

INTRODUCTION

THINKING BIG AGAIN

Across the globe, countries, including in the developing world, look to emulate the success of the US economy. In doing so, they look at the power of ‘market-driven’ mechanisms, versus what might seem like old-style, State-driven mechanisms in places like Europe or the ex-Soviet Union. But the United States is not what it seems. The preacher of the small State, free-market doctrine has for decades been directing large *public* investment programs in technology and innovation that underlie its past and current economic success. From the Internet to biotech and even shale gas, the US State has been the key driver of innovation-led growth—willing to invest in the most uncertain phase of the innovation cycle and let business hop on for the easier ride down the way. If the rest of the world wants to emulate the US model they should do as the United States actually did, not as it says it did: more State not less. A key part of this lesson should be to learn how to organize, direct and evaluate State investments, so that they can be strategic, flexible and mission-oriented. Only in this way will top minds find it an ‘honor’ to work for the State.

This is something that needs to be understood not only by the rest of the world, but in the United States itself, where the dominant political narrative is endangering funding for future innovation and economic growth. In 2013, US government spending for basic research fell below what it was a decade earlier—and will most likely continue to fall due to congressional gridlock over the public budget.

Rather than static discussions over the size of the deficit, there must be more debate about its actual composition; how to invest strategically in key areas, such as research and development (R&D), education and human capital formation, that will increase gross domestic product (GDP) in the future (bringing the debt/GDP ratio down as a consequence); and

how to engage in a debate about the *direction* of change so that such investments will lead to growth that is not only 'smarter' (innovation-led) but also more 'inclusive' and 'sustainable'.

These issues are urgent with the upcoming 2016 US presidential election, which could, if properly informed, change the parameters of the current static debate. The United States desperately needs politicians with the courage to swim against the tide of popular rhetoric and outline a bolder vision for the State's dynamic role in fostering the economic growth of the future. In emerging economies such as China, the public sector is indeed investing billions in new green technologies with the expectation that these industries will be the engines of future growth. The United States could take inspiration from its own history. In 1961 an American president set out a bold, ambitious and risky vision to send a man to the moon. Who will have the courage to set out a new vision for America today?

Addressing today's societal challenges, for example, those around climate change, require a vision, a mission and, most of all, *confidence* about what the State's role in the economy is. As eloquently argued by Keynes in *The End of Laissez Faire* (1926, 46), 'The important thing for Government is not to do things which individuals are doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all'. This, however, requires the public sector to have vision and confidence—increasingly missing today. Why?

A DISCURSIVE BATTLE

What is the role of the public sector in economic growth? After the financial crisis, with public budgets bloated, mainly due to their role in 'saving' the private sector, across the globe we are hearing that in order for nations to be competitive, innovative and dynamic, we must have more market and less State. At best, we are told, governments merely facilitate the economic dynamism of the private sector; at worst, their lumbering, heavy-handed, and bureaucratic institutions actively inhibit it. The fast-moving, risk-loving and pioneering private sector, by contrast, is what really drives the type of innovation that creates economic growth.

According to this view, the secret behind an engine of innovation like Silicon Valley lies in its entrepreneurs and venture capitalists. The State can intervene in the economy—but only to fix 'market failures' or

level the playing field. It can regulate the private sector in order to account for the external costs companies may impose on the public (such as pollution), and it can invest in public goods such as basic scientific research or the development of drugs with little market potential. To some on the political right even fixing market failures would be a sin, because such attempts would lead to a worse outcome in the form of ‘government failures’.

What all these views have in common is the assumption that the State should stick to fixing markets, not directly trying to create and shape them. A 2012 *Economist* article on the future of manufacturing encapsulated this common conception. ‘Governments have always been lousy at picking winners, and they are likely to become more so, as legions of entrepreneurs and tinkerers swap designs online, turn them into products at home and market them globally from a garage’, the article stated. ‘As the revolution rages, governments should stick to the basics: better schools for a skilled workforce, clear rules and a level playing field for enterprises of all kinds. Leave the rest to the revolutionaries’.

This book is committed to dismantling this false image, which underpins a global trend—promoted by conservative economists, politicians and the media—of bashing and diminishing the importance of the State. It focuses on what Tony Judt called a ‘discursive battle’: how we talk about the State matters. Depicting private business as the innovative force, while the State is cast as the inertial one—necessary for the ‘basics’, but too large and heavy to be the dynamic engine—is a description that can become a self-fulfilling prophecy. If we continue to depict the State as only a facilitator and administrator, and tell it to stop dreaming, in the end that is what we get, and ironically it also then becomes easier to criticize it for being lame and inefficient.

