CONCLUSION: THE DARK SIDE OF THE THREE-PLAYER GAME

This book has been a celebration of the collaboration of government with entrepreneurs at the technological frontier, with a parallel focus on how the economic consequences of their productive collaboration have been accelerated and amplified by financial speculation. From World War II through the 1970s, national security provided the legitimizing rationale for state funding of the invention and initial deployment of all the components of the digital revolution. Through the great bull market that began in the early 1980s and climaxed in the Internet Bubble at the end of the 1990s, financial capitalism increasingly focused on the promise of the new economy that has now emerged in the aftermath of the Global Financial Crisis and the Great Recession. This has been a historically constructive configuration of the Three-Player Game.

But the game goes ever on. Endogenously, the interactions amongst the players shift the configuration of the game as revealed in the changed distributions of power and rewards across the public and private sectors. Today, two generations of productive collaboration have yielded place to a paralyzed and delegitimized American state. It is proving itself incapable of either effective response to the distributional consequences of its own past success in sponsoring the digital revolution or effective leadership in the next great challenge, response to climate change. It has been increasingly co-opted by players from the market economy, where extreme inequality has been accompanied by measurable increases in industrial concentration and a decline in economic dynamism. Financial speculation among American investors persists as a motivation for funding ventures, but is substantially focused on the continued exploitation of the digital infrastructure and seems barely aware – Elon Musk's Tesla aside – of the opportunities represented by the next new, green economy.

It is hard to gain perspective from within the game as it is playing out in real time. But one giant caveat looms over any consideration of the relationship between the state and the market economy. As discussed in Chapter 11, the relatively recent and still fragile intersection of political democracy and market capitalism was strained to the breaking point during the 1930s.[1] Now that omnipresent potential for conflict presents itself again. For each set of institutions lays claim to legitimacy in allocating resources and distributing the returns from their employment. And the reciprocal interaction between them generates powerful incentives to deploy power accumulated in one to capture rents available in the other.

Martin Wolf of the *Financial Times* has meditated on the subject:

> Democracy and capitalism rest on an ideal of equality: everybody may share in political decision-making and do the best they can in the market. These freedoms were revolutionary not that long ago.
>
> Yet deep conflicts also exist. Democratic politics depends on solidarity; capitalists do not care about nationality. Democracy is local; capitalism cares little about the distribution of riches. Democracy says all citizens have a voice; capitalism gives the rich by far the loudest. Electorates desire some economic security; capitalism is prone to boom and bust.
>
> The tensions between national democracy and global capitalism can be ruinous, as the 1930s proved. Yet history also shows that the two systems do go together, albeit uneasily.
>
> This is not to argue that all market economies are democracies or that all market economies must be globalised. It is to argue that stable democracies also possess at least reasonably open market economies. No alternative way of managing the affairs of complex societies has proved workable. The aim must now be to manage capitalism so that it supports democracy and to manage democracy

[1] Daniel Treisman of UCLA has recently published a fascinating study of the advent of democracy across the world since 1800. He finds that some two-thirds of such was triggered by mistakes on the part of ruling elites, rather than by deliberate choice: D. Treisman, "Democracy by Mistake," National Bureau of Economic Research Working Paper 23944 (October 2017).

> so that it makes global capitalism work better for all. Today, we are making a mess of this marriage. We must do far better.[2]

Across the developed world, out of this tension have arisen both more or less comprehensive social safety nets, on the one hand, and limits to the freedom to deploy economic power for political advantage, on the other. In the USA, however, attempts to bound the power of money in the political process have failed comprehensively. The complex and contested path through which the Supreme Court in *Citizens United* determined that corporate contributions to political campaigns are "speech" protected by the First Amendment has been traced by a team of academics in detail.[3] Their work is complemented by Larry Bartels's exhaustive study of the sources and consequences of America's "unequal democracy."[4]

Along with the rest of the western world, America's troubled political economy has been subject to the accelerating digitalization of activities that has both transformed labor markets and enabled an unsustainable degree of global economic integration. Together with the financialization of economic activities, which reached its self-destructive peak at the onset of the Global Financial Crisis as discussed in Chapter 8, the result has been the emergence in the world's most technologically advanced nation of a "dual economy," so identified by the distinguished economic historian Peter Temin: an upper sector with 20 percent of the population, whose incomes have continued to rise with (albeit slower) productivity growth, and the lower 80 percent whose real wages have stagnated since the 1970s.[5] This is the consequence in terms of economic demography of the cumulative divide in terms of productivity and compensation of the Best versus the Rest.

The model of a dual economy was developed by Sir Arthur Lewis some sixty years ago. It juxtaposed a modernizing capitalist

[2] M. Wolf, "Capitalism and Democracy – the Odd Couple," *Financial Times*, September 19, 2017. Available at https://www.ft.com/content/cec2664c-9a2e-11e7-b83c-9588e51488a0.

[3] R. H. Bloch and N. R. Lamoreaux, "Corporations and the Fourteenth Amendment," and A. Winkler, "*Citizens United*, Personhood, and the Corporation," in N. R. Lamoreaux and W. J. Novak (eds.), *Corporations and American Democracy* (Cambridge, MA: Harvard University Press, 2017), pp.268–325.

[4] L. M. Bartels, *Unequal Democracy: The Political Economy of the New Gilded Age*, 2nd edn. (Princeton University Press, 2016).

[5] P. Temin, *The Vanishing Middle Class: Prejudice and Power in a Dual Economy* (Cambridge, MA: MIT Press, 2017), p.4.

sector with a pre-existing subsistence sector that offered up "unlimited supplies of labor." Created to explore the dynamics of economic development by the poorest post-colonial nations, its evident relevance for the United States is a shocking commentary on the contemporary state of the nation.[6] Its persistence demonstrates the inability of the American political process to respond adequately to the impact of the digital revolution on the market economy.

In the short run, the political repercussions have been extreme, as represented most dramatically by Donald Trump's election as President. In the longer run, American leadership of the Innovation Economy is at stake. Whether or not Trump proves to be a transient aberration in the life of the American republic, for the time being the US government is playing no role in fashioning what Carlota Perez terms the "Green Golden Age."[7] At the last historic turning point in the 1970s, when the mass production / mass consumption economy ran out of steam, as it were, the US government had already taken the lead in driving the new digital technologies to their readiness for commercial deployment at transformational scale. Now, when climate change offers a legitimizing rationale for state initiatives, the United States – alone among the major economic powers – is missing in action.

Delegitimizing the State

The process through which the American state was rendered illegitimate as an economic actor has deep roots. The first of these began in the realm of public relations but was rapidly translated into the domain of ideas. Even as the USA mobilized for total war in the aftermath of Pearl Harbor, American business organized to win the competition for recognition as the driving force in building and operating the "arsenal of democracy"

6 W. A. Lewis, "Economic Development with Unlimited Supplies of Labor." Available at https://la.utexas.edu/users/hcleaver/368/368lewistable.pdf. Fifty years ago, I had the privilege of taking Lewis's graduate seminar at Princeton, little thinking that it would prove relevant to reading the American political economy two generations thence.

7 C. Perez, "Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future," in M. Mazzucato and M. Jacobs (eds.), *Rethinking Capitalism,* special issue of *Political Quarterly* (Wiley Blackwell, 2016), chap. 11. See the discussion of Perez's work in Chapter 9.

that won the war.[8] When the feared postwar return to depression conditions failed to materialize and, instead, the American economy made the transition to peacetime boom with minimal friction, business's standing was confirmed. As David Hart summarized the experience:

> The boom … continued for more than three years, took a slight dip in 1949, and then resumed. Under these conditions of "exhilaration," rather than "stagnation," the government could cheer on private enterprise, put its books in order, even begin to retire the war debt … The war redeemed the reputation of business.[9]

Although the Republican majorities elected to Congress in 1946 did attack one important element of the New Deal when the Taft–Hartley Act of 1947 materially shifted the balance of federal support away from trade unions, President Eisenhower rejected any comprehensive effort to repeal the New Deal outright "from his election" in 1952 through his two terms in office. Big-state capitalism was institutionalized by the combination of the limited welfare state inherited from FDR and extended by LBJ and the new peacetime warfare state sanctioned by the stand-off with the Soviet Union. Beneath the surface, however, a campaign to constrain the scope and scale of the state's economic role was under way, conducted by one of the most successful ideological initiatives in modern history. Established in 1947, the Mont Pelerin Society mobilized to counter "a decline of belief in private property and the competitive market; for without the diffused power and initiative associated with these institutions, it is difficult to imagine a society in which freedom may be effectively preserved."[10] Its intellectual father was Friedrich Hayek, author of *The Road to Serfdom*; its most visible apostle was Milton Friedman.

