focused on biotechnology. But it does represent a sea-change from the rather more heroic role available in the enabling phase of the digital revolution, from roughly 1970 through 2000, as documented and celebrated in the first half of the book that follows.

It does not take extraordinary insight or courage to predict that the Unicorn Bubble, too, will burst, as all before it have. In addition to FOMO, it has been supported by the aggressive search for return in a capital market environment where the real risk-free rate of interest has been zero to negative since 2008. Thus, it is systemically exposed to the withdrawal of central bank support of interest rates at such historically low levels. It is also exposed in granular fashion to “marks to reality,” as some subset of the Unicorns actually do go public and trade in liquid markets below their private valuations. When it does burst, the fact that this bubble is entirely unleveraged means that the damage caused will be limited to those “wannabe winners” who fail to reach positive cash flow from operations and to the careers of the risk-seeking investment managers who forgot that there is a reason why illiquid assets should be valued at a substantial discount to liquid ones.

Loss of Political Authority

There remains one other exposure at the foundations of the Innovation Economy – indeed, at the foundations of market capitalism. Five years ago I wrote:

Loss of authority by those charged with directing the state will always undermine the confidence of participants in the markets of financial capitalism.²¹

I was thinking then specifically of the collapse in the credibility of political leadership in the United States and Germany in 1931–1932 and, more recently, in the feedback from Watergate to the stagflationary world in which I served my apprenticeship more than forty years ago.

²¹ Janeway, *Doing Capitalism*, p. 31

Writing today, it is impossible not to anticipate a comparable crisis of confidence in American leadership. Indeed, the Trump Administration has already demonstrated a remarkable capacity for incoherent incompetence, mixing messages and undermining commitments and thereby generating confusion, at best, at home and around the world. In Britain, too, the shock of Brexit has been followed by installation of a “weak and wobbly” minority government charged with responsibility for managing the most disruptive peacetime transition in modern British history.

In June 1933, at the bottom of the Great Depression, a new American President “torpedoed” the World Economic Conference, called to mobilize international collaboration in support of the Gold Standard and its constraints – its “golden fetters”²² – on national economic policy. FDR’s refusal to participate freed the United States to pursue a path of economic recovery with *positive* externalities for the rest of the world (as Keynes at the time honored him for doing). Now, a new American President, by withdrawing from the Paris Climate Accord, has imposed an existential *negative* externality on the world. More broadly, the President’s attack on science and the funding of science is pulling out one of the essential props of the Innovation Economy.

It is already possible to imagine that, in retrospect, the most lasting legacy of this Administration will have been its contribution to accelerating China’s advance to global leadership, assuming its own version of the Three-Party Game remains sufficiently stable. At Davos in January 2017, Xi Jinping presented himself and China as the new champions of free trade, in contrast to the incoming President’s denunciation of existing and prospective trade agreements. Inevitably, this puts me in mind of the assertion made 175 years ago by the great (and appallingly neglected) German economist Friedrich List:

Any power which by means of a protective policy has attained a position of manufacturing and commercial supremacy can (after she has attained it) revert with advantage to a policy of free trade.²³

Britain so qualified and acted in 1846, as did the United States almost exactly 100 years later, in 1945; now, China. Such emergence goes hand

²² B. Eichengreen, *Golden Fetters: The Gold Standard and the Great Depression, 1919–1939* (Oxford University Press, 1992).

²³ F. List, *The National System of Political Economy*, trans. Sampson S. Lloyd, 1885 edn. (New York: Augustus M. Kelly, 1966 [1841]), p. 11.

in hand with China’s massive, state-sponsored investments in both AI research and green/clean technology. A new concluding chapter pulls together these threads to cast light on “The Dark Side of the Three-Player Game.”

The Next New Economy

China has leveraged western subsidies for the deployment of renewable energy sources to become the world leader in the production of solar cells and wind turbines and now stands to establish the position in the next new economy – the Green Economy – that the USA has held through the digital revolution.²⁴ Withdrawal from the Paris Accord is symbolic speech, dramatizing American abdication at the level of national statement of purpose. More destructive substantively is Trump’s nomination and Senate approval of a Secretary of Energy and a Director of the Environmental Protection Agency each committed to reversing the half-steps taken to date. Yet, even with active American participation in turning the aspirations of the Paris Accord into working programs, effective response to climate change was bound to be painfully slow.

