

## Doing Capitalism in the Innovation Economy

Legendary economist Hyman Minsky identified author William H. Janeway as a “theorist-practitioner” of financial economics; this book is an expression of that double life. Interweaving his unique professional perspective with political and financial history, Janeway narrates the dynamics of the Innovation Economy from the standpoint of a seasoned practitioner of venture capital, operating on the frontier where financial speculation intersects with novel technology. In this fully revised and updated edition, Janeway develops his theory that asset bubbles play a central role in financing technological innovation and that state investment in national goals enables the innovation process. Now, the digital revolution, sponsored by the state and funded by speculation, has matured to attack the authority, and even the legitimacy, of governments. The populist response in the West, especially in the United States, opens the door for China to seize leadership of the Innovation Economy from America.

WILLIAM H. JANEWAY has been an active venture capital investor for more than forty years. In particular, he built and led the Warburg Pincus Technology Investment team that provided the financial backing to a series of companies that made critical contributions to building the internet economy. He received his Ph.D. in Economics from Cambridge, where he has endowed the Cambridge Endowment for Research in Finance and the Janeway Fund for Economics, and is an affiliated member of the Economics Faculty. He is a member of the Board of the Social Science Research Council, of the Institute for New Economic Thinking and of the Fields Institute for Research in the Mathematical Sciences.

## Advance Praise

“Since its original publication, Bill Janeway’s *Doing Capitalism* has become a classic, helping to launch the digital revolution and explaining how venture capital has leveraged state investments and financial bubbles to change the world through technological innovation. In this new edition, he looks at the past to predict the future, explaining how the digital revolution has grown and taken on a life of its own – and letting us know, with clarity and insight, what comes next.”

*Eric Schmidt*  
*Technical Advisor and Former*  
*Executive Chairman, Google and Alphabet Inc.*

“*Doing Capitalism in the Innovation Economy* is a brilliant (and also much-needed) breath of fresh air. Bill Janeway tells about capitalism as it really is: from his joint perspective as leading-venture-capitalist/leading-economic-theorist.”

*George Akerlof*  
*Nobel Laureate in Economics, 2001*

“Bill Janeway’s double hat of venture capitalist and economist brings a fresh perspective to bear on the political, economic and financial forces behind innovation. This second edition complements the first by tackling new and really important questions, such as the perception of slower productivity growth, the flood of passive investor capital in search of yield in a low-interest world, or the US disengagement of the state. From the analysis of bubbles as speculative funding through the importance of assured access to cash, *Doing Capitalism in the Innovation Economy* is key reading for all those interested in the future of innovation.”

*Jean Tirole*  
*Nobel Laureate in Economics, 2014*

“Bill Janeway nails it again. Yes: the innovation game has changed one more time, with different roles for the Three-Player Game that Janeway defined and so accurately portrayed in the first edition. Technological innovations primarily focused on hardware gave way to those focused on software, which, in turn, gave way to services, which is now giving way to data as the source of competitive advantage. Each of the changes requires a shift in how you play the innovation game. But this last shift will have dire consequences for those who don’t fully understand just how fundamental it is. This book is a must-read.”

*John Seely Brown*  
*Former Chief Scientist, Xerox Corp,*  
*and Director of Xerox Palo Alto Research Center (PARC)*  
*Advisor to the Provost, University of Southern California*  
*Co-Chairman, Deloitte Center for the Edge*

“Anyone who thinks that innovation is driven by the rational market-driven processes of standard economic theory understands neither the history nor the practical reality of innovation. Bill Janeway understands them a lot and has thought deeply about the implications. The result is a superb book which not only debunks mainstream theory but explains the crucial roles which both governments and the private sector must play to drive the innovation which society needs.”

*Lord Adair Turner*  
*Chair of the Institute for New Economic Thinking*

“The world has never been more in need of the economic and political insights of Bill Janeway. I can think of few books that have taught me as much as this one. It will help you see the world around you more deeply – how we got here, where we want to go, and how to renew our faith in our institutions and our future. It is wise, insightful, and rich with economic history, the personal stories of a brilliant investor, and an essential call to action for business leaders, investors, and policy makers.”