The resurgence of business as a political force had been anticipated in the middle of World War II by Michael Kalecki, a Polish economist who, independently from Keynes, developed a theoretical understanding of how an economy could fail to reach and maintain

8 M. R. Wilson, *Destructive Creation: American Business and the Winning of World War II* (Philadelphia: University of Pennsylvania Press, 2016), chap. 3.

9 D. M. Hart, *Forged Consensus: Science, Technology and Economic Policy in the United States, 1921–1953* (Princeton University Press, 2010 [1998]), p.152.

10 Mont Pelerin Society, Statement of Aims, available at https://www.montpelerin.org/statement-of-aims.

full employment of resources.[11] Like Keynes, Kalecki focused on the volatility of private-sector investment. Like Keynes, he reckoned that the public sector would be required to supplement inadequate rates of private investment. In 1943, he went further, to identify the consequences of state success in generating full employment. Kalecki characterized "the future [postwar] economic regime" in loaded but prescient terms:

> In the slump . . . public investment funded by borrowing will be undertaken to prevent large-scale unemployment. But if attempts are made to apply this method in order to maintain the high level of employment reached in the subsequent boom, strong opposition by business leaders is likely to be encountered . . . [since] lasting full employment is not at all to their liking. The workers would "get out of hand" . . . Moreover, the price increase in the upswing is to the disadvantage of small and big rentiers . . .
>
> In this situation, a powerful alliance is likely to be formed between big business and rentier interests . . . The pressure of all these forces . . . would most probably induce the government to return to the orthodox policy of cutting down the budget deficit. A slump would follow in which government spending policy would again come into its own.
>
> The pattern of a political business cycle is not entirely conjectural; something very similar happened in the USA in 1937–8.[12]

It was this "powerful alliance" that was the engine of the Mont Pelerin Society's victory.

Kalecki correctly foresaw that, as and when the commitment to full employment generated inflation and squeezed profits, "more than one economist" would "declare that the situation was manifestly unsound." Many more than one economist responded when the priority given to full employment culminated in cost-push inflation, hugely amplified by the first oil crisis of 1973. The previously observed trade-off between inflation and unemployment – the Phillips Curve – appeared to collapse. As inflation and unemployment rose in parallel, what had

[11] For an informed review of Kalecki's work, see J. Toporowski, "Michale Kalecki's Legacy," an interview with Jan Toporowski. Available at https://www.worldeconomicsassociation.org/newsletterarticles/michal-kalecki/. The article "Political Aspects of Full Employment" was published in the *Political Quarterly* and is available at http://delong.typepad.com/kalecki43.pdf.

[12] Kalecki, "Political Aspects," p. 5.

been a standard guide to policy, indicating whether stimulus or restraint was in order, failed.[13] Thus, the opportunity arose for the ideas of the Mont Pelerin Society to be implemented to further the interests of its business allies.

The Contribution of Economic Theory

Within academia, the apparent breakdown of the Phillips Curve created a historic opening for Robert Lucas of the University of Chicago. From the late 1960s, Lucas and his colleagues had been working to complete the neoclassical program by showing that rational agents operating in the markets of the economy would render any policy initiatives ineffective by shifting their behavior in response to the state's interventions. The expectations of those rational agents would dominate the purposes of the policy-makers.

The assertion that expectations matter was, of course, as central to the economics of Keynes as it is to the economics of Lucas. For Keynes, expectations are necessarily precarious, to use his term, and behavior consequently unstable. For Lucas, in diametric contrast, expectations are defined to be rational in terms of the stationary neoclassical model of the world, which all actors are assumed to share and which is asserted to be true. When participants in efficient markets are defined as exhibiting rational expectations, only unanticipated shocks can have even a transient effect on economic outcomes. What's more, the greater the shock, the more rapidly will the system revert to its equilibrium, full-employment growth path.

The theoretical appeal of the Lucas Critique reflected its insistence that macroeconomics be derived consistently from microfoundations. Rational expectations themselves are internally consistent by definition, at the expense of decoupling those who are asserted to hold them from the manifestly inconsistent and uncertain world in which human beings actually live.[14] Hence arose the fatal undermining of the

[13] As recounted in Chapter 2, this was the shock to economic theory and econometric practice that led me to "discover computers."

[14] See R. E. Lucas Jr., "Nobel Lecture: Monetary Neutrality," *Journal of Political Economy*, 104(4) (1996), pp.661–682. For an accessible and insightful review of the rise of the Rational Expectations Hypothesis as the capstone of the Efficient Market Hypothesis, see J. Cassidy, *How Markets Fail: The Logic of Economic*

neoclassical synthesis of the "bastard Keynesians." To Keynes's followers in Cambridge, England, Paul Samuelson and his colleagues in Cambridge, Massachusetts, had skimmed the surface of Keynes's economics to invoke discretionary macroeconomic policy as capable of assuring that all resources could always be counted on to be fully employed. Now, the apparent failure in practice of Keynesian macroeconomic policy in the face of stagflation rendered Keynesian macroeconomic theory vulnerable to the charge of internal inconsistency.

Broad acceptance of the Rational Expectations revolution was reinforced by two exercises in overreaching by those in charge of the state during the 1970s. In the United States, Richard Nixon imposed peacetime wage and price controls, an unprecedented exercise in opportunism that contributed to his landslide re-election in 1972. In the United Kingdom, later in the decade, the Labour government then in power attempted to fend off inflation through an "incomes policy" that depended on voluntary restraint on the part of its allied labor unions. Both initiatives failed, and in failing they legitimized the libertarian program to roll back the state, implemented to varying extents in Britain and America by the Thatcher and Reagan administrations, respectively.

There is a historical irony here whose significance extends beyond the realm of academic economic theory. At the time of the first oil shock, very few analysts and commentators – one of them was Richard Cooper of Harvard – correctly read the quadrupling of oil prices by the OPEC governments' cartel as a massive excise tax imposed on energy consumers in the advanced countries, industrial and residential alike.[15] Radically augmenting already apparent cost-push wage inflation, it drove up the cost of doing business and, as producers sought to maintain profit margins, it also drove up prices and the cost of living. But it *was* a tax: cash was drained from energy-deficit economies, where the propensity to consume was high, and flowed to the underdeveloped producing states, so global aggregate demand was depressed. No wonder that unemployment and inflation were observed to rise in tandem.

Reducing the impact of this tax depended on increasing the elasticity of demand and the elasticity of substitution with respect to

Calamities (New York: Farrar, Straus and Giroux, 2009), pp.97–107, and P. Mehrling, *The New Lombard Street: How the Fed Became the Dealer of Last Resort* (Princeton University Press, 2010), pp.88–89.

15 See R. Cooper, "Oil and the International Monetary System," in Patrick Boarman and David Tuerck (eds.), *World Monetary Disorder* (New York: Praeger, 1976).

energy – that is, increasing the efficiency of energy production and consumption while reducing the cost of switching to non-petroleum sources. But this investment was not forthcoming from the private sector as profit margins were squeezed and the economy slumped while interest rates rose with inflation. Even with international banks incentivized to recycle petrodollars back into the western financial system and with the prod of state initiatives such as minimal fuel standards for autos, this was the work of years. So the intellectual revolution that expelled the state from the market economy was validated by a willed misreading of the economic consequences of state action by OPEC.

In Chapter 8, we explored how the Rational Expectations Hypothesis combined with the Efficient Markets Hypothesis to constitute a framework for explaining away the dynamics of speculation in financial markets. But the significance of the Lucas Critique and the REH intellectual revolution reached much further, to reconstitute the content of economics comprehensively.

Once upon a time, all economics (like Caesar's Gaul) had been divided into three parts: the *Allocation* of resources, the *Distribution* of income, and the *Stabilization* of the economy as a whole. Under REH and EMH, *Allocation* ate economics. *Distribution* disappeared as a focus both of research and of policy since, under competitive conditions, efficient markets will reward the factors of production with compensation equal to their marginal contribution to output: what could be more fair than that? Then, by embodying the required microfoundations of macroeconomic models in a "representative rational agent," *Stabilization* disappeared, given that the representative rational economic agent would act to offset government interventions as she pursued her own optimizing course of action. Moreover, any threat to economic stability from the financial system was eliminated, since that representative agent was both debtor and creditor, issuer and investor: the two sides of the relationship collapsed into nothingness.