The technology does continue to improve apace, with a variety of innovative approaches increasing the efficiency of solar cells toward “grid-equivalence” – that is, competitive with the cost of electricity produced from fossil fuels. But there are a host of complementary inventions required, most especially radical improvements in energy storage to accommodate intermittent sources of power. And the transformation in energy consumption – both through carbon taxes and more direct regulations – remains beyond the bounds of political feasibility even in nations that embrace the reality of climate change and the inevitability of state-sponsored response on both the demand and supply sides of the economy.

In the absence of the mission-driven US state that accelerated all of the technologies that combined to create the digital revolution, computing as a general-purpose technology would still have emerged during the second half of the twentieth century. Its maturation into the networked digital economy in which we now live would have occurred

²⁴ See <https://www.theguardian.com/environment/2017/jan/06/china-cementing-global-dominance-of-renewable-energy-and-technology>.

far more gradually and haphazardly, no doubt. But its benefits would only have been deferred, as would the costs imposed on disrupted participants in the legacy economy. The problem with delay in building the Green Economy is that global warming won't wait.

New Economic Ideas

And yet, and yet . . . John Vogelstein, who hired me into Warburg Pincus almost thirty years ago, used to say: "A pessimist cannot survive as a venture capitalist." And there is one source of optimism of strategic significance. I concluded the first edition of this book with reference to the impact of the Global Financial Crisis on the discipline of economics:

I did not expect to live to see the economics I had absorbed at Cambridge more than forty years ago – the economics of Keynes; of uncertainty at the level of the individual investor, consumer, firm and government; and of consequent instability at the level of the integrated financial economy – again become so relevant and so broadly recognized as such within the discipline.²⁵

Woven throughout this book are examples of the sins of omission and commission attributable to mainstream neoclassical economics. A striking example of the former is the failure to integrate the necessary waste generated by trial-and-error innovation into a theory of economic growth. A striking example of the latter is the contribution that modern finance theory made to the great credit bubble that imploded in the Global Financial Crisis of 2008–2009. From today's perspective, we can see that populist rejections of established institutions and their leaders, most visibly in the United States and United Kingdom, fed on the failure of mainstream neoclassical macroeconomics even to allow for the possibility of a Global Financial Crisis and Great Recession, let alone to anticipate such a destructive rupture.

Yet, in intellectual terms, the Crisis and the consequent Recession are the gifts that keep on giving. They have motivated an enormous range of empirical exploration: first, into the processes that generated the

²⁵ W. H. Janeway, *Doing Capitalism in the Innovation Economy: Markets, Speculation and the State* (Cambridge University Press, 2012), p.282.

financial “sudden stop” and, then, into the processes that resonated through the real economy with unanticipated persistence, and – of greatest importance – into the transmission mechanisms between the two. And from this wealth of new empirical research theoretical constructs responsive to and reflective of observable, real-world behavior are beginning to emerge. The new Coda at the end of this second edition calls out salient examples of this work.

Keynes began his *General Theory* by stating that its composition had been “a long struggle of escape . . . from habitual modes of thought and expression.” And escaping from the habitual modes of neoclassical economics instantiated in the Efficient Markets and Rational Expectations Hypotheses will no doubt be even more arduous for those endowed with less creative and contrarian intellectual force – and that must be almost all of us – than Keynes. The struggle will be worth the effort. For Keynes concluded the *General Theory* with this contrast between the power of vested interests, as evident in his day as in ours, and the power of ideas:

I am sure that the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas. Not, indeed, immediately, but after a certain interval . . . But, soon or late, it is ideas, not vested interests, that are dangerous for good or evil.

The new economic ideas generated from the Financial Crisis and its economic consequences are dangerous for good. Most importantly, if we are to change the world, to reconfigure the American version of the Three-Player Game so that it can again generate positive outcomes, best that first we understand how it is structured and how it functions. So we invert Marx, whose gravestone reads: “The philosophers have only interpreted the world, in various ways. The point, however, is to change it.” If *we* are to change the world, we must apply ourselves to interpreting it in all its messy reality.