*Tim O’Reilly*  
*Founder and CEO O’Reilly Media;*  
*Partner, O’Reilly Alphatech*

“This one-of-a-kind book bringing together insights about venture capital, macroeconomics and the future of technology is now more timely than ever. How to reconcile the dynamism of 21st-century technology with the disappointing sluggishness of economic growth and persistent stagnation of wages is one of the great intellectual challenges of our age. The explanation, Bill Janeway suggests, lies at the junction of technology and finance. There is no one better qualified than the author to help us navigate that dangerous intersection.”

*Barry Eichengreen  
George C. Pardee and Helen N. Pardee Professor  
of Economics and Political Science  
University of California, Berkeley*

“Neither Adam Smith’s nor Henry Ford’s picture of the economy is relevant for us today. What thumbnail picture is relevant? We do not know, but Bill Janeway thinks harder and more successfully about this question than anybody else I have seen.”

*J. Bradford DeLong  
Professor of Economics, University  
of California, Berkeley*

## Praise for the First Edition

“William H. Janeway, a key creator of modern venture capital, tells the amazing story of the intersection of economics and innovation. This book is essential to anyone who wants to understand technology and how its creation will be financed for decades to come.”

*Marc Andreessen, co-creator of the internet browser,  
co-founder of Netscape and Andreessen Horowitz*

“When the despair of troubled economic conditions compels us to yearn for a better time, our fantasies gravitate to a savior called innovation. To discern whether such yearning attracts us to a mirage or to a sound basis for hope requires a discriminating and experienced mind. I know of no better mind in this realm than Bill Janeway, whom Hyman Minsky called a theorist-practitioner of financial economics. He has spent 40 years at the forefront of venture capital and financial economics. He takes us beyond mechanical details and reveals the deeper processes and interactions between state, market and finance that can foster and/or inhibit technological progress. *Doing Capitalism* leaves the neoclassical economic framework in tatters. It is a historically grounded and sophisticated look at how our society must rise to the challenges of collective action under radical uncertainty and integrate institutions on many levels to bring about the betterment of our human condition. This fine work will deepen your understanding of what innovation entails and impart a vision that will both surprise you, and inspire you, to move beyond your prejudices, whatever your political persuasion.”

*Rob Johnson, Executive Director of the Institute  
for New Economic Thinking*

“This is, quite simply, the only book I have read that does justice to the necessary interplay between the market of real goods and services, speculative financial markets, and the state. It is wise,

insightful, and rich with both economic history and the personal stories of a brilliant investor. If you want to understand the innovation economy, go no farther: read this book.”

*Tim O’Reilly, Founder and CEO O’Reilly Media;  
Partner, O’Reilly Alphatech*

“A powerful reinterpretation of capitalism, seen from above and lived from inside, by someone who is as much at home in the practical world of innovation and finance as in the abstract world of economic theory. Janeway’s book is a fascinating double dip from theory to reality and back. Indispensable for anyone in finance or academia, in policy or politics, wanting to act intelligently in the post-bubble world and beyond.”

*Carlota Perez, Professor of Technology and Socio-Economic Development, Tallinn University of Technology, Estonia, and LSE, Cambridge and Sussex Universities in England*

“This is a masterful historical and conceptual analysis of the Three Player Game between the state, private entrepreneurial innovation and financial capitalism. The state has a key role in funding scientific research that leads to innovation. Amply funded by financial capitalism, innovation is a source of long-term growth. But speculative funding of innovation is also associated with asset and credit bubbles that end up in financial crashes . . . A Minsky-inspired synthesis of the financial excesses of Schumpeterian creative destruction, this book should be required reading for all.”

*Nouriel Roubini, Professor of Economics at New York University and Chairman of Roubini Global Economics*

“A revelatory exploration of the complex dynamics underlying the innovation economy and the inherent roles of speculation and waste as experienced by one of the great venture capitalists and political/economic thinkers of our age. This book provides a powerful framework for dealing with the economic challenges we are facing today. It couldn’t have come at a better time!”