At Chicago, Ronald Coase went further, attacking the deeply embedded concept of market failure when externalities are generated by economic activities. The classic negative externality is pollution; the classic positive externality is the lighthouse. In each instance, a cost and a benefit, respectively, are generated but not priced into the system of exchange. Hence the legitimacy of corresponding state taxes and subsidies, the case for which was definitively made in Cambridge

Professor Arthur Pigou's *Economics of Welfare* in 1920.[16] Coase demonstrated theoretically that, abstracting from the real-world existence of transaction costs, market participants could negotiate the efficient, optimum compensation for externalities with no government intervention.[17] Coase's expulsion of the state from the micro-markets of the economy played a central role in Chicago's successful colonization of legal theory, known as "law and economics."[18]

Thus, economic theory provided an intellectual foundation for President Reagan's notorious assertion in his first inaugural address: "government is not the solution to our problem, government is the problem." This was the political appeal of the Lucas Critique, and it was powerful. It was also, of course, a statement that would have been rejected out of hand by the founders of the digital economy, from Route 128 to Silicon Valley.

Through the Bush, Clinton and Bush II Administrations, the domestic reach of state underwriting of economic life was substantially reduced. In the aftermath of 9/11, once again national security was invoked to legitimize the extension of state power, reaching from programs of domestic surveillance to seemingly perpetual military intervention in the Middle East. And, as recounted in Chapter 11, the Global Financial Crisis briefly compelled state intervention of the most extreme sort around the world.

In 2008, the macro-models of mainstream economics were structurally incapable of anticipating or explaining the Global Financial Crisis, when a panicked rush for cash in the face of heightened uncertainty decoupled demand and supply. Nor could the models account for the disastrous effect on the real economy of disruption in the availability and cost of credit. Fortunately, the intellectual entrepreneurs of REH and the interests that supported them had not completed their political agenda.

[16] A. C. Pigou, *The Economics of Welfare*, Palgrave Macmillan Classics in Economics (London: Palgrave Macmillan, 2013 [1920]).

[17] R. Coase. "The Problem of Social Cost," *Journal of Law and Economics*, 3 (1960), pp.1–44.

[18] For a critical discussion of the rise of law and economics in the context of a deep historical reading of market fundamentalism, see B. E. Harcourt, *The Illusion of Free Markets* (Cambridge, MA: Harvard University Press, 2011), chap. 6. For an agenda aimed at reconstructing law and (new) economics, see M. T. McClusky, F. A. Pasquale and J. Taub, "Law and Economics: Contemporary Approaches," August 13, 2016, and 35 *Yale Law & Policy Review* 297 (2016), pp.297–308, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2728030.

Big Government was still of sufficient scale to save capitalism from itself. But its longer-term, strategic role in economic affairs was compromised, as the premature turn to austerity demonstrated.

While the digital revolution continued to generate its own momentum beyond any need for state support, substantive initiatives to foster the next new, green economy were dead on arrival in Washington. At the end of November 2010, the late Ralph Cicerone, then President of the National Academies of Sciences and a renowned climate scientist, came to Cambridge to lecture on the occasion of the fiftieth anniversary of Churchill College. He arrived directly from a confrontation with the new Republican leadership of the relevant committees of the House of Representatives. He recounted a one-sided, non-conversation that went as follows:

> We understand: all this talk about global warming is so that you can take control over our lives. What *you* need to understand is that, if it happens, as far as we're concerned it will be God's will.

Even while the rest of the world, from Germany to China, began to formulate means of responding to climate change, the policy process in Washington was frozen. The hugely contentious passage of the Obama Administration's Affordable Care Act catalyzed the Republican congressional victory in 2010. Historian Gary Gerstle, in his analysis of the complex dance through the American twentieth century of two conceptions of nationalism – inclusive "civic" versus exclusive "racial" nationalism – identifies a deeper, more troubling force at work:

> For all the civic nationalist hope Obama's election unleashed, it also became the occasion for remobilizing racial nationalist sentiment on an epic scale, much of it centering on a powerful conviction that no black man, even one that was half-white, had a right to sit in the White House. White fears about Obama were magnified by what people's eyes and the nation's demographers were telling them: the country was in the process of becoming nonwhite. Not just the White House but also the country was being "lost." The hopes and despair coursing through Obama's America revealed how much the two contrary nationalist traditions that defined the country since its beginning still mattered, and how much they still organized the country's political and cultural life.[19]

[19] G. Gerstle, *American Crucible*, 2nd edn. (Princeton University Press, 2017), p.376.

Thus, Washington was not only frozen in the face of the long-term, existential challenge represented by global warming. It was also singularly unequipped to deal with the immediate economic and political effects of the multiform consequences of the digital revolution it had nurtured and hosted.

Globalization and Automation

Even while the legitimacy of the state was being undermined, the consequences of its previous catalytic role were accumulating. Over a short generation, digital technologies radically reduced the frictions that inhibit the movement of goods and services, people and capital. As defined by Dani Rodrik of Harvard's Kennedy School, the result is a Political Trilemma. We can choose to maintain national autonomy, representative political institutions or deep economic and financial integration – two out of three:

> If we want to push globalization further, we have to give up either the nation state or democratic politics. If we want to maintain and deepen democracy, we have to choose between the nation state and international economic integration. And if we want to keep the nation state and self-determination, we have to choose between deepening democracy and deepening globalization . . .
>
> Even though it is possible to advance both democracy and globalization, the trilemma suggests this requires the creation of a global political community that is vastly more ambitious than anything we have seen to date or are likely to experience soon.[20]

The facts of globalization can be stated in brief:

- From 1995 through 2007, the value of international trade rose from about one-fifth to almost one-third of world GDP.[21]
- Between 2000 and 2015, the number of resident international migrants rose by 40–45 percent across all regions.[22]

[20] D. Rodrik, *The Globalization Paradox: Democracy and the Future of the World Economy* (New York: W. W. Norton, 2011), pp. xviii–xix.

[21] World Trade Organization, International Trade Statistics 2015. Available at https://www.wto.org/english/res_e/statis_e/its2015_e/its2015_e.pdf.

[22] United Nations, International Migration Report 2015. Available at http://www.un.org/en/development/desa/population/migration/publications/migrationreport/docs/MigrationReport2015_Highlights.pdf.

- Average yearly cross-border flows of capital doubled as a percentage of GDP, from 6.2 percent to 13.3 percent, between the 1990s and 2000–2007.[23]
- In just five years, from 2002 to 2007, the claims of US banks on European banks tripled to $1.6 trillion, and the reverse claims of European banks on US banks rose from $1 trillion to $2.6 trillion.[24]

It was the international flow of capital that globalized the US subprime mortgage fiasco into a general economic crisis. But it is the movement of goods and people that has provoked the most extreme political responses.

The same digital capabilities that enabled the second great globalization have directly attacked the legacy structures of the market economy. Of course, the impact of technological innovation on employment has had a long and disruptive history: back to the "Luddites" and displaced handloom weavers of the First Industrial Revolution through the mass industrialization of the Second. The most comprehensive analysis of current data concludes that "the raw count of jobs available in industrialized countries is roughly keeping pace with population growth" as the decline in employment in the primary (agricultural) and secondary (manufacturing) industries has been offset by increased employment in the tertiary (service) industries. But the distribution of jobs in the service industries is highly skewed between high-skilled, well-paid jobs that "are out of reach to [*sic*] workers without a college education" and low-skilled, low-paid jobs that "do not offer a stable, sustainable standard of living."[25]

With respect to manufacturing specifically, the empirical evidence overwhelmingly attributes the decline in employment to automation rather than to imports.[26] And yet the political consequences of

[23] E. James, K. McLoughlin and E. Rankin, "Cross-border Capital Flows since the Global Financial Crisis," *Bulletin of the Royal Bank of Australia*, June 2014. Available at http://www.rba.gov.au/publications/bulletin/2014/jun/pdf/bu-0614–8.pdf.

[24] Bank for International Settlements, Locational Banking Statistics. Available at http://www.bis.org/statistics/bankstats.htm.

[25] D. Autor and A Salomons, "Does Productivity Growth Threaten Employment?" Available at https://www.ecbforum.eu/uploads/originals/2017/speakers/papers/D_Autor_A_Salomons_Does_productivity_growth_threaten_employment_Final_Draft_20170619.pdf.

[26] See D. Acemoglu, D. Autor, D. Dorn, G. H. Hanson and B. Price, "Import Competition and the Great US Employment Sag of the 2000s," *Journal of Labor Economics*, 34(S1), Part 2 January (2016), S141–S198.

perceived job losses to foreign trade have been extreme, even beyond the terms of Trump's presidential campaign. Thus, David Autor and his colleagues summarize their study of the polarizing impact of increased import competition on politics at the congressional level:

> [W]e find strong evidence that congressional districts exposed to larger increases in import competition disproportionately removed moderate representatives from office in the 2000s. Trade-exposed districts initially in Republican hands become substantially more likely to elect a conservative Republican, while trade-exposed districts initially in Democratic hands become more likely to elect either a liberal Democrat or a conservative Republican. Polarization is also evident when breaking down districts by race: trade-exposed locations with a majority white population are disproportionately likely to replace moderate legislators with conservative Republicans, whereas locations with a majority non-white population tend to replace moderates with liberal Democrats.[27]

A similar analysis of the regional incidence of the China trade shock on Britain showed a corresponding increase in the Leave share of the vote in the Brexit referendum of June 2016.[28]

The international flow of people is politically even more sensitive, despite the demonstrable economic benefits that immigrants bring to the host country. There could scarcely be two more ideologically opposed think tanks than the right-wing Manhattan Institute and the left-wing Economic Policy Institute. But on this subject they agree. The Manhattan Institute offers the assertion: "Immigration benefits the economy, and America must adopt more flexible immigration policies that spur growth."[29] And the Economic Policy Institute provides the evidence:

> For the United States as a whole, immigrants' share of total output was about 14.7 percent over 2009–11. Note that this is actually larger than immigrants' 13 percent share of the population . . .

[27] D. Autor, D. Dorn, G. Hanson and K. Majlesi, "Importing Polarization: The Electoral Consequences of Rising Trade Exposure," MIT Working Paper (December 2016), abstract. Available at https://economics.mit.edu/files/11499.

[28] I. Colantone and P. Stanig, "Global Competition and Brexit," unpublished paper, Bocconi University (September 28, 2016). Available at ftp://ftp.unibocconi.it/pub/RePEc/baf/papers/cbafwp1644.pdf.

[29] D. Furchtgott-Roth, "The Economic Benefits of Immigration," Manhattan Institute, February 5, 2013. Available at https://www.manhattan-institute.org/html/economic-benefits-immigration-5712.html.

> Immigrants . . . are disproportionately likely to be working and are concentrated among prime working ages. Indeed, despite being 13 percent of the population, immigrants comprise 16 percent of the labor force. Moreover, . . . the share of immigrant workers who own small businesses is slightly higher than the comparable share of U.S.-born workers.[30]

Surprisingly enough, in the face of Trump's central focus on the threat posed by illegal immigrants, especially from Mexico, American attitudes on the economic impact of immigrants have grown substantially more positive over the past decade. Among all adults, the proportion of those polled by the Pew Research Center in the heat of the 2016 election campaign who agreed that immigrants "help" American workers rose from 28 percent to 42 percent, while those saying they "hurt" fell from 55 percent to 45 percent.[31] Three-quarters of those polled included a "path to citizenship" among their preferred policies, up from less than two-thirds three years ago. And a clear majority reject the "wall," even while Trump's commitment to his "beautiful wall" on the Mexican border represented perhaps his most effective appeal to nativist rage. In Britain and more broadly across Northern Europe, immigrants generally and refugees in particular triggered right-wing populist reactions, the most destructive of which fueled Britain's vote to leave the European Union.

Rodrik has reflected on the differential response to globalization:

> Globalization had a big upside. It greatly expanded opportunities for exporters, multinational companies, investors, and international banks, as well the managerial and professional classes who could take advantage of larger markets. It helped some poor countries – China in particular – rapidly transform farmers into workers in manufacturing operations for export markets, thereby spurring growth and reducing poverty. But the decline in global inequality was accompanied by an increase in domestic inequality and cleavages.[32]

[30] Economic Policy Institute, "Immigrants and the Economy." Available at http://www.epi.org/publication/immigration-facts.

[31] Pew Research Center, "Americans Less Concerned than a Decade Ago over Immigrants' Impact on Workforce," October 7, 2016. Available at http://www.pewresearch.org/fact-tank/2016/10/07/americans-less-concerned-than-a-decade-ago-over-immigrants-impact-on-workforce.

[32] D. Rodrik, "Populism and the Economics of Globalization," National Bureau of Economic Research Working Paper 23559 June (2017), p.21.

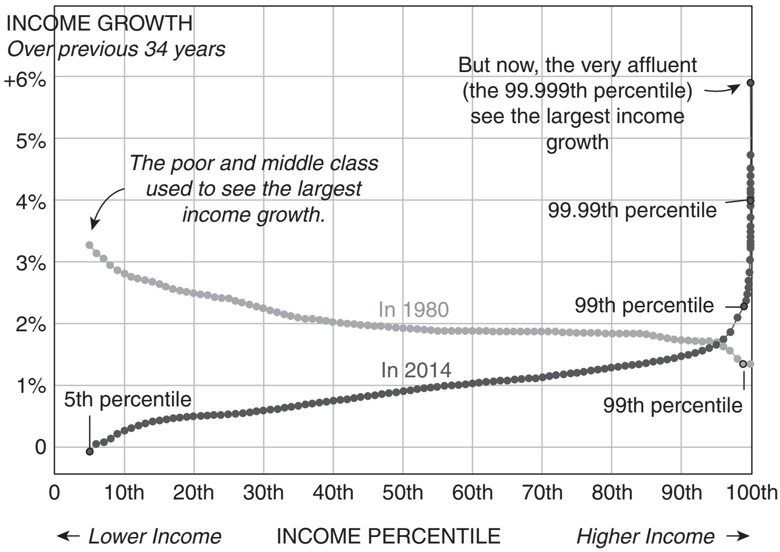
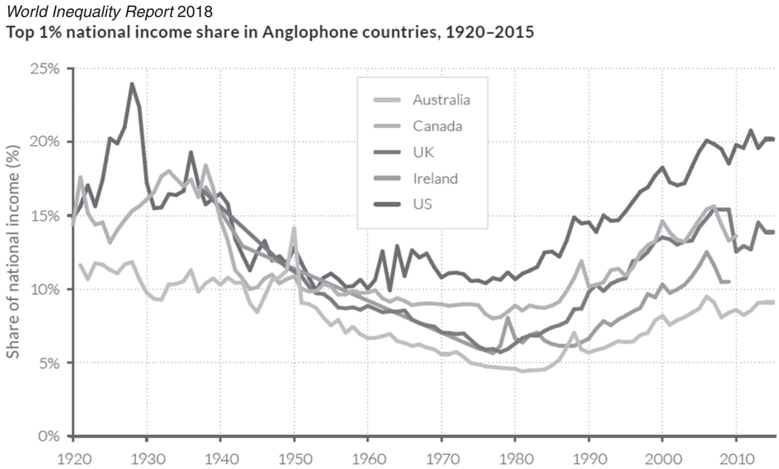


Figure C.1 Our broken economy, in one simple chart.
Source: D. Leonhardt, "Our Broken Economy in One Simple Chart," *New York Times,* August 10, 2017, adapted from the work of Thomas Piketty, Emmanuel Saez and Gabriel Zucman, available at https://www.nytimes.com/interactive/2017/08/07/opinion/leonhardt-income-inequality.html?_r=0.

If the virtue of economics is efficiency and that of politics is fairness, little wonder that large segments of the American electorate should have little regard for "the gains from trade" which too many economists simplistically celebrate. On the contrary, the cumulative political consequences of a generation of rising inequality have been increasingly visible since the credit bubble burst in 2008. Gabriel Zucman of Berkeley has illustrated the radically different rates of growth in income (post-taxes and transfers) over the past generation, versus the generation up to 1980, as one moves up the distribution, with the extreme break occurring since 1980, indeed, at the 99th percentile (Figure C.1).

In truth, as shown in Figure C.2, the English-speaking world appears substantially distinctive in its tolerance for the extremes of inequality, relative to other developed nations, with the share of income going to the top 1 percent in the USA, and the UK returning to levels last seen before World War I, while Canada and Australia lag not far behind, in contrast with continental Europe and Japan.[33] And yet, as the rise of nativist movements across all of Northern Europe testifies, a

[33] World Wealth and Income Database at http://wid.world.