*John Seely Brown, Former Chief Scientist of Xerox Corp and Director of its Palo Alto Research Center (PARC)*

“I have never held orthodox financial theory in high regard. I do not find it useful. It presumes a stability and certainty of knowing about the future that is both wrong and dangerously misleading. Bill Janeway can see that. He is both a practitioner and a financial theorist and his book, *Doing Capitalism*, is serious new economic thinking on the process of innovation. This is a realm where standard economic treatments do not get to the heart of the matter – dealing with radical uncertainty. Janeway applies keen insights from his experience as a venture capitalist and creates a vision of the interaction between governments, financiers, and firms that shows what institutions society must develop to foster innovation. I believe that *Doing Capitalism in the Innovation Economy* will help all of us, whether academics, private sector leaders, or government officials, to see beyond shallow political dogma and move to a deeper understanding of challenges of technological advance.”

*George Soros, Chairman of Soros Fund Management*

“*Doing Capitalism* is a magnificent chronicle of how technology combined with economics to forge the beast that is today’s financial environment . . . A bravura literary debut.”

Cambridge Business Online

“Janeway, who built the technology investment team of Warburg Pincus, has a powerful message: an innovative economy ‘begins with discovery and culminates in speculation.’ Unfashionably, he insists that the state plays a central role in the innovative economy, as a source of funding for infrastructure and research and as a guarantor of stability when financial speculation ends in disaster, as it tends to do.”

*Martin Wolf, Financial Times (online),  
“Best Books of 2012”*

“. . . a tour de force with a solid thesis, excellent writing and exposition, and a history that too many have forgotten . . . or never knew. Brilliant!”

*John C. Bogle, founder of Vanguard*

“I highly recommend *Doing Capitalism in the Innovation Economy* by William H. Janeway. The author is a venture capital veteran who provides a fascinating glimpse into a rarified niche of the financial world, especially as to how VC firms funded the first modern technology start-ups of the 1970s and '80s.”

*Simon Towers, Associate Vice President and Group Manager,  
Center of Innovation for Tomorrow's Enterprise, Infosys Labs*

“... [an] original and thought-provoking book.”

*John Cassidy, The New Yorker*

“If you have ever wondered what the interplay of government, bubbles and venture capital have to do with innovation, this is the book for you ... *Doing Capitalism in the Innovation Economy* is rich in historical references and stories, wise in its philosophy, deep in its evaluation and observation; and a tribute to the life's work of an important investor and constructive thinker. This book is outstanding and deserves your time.”

*Wall Street Oasis (wallstreetoasis.com)*

“‘Some books,’ said Sir Francis Bacon, ‘are to be tasted, others to be swallowed and some few to be chewed and digested.’ From a lifetime of reflection and experience, Janeway has produced a book that should be chewed and digested thoroughly.”

*Sanjay Unni, Quantitative Finance*

“A rewarding memoir about the learning, training and life experience required to achieve mastery in the venture economy.”

*Kirkus Reviews*

“This is one of the most intelligent, sensible and insightful books about Wall Street published since the financial implosion of 2008.”

*Robert Teitelman, Slate*

“Janeway is a well-informed economist as well as a successful venture entrepreneur, and he argues for the importance of government in the nation’s economic growth.”

*Jeff Madrick, NYRB*

“Drawing on 40 years of experience in venture capital . . . Janeway offers detailed accounts of several incidents from history, emphasizing the role of the state. This . . . will find its ideal audience among the market-savvy.”