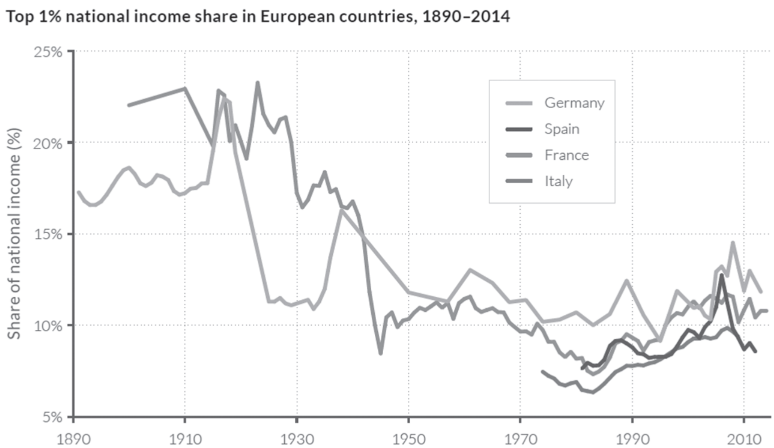


Figure C.2 Share of total income going to the top 1 percent, 1920–2015. The top figure is reproduced courtesy of the World Wealth and Income Database, www.wid.world. The bottom figure is from Alvaredo F, Chancel L, Piketty T, Saez E, Zucman, G. 2017. World Inequality Report 2018. (A paper version will be published by Harvard University Press this year; reference given in http://www.hup.harvard.edu/catalog.php?isbn=9780674984554)

significantly more comprehensive social safety net and more progressive tax regime do not insulate political elites from populist rebellion.

Rodrik explores why it has been globalization rather than digitalization that has triggered the transnational populist response:

> Globalization was hardly the only shock which gutted established social contracts. By all accounts, automation and new digital technologies played a quantitatively greater role in de-industrialization and in spatial and income inequalities. But globalization became tainted with a stigma of unfairness that technology evaded. People thought they were losing ground not because they had taken an unkind draw from the lottery of market competition, but because the rules were unfair and others – financiers, large corporations, foreigners – were taking advantage of a rigged playing field.[34]

The populist opportunity reflects two cleavages in society: an ethno-national cleavage between a native majority and foreign or otherwise distinguishable minorities, and an income/class cleavage between the rich and the rest. The sort of populism that emerges reflects the choice of cleavage targeted for exploitation. In this instance, the United States has been distinctive for hosting both forms of populism, while Europe has witnessed a divergence in the northern nations, where right-wing populism targets the ethno-national cleavage, in contrast with the left-wing populism evident in Southern Europe that corresponds to the classically leftist populism of Latin America.[35]

This is not the first time that the excessive flows of globalization have produced political crises and haphazard, unmanaged, disruptive and destructive retreat. Harold James of Princeton is the most distinguished historian of globalization: his book *The End of Globalization* analyzed the decline and collapse of the international political economy from 1914 through the Great Depression and World War II.[36] More recently, he reflected on "the phenomenon of globalization," which, he wrote, "has . . . become a ubiquitous way of understanding the world, but people who used the concept . . . failed to understand its volatility and instability." Writing in the depth of the Global Financial Crisis, he emphasized:

> [G]lobalization generates continuous uncertainty about values, both in a monetary and a more fundamental (nonmonetary) sense.
>
> Globalization is vulnerable to periodic financial catastrophes which involve very sudden alterations of concepts of value . . . [O]ur values themselves are reevaluated . . .

[34] *Ibid.* [35] *Ibid.* 24.

[36] H. James, *The End of Globalization* (Cambridge, MA: Harvard University Press, 2001).

> Politics and economics are inextricably and inherently linked, and politics provides an alternative to market mechanisms for the management of global crises.
>
> When breakdowns occur, reconstruction is extremely difficult and involves a long and arduous effort for the rebuilding of social trust.[37]

Since 2009, when James summarized his understanding of globalization and its discontents, the "political alternative" briefly served the world well, putting a floor under the financial collapse and its economic consequences. And yet, by failing to do more to cushion and constrain globalization's flows, those with political authority discredited themselves with constituencies sufficiently large to drive the shocks of Brexit and the Trump election and to threaten more to come. Mark Blyth puts it this way, "The era of neoliberalism is over. The era of neonationalism has just begun."[38]

During the retreat from globalization of 1914–1945, too often politics failed as "an alternative to market mechanisms for the management of global crises." Too often – most disastrously for Germany and the world in Berlin in 1933 – the political regime itself served to intensify the crisis. Today, we remain suspended in the paradox of politics. Securing financial stability and regenerating economic prosperity requires market interventions by governments deemed untrustworthy by broad segments of the populations they represent and are meant to serve.

From Leader to Follower?

What does this mean for the Innovation Economy? While the digital revolution continues under its own momentum, the legacy economy in which it is embedded appears stagnant: characterized by extraordinarily high profits in increasingly concentrated industrial sectors and a sustained slump in new business creation and labor mobility. Through a novel methodological approach, an important new paper by De Loecker and Eeckhout estimates that average mark-ups of price

[37] H. James, *The Creation and Destruction of Value: The Globalization Cycle* (Cambridge, MA: Harvard Univsersity Press, 2009), pp.7–9.

[38] M. Blyth, "Capitalism in Crisis: What Went Wrong and What Comes Next," *Foreign Affairs* (Summer 2016).

over cost – the canonical measure of effective market power – have increased since 1980 from about 18 percent to 67 percent. Some portion of this increase may reflect the economics of the new dominant, digital platform companies, characterized by vanishingly low marginal costs, as discussed in Chapter 12.[39] The authors ambitiously trace the effects of increased market power across the economy. In labor markets, the findings help explain falling low-skilled wages and decreased labor force participation which go with reduced movement of workers between jobs and across regions. In aggregate, the distributional consequences – the fall in labor's share and the rise in the share of capital along with profits – are accompanied by lower economic growth, the result of firms with market power maximizing profits at lower levels of output.[40]

The loss of economic dynamism shows itself in the life histories of those who have the opportunity to express themselves politically as well as in the market economy. Raj Chetty of Stanford orchestrates its far-reaching Equality of Opportunity Project. One chart (Figure C.3) dramatizes "the fading American dream," by illustrating the sustained decline in the percentage of children earning more than their parents at the same time of life.

Other analyses offer complementary evidence. The Silicon Valley-sponsored Economic Innovation Group reports a sustained decline in new business formation over the past forty years. More than one-third of US firms were more than sixteen years old in 2014, versus less than a quarter in 1992; they account for three-quarters of all jobs today versus 60 percent in 1992.[41] As a function both of mergers and acquisitions and of the decline in the number of IPOs, the number of public US companies has fallen from a peak of more than 8,000 in 2000 to slightly more than half of that number.[42] And upstream in the

39 I owe this insight to Martaan de Ridder of the Cambridge Economics Faculty.

40 J. De Loecker and J. Eeckhout, "The Rise of Market Power and the Macroeconomic Implications," National Bureau of Economic Research Working Paper 23687 (August 2017).

41 Economic Innovation Group, *Dynamism in Retreat: Consequences for Regions, Markets and Workers*, February 2017. Available at http://eig.org/wp-content/uploads/2017/07/Dynamism-in-Retreat-A.pdf.

42 World Bank Group, "Listed Domestic Companies, Total." Available at https://data.worldbank.org/indicator/CM.MKT.LDOM.NO?locations=US. A detailed analysis is provided in C. Doidge, G. A. Karolyi and R. M. Stulz, "The U.S. Listing Gap," *Journal of Financial Economics*, 123 (3) (March 2017), pp.464–487.

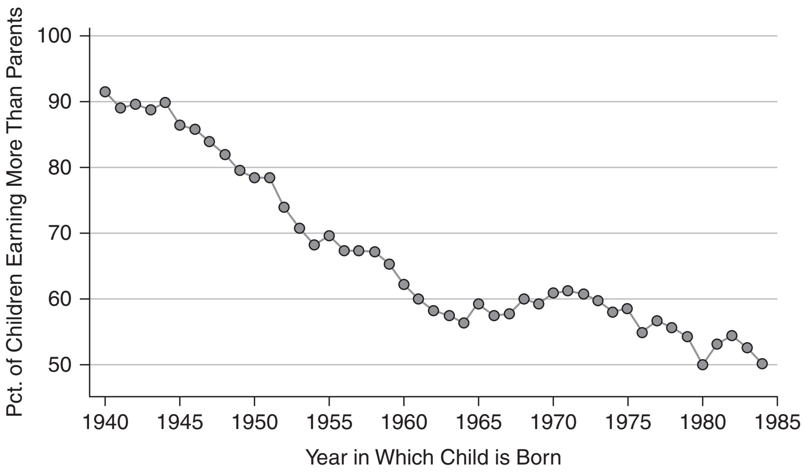


Figure C.3 The fading American dream.
Source: "The Equality of Opportunity Project." Available at http://www.equality-of-opportunity.org.

economy, Nick Bloom of Stanford and colleagues have generated a variety of examples to answer affirmatively the question "Are Ideas Getting Harder to Find?" In aggregate and across such disparate sectors as semiconductors and agricultural crops, they document that the number of dedicated researchers per incremental gain has increased radically over the past generation.[43]

A further, debilitating role is played by the extraordinary financialization of the American economy over the past generation, a process only temporarily reversed by the Global Financial Crisis. As discussed in Chapter 8, the institutionalization of the stock market means that the valuation of public companies is dominated by investors who cannot afford to be wrong for very long, or who – the index funds and ETFs – are contractually not allowed to take a contrary position against the market. In turn, the extension across established companies of stock options originally deployed to induce talent to move from established companies to start-ups, as discussed in Chapter 4, has served to align senior executives with the short-term focus of their dominant stockholders.

[43] N. Bloom, C. J. Jones, J. Van Reenen and M. Webb, "Are Ideas Getting Harder to Find?" National Bureau of Economic Research Working Paper 23782 (September 2017). Available at http://www.nber.org/papers/w23782.

The results can be observed in two independent, parallel phenomena. The first, as documented exhaustively by William Lazonick, is the massive application of corporate cash to stock buybacks in pursuit of immediate increase in shareholder returns.[44] The second is the shift of internal R&D expenditures from long-range research to short-term development, as identified by Ashish Arora of Duke and his colleagues.[45]

This is the context in which the United States has abdicated from leading the next technological transformation that is presenting itself with increasing urgency. Response to climate change has offered the potential for massive, job- and profit-creating investment in "greening" the world's economic infrastructure while simultaneously sponsoring the invention and deployment of alternative technologies for energy generation and for managing energy consumption. This is Carlota Perez's vision summarized above as the Green Golden Age. Here, Trump's unilateral withdrawal from the Paris Accord is the symbolic statement of rejection. Concurrent efforts to reverse and/or refusal to enforce relevant regulatory initiatives constitute the substantive retreat.

While the 2018 Budget proposed by the White House in May 2017[46] clearly has no function or future as the map of the federal government's actual spending in coming years, it does provide indications of intent that may be implemented by means that do not require – as the Budget does – congressional approval. One salient example is the proposed cancellation of funds for the Department of Energy's Advanced Research Projects Agency.[47] More broadly, with respect to the substance of policy, Trump's appointees at the Department of Energy and the Environmental Protection Agency have been effectively liquidating all regulations and initiatives that smack of reducing the generation of carbon or tilting the playing field toward alternative

[44] W. Lazonick, "The Value-Extracting CEO: How Executive Stock-based Pay Undermines Investment in Productive Capacities," Institute for New Economic Thinking Working Paper 54 (December 3, 2016).

[45] A. Arora, Z. Belenzon and A. Patacconi, "Killing the Golden Goose: the Decline of Science in Corporate R&D," National Bureau of Economic Research Working Paper 20902 (January 2015).

[46] Available at https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/budget.pdf.

[47] Appendix to 2018 Budget, p. 389. Available at https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/doe.pdf.

energy sources.[48] From substance back to symbol: a particular focus has been elimination of the words "climate change" from the official vocabulary.[49]

The Trump Administration's abdication has generated a countervailing response at state and local levels. The initiatives recall the discussion in Chapter 10 of how individual states adopted their own mercantilist programs of economic development when Henry Clay's "American Plan" was rejected at the federal level almost 200 years ago.[50] The most economically significant initiative is under consideration in California, the world's sixth-largest economy and long a leader in environmental regulation whose restrictions on auto emissions have had global effect.[51] After successive implementations of cap-and-trade carbon permits have failed to accomplish the goal sought, the state legislature is now considering amendments that would shift the program toward an outright carbon tax, approaching closer alignment with Canada.

But state and local initiatives can offer only limited offsets to a national administration determined to reject climate change as both a reality and a motive for action. For the time being, policy paralysis where legislative action is required appears the most likely outcome. What is certain is that purposeful, responsive, consensus leadership of the state – a central requirement for the Three-Player Game to function productively in support of innovation – is not available for the duration. We live on the dark side of America's Three-Player Game .

[48] For example, on September 29, 2017, the Department of Energy issued a Notice of Proposed Rulemaking to subsidize coal-fired generating plants. See *The National Law Review*, "Department of Energy Proposes Rule Benefiting Coal and Nuclear to FERC," October 3, 2017. Available at https://www.natlawreview.com/article/department-energy-proposes-rule-benefiting-coal-and-nuclear-to-ferc.

[49] J. Tollefson and A. Maxmen, "US Energy Agency Asks Scientists to Scrub References to Climate Change," *Nature*, August 25, 2017. Available at http://www.nature.com/news/us-energy-agency-asked-scientists-to-scrub-references-to-climate-change-1.22513.

[50] G. Tett, "How Trump Is (Accidentally) Making America Green Again,"*Financial Times*, July 7, 2017. Available at https://www.ft.com/content/52eaf26e-610d-11e7-8814-0ac7eb84e5f1.

[51] H. Tabuchi, "California Upholds Auto Emissions Standards, Setting Up Face-off with Trump," *New York Times*, March 24, 2017. Available at https://www.nytimes.com/2017/03/24/business/energy-environment/california-upholds-emissions-standards-setting-up-face-off-with-trump.html.

From Follower to Leader?

The rise of China as an economic force vies with maturation of the digital revolution as the most important phenomenon of the past generation. And its rise has been propelled in good part by the most extensive exercise ever in state-sponsored "appropriation" of the intellectual property invented by others. My friend Mark Anderson of Strategic News Service has been among the most aggressive and vocal students of this process through his "INVNT/IP Consortium,"[52] and the Trump Administration has positioned itself at least rhetorically in alignment.[53] In this respect, China's policies go beyond industrial espionage to the open and entirely rational determination to trade access to its massive and rapidly growing market for access to frontier technology. China's dependence on the inventiveness of others tracks the experience of all follower nations, from the United States in the nineteenth century to Japan and Korea in the twentieth, as reviewed in Chapter 10.

Efficient production of proven technology and incremental improvements thereto have generally been the responsibility of more or less officially sanctioned national champions, such as the Japanese keiretsu and the Korean chaebols. These East Asian tigers emulated the United States and Germany in the nineteenth century, recapitulating Britain's entire history of industrial development, from textiles onwards. But China may be the last emerging economy to reach the frontier while moving its population out of subsistence agriculture and raising living standards through manufacturing. Dani Rodrik has highlighted the challenge of digital automation's transformation of manufacturing for today's poor economies, for whom labor-intensive growth through manufacturing no longer exists as a relevant path to development.[54]

52 E. R. Anderson, "Theft Nation: How IP Theft Drives the Chinese National Business Model, and Its Effect upon the Global Economy," INVNT/IP Consortium, January 15, 2016. Available at https://store.stratnews.com/shop/theft-nation.

53 L. Wroughton and J. Mason, "Trump Orders Probe Of China's Intellectual Property Practices." Available at https://www.reuters.com/article/us-usa-trump-trade-china-idUSKCN1AU23N.

54 D. Rodrik, "Growth Without Industrialization?" *Project Syndicate*. Available at https://www.project-syndicate.org/commentary/poor-economies-growing-without-industrializing-by-dani-rodrik-2017–10.

As China moves to the frontier, it has found that radical innovation by trial and error has, once again, *not* been generated by the dominant industrial firms. When the great American technology corporations were still funding basic research in their central labs, their monopoly positions in the markets they served inhibited their ability to exploit the technologies derived therefrom. Three times I directly observed signal examples of such failure. During the 1980s, I witnessed repeated instances of "fumbling the future" at Xerox when none of the innovations delivered by PARC could measure up to the profits of the entrenched, patent-protected copier business.[55] Like all investors in the birth of client–server computing, I was an indirect beneficiary of AT&T's failure to capitalize on the extraordinary information technologies created within its Unix Systems Laboratory. And at BEA, I was both the direct beneficiary of AT&T's invention of Tuxedo and, in equal measure, of IBM's inability to sacrifice the profits from its proprietary products to compete directly in the new world of open and distributed computing.

Late in his career, Joseph Schumpeter reversed himself to express the view that large firms have an inherent advantage in innovation, relative to smaller enterprises.[56] But, as Josh Lerner summarizes the experience of the biotech and internet revolutions: "The enabling technologies were developed with government funds at academic institutions and research laboratories. It was the small entrants ... who first seized upon the commercial opportunities."[57] In defiance of Schumpeter's expectation, economic innovation has not been effectively bureaucratized by the great corporations. Rather, it tends to be delivered by new companies. But funding those new companies depends on access to financiers who, in turn, have access to financial markets prone to speculative excess.