*Publisher’s Weekly*

Cambridge University Press  
978-1-108-47127-5 — Doing Capitalism in the Innovation Economy  
2nd Edition  
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# Doing Capitalism in the Innovation Economy

Reconfiguring the Three-Player Game  
between Markets, Speculators  
and the State

Second Edition

William H. Janeway



CAMBRIDGE  
UNIVERSITY PRESS

Cambridge University Press  
978-1-108-47127-5 — Doing Capitalism in the Innovation Economy  
2nd Edition  
Frontmatter  
[More Information](#)

**CAMBRIDGE**  
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom  
One Liberty Plaza, 20th Floor, New York, NY 10006, USA  
477 Williamstown Road, Port Melbourne, VIC 3207, Australia  
314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,  
New Delhi – 110025, India  
79 Anson Road, #06-04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

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[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781108471275](http://www.cambridge.org/9781108471275)

DOI: 10.1017/9781108558440

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First edition published 2012

Second edition published 2018

Printed in the United States of America by Sheridan Books, Inc.

*A catalogue record for this publication is available from the British Library.*

ISBN 978-1-108-47127-5 Hardback

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Cambridge University Press  
978-1-108-47127-5 — Doing Capitalism in the Innovation Economy  
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**In memoriam, Michael Janeway**

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Cambridge University Press  
978-1-108-47127-5 — Doing Capitalism in the Innovation Economy  
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Frontmatter  
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## 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

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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

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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.<sup>1</sup>

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.<sup>2</sup>

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

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

<sup>2</sup> 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,<sup>3</sup> 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

<sup>3</sup> 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.<sup>4</sup>

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.<sup>5</sup> And, beyond manufacturing, inequalities of income and wealth rebounded with the stock market after 2009, especially in the United States.<sup>6</sup>

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

<sup>4</sup> 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>.

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

<sup>6</sup> 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.<sup>7</sup> 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.<sup>8</sup>

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](http://www.healthcare.gov), on October 1, 2013, generated a crisis response now legendary within the IT community.<sup>9</sup> 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.”<sup>10</sup> 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.<sup>11</sup>

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 Administration<sup>12</sup> and that of OSTP more than six months into the Trump Administration<sup>13</sup> – provides definitive, graphic evidence.

<sup>7</sup> 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).

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

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

<sup>10</sup> <https://www.usds.gov>.

<sup>11</sup> 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>.

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

<sup>13</sup> <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.<sup>14</sup> 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.

<sup>14</sup> 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.<sup>15</sup> 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.<sup>16</sup> 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.<sup>17</sup>

<sup>15</sup> 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](http://www.oecd-ilibrary.org/economics/the-best-versus-the-rest_63629cc9-en).

<sup>16</sup> 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).

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

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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.”<sup>18</sup> 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.<sup>19</sup>

<sup>18</sup> 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>.

<sup>19</sup> 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](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.<sup>20</sup>

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

<sup>20</sup> 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.<sup>21</sup>

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.

<sup>21</sup> 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”<sup>22</sup> – 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.<sup>23</sup>

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

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

<sup>23</sup> 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.<sup>24</sup> 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

<sup>24</sup> 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.<sup>25</sup>

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

<sup>25</sup> 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.

## ACKNOWLEDGMENTS

This book would not have been conceived, let alone written, were it not for the goading and guidance of Richard Sennett. In the spring of 2009, Richard suggested that I assemble all my various writings over the near-forty years since the submission of my doctoral thesis into a “dossier” (his term). He agreed to read it through and offer his opinion as to whether a book might be developed from the assortment of published articles, private notes and more or less public lectures. Given his own extraordinary ability to render abstractions of experience into compelling literary form, as demonstrated in his many works that mediate between acute observation of how people live and work and sensitive interpretation of how they represent their living and working, this was not a proposal that I could refuse.