This is the lesson both of my professional life as a practitioner and of my research into the sources of venture capital returns. And it is a lesson drawn not only from the most recent iteration of the Innovation

[55] D. K. Smith and R. C. Alexander, *Fumbling the Future: How Xerox Invented, then Ignored, the First Personal Computer* (San Jose, CA: Excel, 1999).

[56] J. A. Schumpeter, *Capitalism, Socialism and Democracy*, 4th edn. (London: Allen & Unwin, 2010 [1943]), pp.132–134.

[57] J. Lerner, *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do about It* (Princeton University Press, 2009), p.46.

Economy or from the long-term development of the British and American economies. Even in the bank-based industrial economies of Germany and Japan, the stock exchange played a critical role in funding aggressive investment in frontier technologies during their initial high-growth decades of the late nineteenth and early twentieth centuries, respectively.[58] The vast expansion of the German and Japanese banking systems took place to finance post-World War II recovery, precisely when innovation was a distraction from the defined task of literally reconstructing the physical assets of the economy.

China itself has been experiencing a radical shift in economic weight from low-productivity state-owned enterprises (SOEs) to high-productivity, entrepreneurial private firms under its gradualist, dual-track policy of economic development. China's rise has been characterized by the maintenance of extremely high returns on capital through twenty-five years of rapid growth accompanied by even higher rates of saving and the accumulation of massive foreign surpluses.

In conventional theory, rates of return should decline with capital accumulation and fast-growing developing countries should import capital, not export it. An important recent paper explores the dynamics of "Growing Like China," finding the explanation through the integration of economic and financial analysis. The SOEs were blessed with effectively unlimited access to capital from the equally state-owned banks, while the new firms were capital-constrained, relying on retained earnings to finance growth. As the share of output generated by the SOEs has declined, the banks have bought foreign financial assets with funds deposited by the savings of an increasingly prosperous population.

China's massive response to the Global Financial Crisis loosened the gradualist restraints on debt incurred by the SOEs and local governments, the effective agents of the central government's program of stimulus. And rising aggregate debt levels – from 1.2 times GDP to 2.1 times GDP in only seven years from 2008 to 2015 – accompanied by

[58] For Germany, see R. Tilly, "Public Policy, Capital Markets and the Supply of Industrial Finance in Nineteenth-Century Germany," in R. Sylla, R. Tilly and G. Torella, *The State, the Financial System and Economic Modernization* (Cambridge University Press, 1999), pp.134–157, and S. Lehmann-Hasemeyer and J. Streb, "The Berlin Stock Exchange in Imperial Germany: A Market for New Technology?" *American Economic Review*, 106(11) (2016), pp. 3558-3576. For Japan, see T. Hishi and K. Kashyap, *Corporate Finance and Governance in Japan: The Road to the Future* (Cambridge, MA: MIT Press, 2001), pp.3–27.

soaring house prices, have raised concerns of a looming financial crisis. These concerns were exacerbated by the $1 trillion decline in foreign exchange reserves in 2016 that triggered new, and apparently effective, capital controls.

Michael Song and Wei Xiong argue that the extraordinary rates of precautionary saving by households and firms, the central government's proven expertise in resolving insolvencies, and China's continued trade surplus combine to minimize the risk of a near-term debt crisis, internal or external. Rather, he warns that the long-term risk is from slowing growth due to inefficient investment, especially as firms join retail investors in real estate speculation. Yet, as China moves to the frontier across the spectrum of relevant technologies – from machine learning to photovoltaics – it, too, will be challenged to manage the necessary inefficiency that accompanies investment in necessarily unproven technologies.[59]

Maturation of the Chinese financial system can serve to rebalance the apparent anomalies, especially as external, speculative capital becomes available to the new, private economy with materially less of the corruption that previously infested it.[60] Yet liberalized capital markets initiate a significant new phase in China's own version of the Three-Player Game. The guiding role of the central government over almost forty years, in sponsoring the emergence of the market economy while supporting the continued existence of the SOEs, has been responsible for the most rapid and large-scale increase in human prosperity and productivity in history. But, on the margin, the emergence of highly speculative capital markets opens the door to the sort of gaming of policy by speculators that can mute if not overwhelm the effectiveness of policy initiatives.[61]

Despite China's stock market boom and bust in 2014–2015, recent data suggest that risk-seeking finance is increasingly available to support the Chinese version of the Innovation Economy. Since the end of the Internet Bubble in 2000, total IPOs completed in Asia have consistently outnumbered those in the Americas, and in many years have been

[59] Z. Song and W. Xiong, "Risks in China's Financial System" (2017), unpublished Available at http://www.princeton.edu/~wxiong/papers/Risk.pdf.

[60] Z. Song, K Storesletten and F. Zilibotti, "Growing Like China," American Economic Review, 101 February (2011), pp.196–233. See also L. Lucas, "China Tech Emerges as Global Hotspot for VC Capital," *Financial Times*, May 23, 2017. Available at https://www.ft.com/content/7389bc5a-3f91-11e7-9d56-25f963e998b2.

[61] M. K. Brunnermeier, M. Sockin and W. Xiong, "China's Gradualist Economic Approach and Financial Markets," *American Economic Review: Papers and Proceedings 2017*, 107(5) (2017), pp.608–613.

more numerous than those in both America and Europe combined. In the most recent data available as of this writing, through the third quarter of 2017, the 353 IPOs completed in Mainland China alone (not counting a further 103 in Hong Kong) totalled more than three times the number completed in the United States.[62] And China's own set of dominant digital companies – Alibaba, Baidu, Tencent – are aggressively constructing networks of ventures funded by their own monopoly profits.

As the opportunity emerges for China to take leadership of the Innovation Economy, the legitimacy of the Chinese state is unquestioned. And it is amply endowed with the bulwarks of autonomy: Cash and Control. In international terms, this means a current account surplus and ample reserves. The public signal, as in the case of Britain in 1846 and the United States a century later in 1945, is adherence to Free Trade. As the great German economist Friedrich List put it succinctly:

> 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.[63]

So Xi Jinping's championship of Free Trade at the World Economic Forum in January 2017 represented a coming of age for China.

A state so positioned can resist the persistent demands that public funds be deployed only on projects that are demonstrably "useful and productive" – that meet the test of static efficiency. For the leadership of the Innovation Economy depends on an entrepreneurial state that can play two roles as needed: to invest in speculative science and technology before commercially motivated firms and their investors can envision either an economic or financial return; and to ensure that the burden of Keynesian waste on economic growth is minimized.

As the public's cash is put to work, however, a prime challenge is to keep the "corruption tax" sufficiently small so as not to discredit the whole exercise, while disbursing funds freely enough to have substantive impact. Straightforward bribery is not the only form of corruption. Political earmarking of research funds is a soft version. Both were managed well enough when national security provided the rationale for

[62] Statista, "Leading Countries by Number of Company IPOs." Available at https://www.statista.com/statistics/274138/leading-countries-by-number-of-company-ipos;.

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

US leadership in information technology, and they have also been well managed for two generations by the NIH. Of course, managing investment in science responsibly ceases to be a relevant challenge when science itself is "sidelined" by a presidential administration.[64]

Taking into account this history, recent and ongoing developments in China are impressive. The war on corruption led by the "core leader" Xi Jinping is extensive and is now supplemented by a crackdown on entrepreneurial international dealmakers whose activities have contributed to the $1 trillion decline in the country's foreign exchange reserves.[65] And, critically, the Chinese state has been funding investments in fundamental science and technology at an increasing rate, while (finally) cracking down on widespread fraud in the publication of scientific research.[66]

Since 1996, China's spending on R&D has risen from 0.5 to 2.0 percent of GDP (the USA has been roughly flat at 2.8 percent).[67] Calculated at purchasing power parity by UNESCO, China is currently spending $370 billion, of which almost $60 billion is by state institutions and $25 billion by universities, versus US aggregate expenditures of $480 billion, of which about $55 billion is by state institutions and $85 billion is by universities and private non-profit entities.[68] Already, by 2010, China had become the world leader in clean energy investment[69] and has announced its increasing commitment through 2020 even as the USA pulls back.[70]

[64] See, for example, Union of Concerned Scientists, "Trump Adminstration Sidelines Science in Its First Six Months." Available at http://www.ucsusa.org/news/press-release/sidelining-science-six-months#.WaBy6CiGNUQ.

[65] L. Hornby, "Chinese Crackdown on Dealmakers Reflects Xi Power Play," *Financial Times*, August 9, 2017. Available at https://www.ft.com/content/ed900da6-769b-11e7-90c0-90a9d1bc9691.

[66] D. Normile, "China Cracks Down on Fraud," *Science*, 357(6350) (August 4, 2017), p.435.

[67] World Bank Group, "Research and Development Expenditure (% of GDP)." Available at https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=CN.

[68] UNESCO Institute of Statistics, "How Much Does Your Country Invest in R&D?" Available at http://uis.unesco.org/apps/visualisations/research-and-development-spending.

[69] Pew Charitable Trusts, "Who's Winning the Clean Energy Race: Growth, Competition and Opportunity in the World's Largest Economies," in *G20 Clean Energy Factbook* (Washington, DC: Pew Charitable Trusts, 2011).

[70] M. Forsythe, "China Aims to Spend at Least $360 billion on Renewable Energy by 2020," *New York Times*, January 5, 2017. Available at https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html.

Furthermore, China is reaching and even advancing the frontier in digital technologies. Its commitment to machine learning and AI is manifest and deployment of products and services derived therefrom may be less inhibited – for good or ill – by regulation and litigation than in the USA and Europe.[71] An unequivocal example of scientific and engineering leadership is China's demonstration of quantum entanglement over 1,200 kilometers, from satellite to ground station, "a stepping stone to ultrasecure communication networks and, eventually, a space-based quantum internet."[72]

Yet questions persist with respect to China's potential to tolerate the open, trial-and-error, creative destruction that has characterized US technological leadership, as it did British leadership in the nineteenth century. In particular, Daron Acemoglu and James Robinson argue that leadership at the frontier requires "inclusive" – open and pluralistic – economic and political institutions. Given the unquestioned authority of the Chinese Communist Party in all aspects of political expression and its aggressive repression of any challenges, they express extreme skepticism at the potential for China to make the transition from the most effective follower in the history of capitalism (albeit "with Chinese characteristics") to innovative leadership.[73] Even as China reaches out globally through its "One Belt / One Road" initiative, at home the Great Firewall constrains and monitors use of the internet for academic as for social purposes.

Let us reach back almost 200 years, to consider the state of Britain's political economy when the First Industrial Revolution was gathering steam, as one might put it. England in 1820 was governed by a corrupt oligarchy whose authority was exercised across the country in intimate collaboration with a national religious establishment, the Church of England. While limits on the arbitrary authority of the sovereign had been established by the Glorious Revolution of 1688, for the great mass of the people draconian repression was the rule: under the "Bloody Code" of

[71] An intriguing perspective is offered by S. Oster, "China's Kai-fu Lee on Why the U.S. Could Fall Behind in AI," *The Information*. Available at https://www.theinformation.com/chinas-kai-fu-lee-on-why-the-u-s-could-fall-behind-in-ai?eu=-OSqF7f3yPpADzd3zm84QA.

[72] G. Popkin, "China's Quantum Satellite Achieves 'Spooky Action' at Record Distance," *Science* (June 15, 2017). Available at http://www.sciencemag.org/news/2017/06/china-s-quantum-satellite-achieves-spooky-action-record-distance.

[73] D. Acemoglu and J. Robinson, *Why Nations Fail: The Origins of Power, Prosperity and Poverty* (New York: Crown Business, 2012), especially chap. 13.

criminal justice, more than 100 felonies were definitionally punishable by death or transportation. The patent system was notoriously expensive and inaccessible. The aristocratic elite were insulated from legal exposure and enjoyed enormous rents: both actual from their ownership of land and virtual through political and social institutions. Legitimacy was validated by the fear of anarchy, the terrifying reality of which had been observed in Paris, just across the English Channel, within living memory.

Those who ruled England were seeking to hold the lid on the greatest explosion of economic energy and financial wealth in human history. Yet, over a long generation from roughly 1830, England was transformed along multiple dimensions, from the "Old Corruption" derided by William Cobbett to the High Victorian order celebrated by Anthony Trollope. From the Great Reform Act of 1832 to repeal of the Corn Laws in 1846 and on to the Northcote–Trevelyan civil service reforms initiated in 1853 and the radical Representation of the People Act of 1867, Britain followed its own unique path toward a relatively stable and sustainable democratic capitalism that could survive the disruptive consequences of successive waves of Creative Destruction.

Did "inclusive" political institutions enable the Industrial Revolution, or were they in good parts its consequence? Or are both questions misconceived? In the complex and contingent process of social evolution, is it possible to abstract *any* causal law on which it is useful to rely when seeking to interpret – let alone anticipate – the outcome of another such evolutionary process, itself comparably complex and contingent?

Just how uncertain the dynamics of transition from follower to frontier are is demonstrated by the history of that other challenger to Britain's leadership, Germany. At the end of the nineteenth century, when mechanical tinkering had definitively yielded to scientific discovery as the source of technological innovation, Germany – not the United States – was the emergent winner. Not only was Germany the host of the first truly science-based industry – chemicals – and fully competitive in the transformation of the phenomenon of electro-magnetism into the infrastructure of a comprehensively "new" electrified economy. Germany had already invented the research university and was uniquely able to educate British and American students to the doctoral level while providing the model for educators in the UK and USA to emulate. Germany was the home of the world's most comprehensive system of primary education and technical schools. What's more, under Bismarck its paternalistic state had preemptively initiated the first ever elements of a social safety net.[74]

The late historian David Landes, considering Germany's success in overtaking Britain at the end of the nineteenth century, identifies "one of the strangest paradoxes in history":

> that on the one hand, a liberal society standing out from all others for equality and mobility of status, should have lost something of these during the very period of its progressive political democratization; while on the other, a far more authoritarian society, characterized in its pre-industrial period by a clearly defined, fairly rigid hierarchy of rank, should have developed a more open structure, without corresponding political change.[75]

In the language of Acemoglu and Robinson, Britain's economic institutions became *less* inclusive even as its political institutions became *more* so; Germany's economic institutions became *more* inclusive even as its political institutions remained substantially extractive.

For Germany, there then followed thirty years of destruction from 1914 on: two World Wars, a hyper-inflation, the Great Depression and the Third Reich. The succession of political, military and financial catastrophes trumped the economic momentum derived from scientific discovery and technological advance. We may hope that China finds greater continuity as its own Three-Player Game continues to evolve. Certainly, the challenges are as evident to China's leadership as to western commentators.

The official Chinese report of the highlights of Xi Jinping's speech to the 19th National Congress of the Communist Party presents this upfront:

> What we now face is the contradiction between unbalanced and inadequate development and the people's ever-growing needs for a better life. China has seen the basic needs of over a billion people met, has basically made it possible for people to live decent lives, and will soon bring the building of a moderately prosperous society to a successful completion. The needs to be met for the people to live better lives are increasingly broad. Not only have their material and cultural

[74] D. S. Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present*, 2nd edn. (Cambridge University Press, 2003), pp.346–347.

[75] *Ibid.* 348.

> needs grown; their demands for democracy, rule of law, fairness and justice, security, and a better environment are increasing.[76]

The existential conflict that confronts China's leadership and people is evident when Xi Jinping also emphasized:

> Every one of us in the Party must do more to uphold Party leadership and the Chinese socialist system, and resolutely oppose all statements and actions that undermine, distort, or negate them. We must do more to protect our people's interests, and firmly oppose all moves that damage their interests or put distance between the Party and the people. We must do more to channel our energies toward the contemporary current of reform and innovation, and resolvedly address deep-rooted problems. We must do more to safeguard China's sovereignty, security, and development interests, and staunchly oppose all attempts to split China or undermine its ethnic unity and social harmony and stability. We must do more to guard against all kinds of risks, and work determinedly to prevail over every political, economic, cultural, social, and natural difficulty and challenge.

As always, the proof of the pudding will be through lived experience, not political rhetoric.

For China not merely to emulate Japan and Korea as an effective follower that got stalled at the frontier, that lived experience must include learning by failing, succeeding by trial and (especially!) error, distributed broadly through the culture. Moreover, it is not hard to find suggestions that America's potential abdication is occurring embarrassingly early for China. Yet it may be that, over the next decades, the world will witness only the second example of this world-historical event: the transfer of leadership from the acknowledged leader of the Innovation Economy to its successor. The likelihood of this world-historical process actually reaching fulfillment, however, has been called into question by Xi Jinping's move to defer indefinitely his own transfer of leadership under the rules of China's distinctive, post-Mao game. That is to say, the Third-Player Game with Chinese characteristics clearly has its own dynamic.

[76] Xinhua, "Xi's Report at the 19th CPC National Congress," October 18, 2017. Available at http://www.xinhuanet.com/english/download/Xi_Jinping's_report_at_19th_CPC_National_Congress.pdf.