Richard’s oversight of my first drafts brought both encouragement and discipline to the project. As a book did, indeed, begin to emerge, I began to seek comments from a range of scholars. First, and repeatedly relevant in their responses, were Barry Eichengreen and Carlota Perez. They understood my purpose and endeavored to help me keep control of a manuscript that threatened to veer in its later chapters from strategic analysis toward commentary on current events. And Carlota Perez has generously granted permission for reproduction of the graphics that appear as Figure 9.2 and Table 9.1. As the book began to assume its final shape, constructive criticism was offered by Christopher Beaman, Mark Blyth, Craig Calhoun, Roman Frydman, Ira Katznelson, Henry Kressel, Paul Ricci, Jose Scheinkman, Til Schuermann and Catharine Stimpson. From their diverse domains of

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knowledge and analytical approaches, I have been privileged to receive questions, corrections and alerts, all of which have served to focus my efforts and the book's arguments. I must thank D'Maris Coffman of the Bartlett School of University College London for her contribution to my understanding of financial history generally, and, specifically, for her aid in constructing Figure 7.1.

In parallel with the process of writing and rewriting the manuscript, I refined ways of communicating its narrative and analysis through two different styles of rhetoric. In particular, the discussion of the evolving role of venture capital in Chapter 4 reflects lectures contributed to the courses in Entrepreneurial Finance taught by Professor Antoinette Schoar at MIT Sloan School of Management, and by Professor Alexander Ljungqvist at NYU Stern School of Business and Cambridge Judge Business School. The broader themes developed in the second half of the book variously arose in their nascent form as semi-formal presentations at each of two distinctive gatherings of people engaged in pushing the state of the art in information technology and deeply interested in the consequences thereof. I am very much indebted to Tim O'Reilly for my many opportunities to participate in the "FooCamp" and "SciFoo" gatherings that he originated and inspires, and to Mark Anderson for our repeated public conversations at his annual Future in Review conferences. Closer to home, I and this book have been the beneficiary of discussions with my wife Weslie, my son Charles, and my late brother Michael Janeway – discussions which in all three cases preceded by years my commitment to the writing, and carried through to its completion. My thanks to them for their never unquestioning support is boundless.

For this second edition, I must also spread thanks across the successive classes of students in the M.Phil. in Finance and Economics at the Faculty of Economics of the University of Cambridge who have taken my course on "Venture Capital in the Innovation Economy." They have challenged me to evolve my thinking in step with the continuing evolution of the world the course addresses and – not a trivial task – to keep up with the increasingly relevant literature. A very special thanks in this regard goes to my colleagues in Cambridge's Economics faculty, including its Chair, Professor Sanjeev Goyal; to the Director of the Cambridge-INET Institute, Professor Giancarlo Corsetti; and especially to Professor Chris Harris, who oversees this M.Phil. program and

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who induced me to prepare and teach the course that emerged from the first edition of this book.

In addition, much of how I think about the ongoing digital revolution – spelled out in the new Chapter 12 of this edition – derives from conversations with Tim O’Reilly. His own new book, *WTF? What’s the Future and Why It’s Up to Us*, complements this book and enriches understanding of the transformation of the world in which we live and work. And Diane Coyle, the inaugural Bennett Professor of Public Policy in Cambridge University, helped clarify the issues raised by the “productivity puzzle” addressed in that chapter. The discussion of the transformation of the enterprise software industry provided in the “Postscript to Part II” in this second edition benefited from discussion with my Warburg Pincus colleague Raj Kushwaha. Carlota Perez and Til Schuermann have provided thoughtful comments on the Conclusion. And the review of new economic ideas in the Coda has benefited greatly from comments by George Akerlof and Daniel Goroff.

When I circulated a mature manuscript of what became the first edition, Chris Harrison of Cambridge University Press signally determined that this hybrid work of a “theorist-practitioner” of entrepreneurial finance could be worthy of publication. His support and sponsorship have been constant. A word of thanks must go to my more-than-copy editor of that first edition, Meg Cox, whose representation of the lay reader has contributed to the translation of much that was arcane into common speech. And now my thanks also go to Phil Good of Cambridge University Press who has shepherded this second edition into print, and to Leigh Mueller, its dedicated copy-editor.

After all aid solicited, offered and received, I do affirm my own sole responsibility for all errors of commission and omission and interpretation that reside herein.

Cambridge University Press  
978-1-108-47127-5 — Doing Capitalism in the Innovation Economy  
2nd Edition  
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