The book argues that the fabricated image of a lazy State and a dynamic private sector is one that has allowed some agents in the economy to describe themselves as the ‘wealth creators’, and in doing so, extract an enormous amount of value from the economy—in the name of ‘innovation’. Indeed, the biggest fall in capital gains tax in US history happened at the end of the 1970s when the National Venture Capital Association managed to succeed in their lobbying for a 50 per cent fall (from 40 to 20 per cent) in just five years (Lazonick and Mazzucato, 2013). All on the back of a narrative of the venture capitalists being the true entrepreneurs and risk takers—a story we will see is far from the truth.

This biased story line, describing some actors in the economy as the true ‘innovators’, wealth creators and risk takers, and the others—including the State—as wealth extractors or just distributors, is hurting the possibility of building dynamic and interesting public-private partnerships today. To put it bluntly, this fabricated story hurts innovation and increases inequality. And the problem goes beyond innovation. The story has been used to downsize the State through an increased number of public activities being outsourced to the more ‘dynamic and efficient’ private sector, chopping away at the very brains of the State—with fewer and fewer resources aimed at building its own internal competencies and capabilities—and reducing what was once a wholesome notion of public ‘value’ as something to aspire to into a narrow notion of ‘public good’ used only to delineate the narrow areas that merit some government intervention (e.g. infrastructure, etc.).

THINKING BIG

This conventional view of a boring, lethargic State versus a dynamic private sector is as wrong as it is widespread. The book concentrates on telling a very different story: in countries that owe their growth to innovation—and in regions within those countries, like Silicon Valley—the State has historically served not just as an administrator and regulator of the wealth creation process, but a key actor in it, and often a more daring one, willing to take the risks that businesses won’t. This has been true not only in the narrow areas that economists call ‘public goods’ (like funding of basic research) but across the entire innovation chain, from basic research to applied research, commercialization and early-stage financing of companies themselves. Such investments (yes governments invest, not only ‘spend’) have proved transformative, creating entirely new markets and sectors, including the Internet, nanotechnology, biotechnology and clean energy. In other words, the State has been key to creating and shaping markets not only ‘fixing’ them. Indeed, as is described in one of the longest chapters of the book (Chapter 5), every technology that makes the iPhone smart and not stupid owes its funding to both basic and applied research funded by the State. This of course does not mean that Steve Jobs and his team were not crucial to Apple’s success, but that ignoring the ‘public’ side of that story will prevent future Apples from being born.

Transformational public investments were often fruits of ‘mission-oriented’ policies, aimed at thinking big: going to the moon or fighting

climate change. Getting governments to think big again about innovation is not just about throwing more taxpayer money at more activities. It requires fundamentally reconsidering the traditional role of the State in the economy. In the remainder of this introduction I delineate what this entails.

First, it means empowering governments to envision a *direction* for technological change and invest in that direction. Creating markets not only fixing them. Different from narrow attempts to identify and pick winners, envisioning a direction for economic development and technical change broadens the technological opportunity landscape and requires that the State creates a network of willing (not necessarily 'winning') agents that are keen to seize this opportunity through public-private partnerships. Second, it means abandoning the short-sighted way public spending is usually evaluated. Public investment should be measured by its courage in pushing markets into new areas, rather than the usual assumption of an existing market that the public and private actors must bump elbows in (one 'crowding out' the other). Third, it means allowing public organizations to experiment, learn and even fail! Fourth, precisely because failure is part of the trial and error process of trying to push markets into new areas, it means figuring out ways for governments and taxpayers to reap some of the rewards from the upside, rather than just de-risking the downside. Only once policy-makers move past the myths about the State's role in innovation will they stop being, as John Maynard Keynes put it in another era, 'the slaves of some defunct economist'.

CREATING MARKETS NOT ONLY FIXING THEM

According to neoclassical economic theory that is taught in most economics departments, the goal of government policy is simply to correct market failures. In this view, once the sources of failure have been addressed—a monopoly reined in, a public good subsidized, or a negative externality taxed—market forces will efficiently allocate resources, enabling the economy to follow a path to growth. But that view forgets that markets are blind, so to speak. They may neglect societal or environmental concerns. And they often head in suboptimal, path-dependent directions that are self-reinforcing. Energy companies, for example, would rather invest in extracting oil from the deepest confines of the Earth than in clean energy. In other words, our energy system moves along a carbon-intensive path that was set up more than

a century ago. This is not just about market failure, it's about the wrong kind of market getting stuck.

The path-dependent direction that the economy follows under 'free-market' conditions is problematic, particularly when the world is confronted with great societal challenges such as climate change, youth unemployment, obesity, aging and inequality. In addressing these challenges, the State must lead—not by simply fixing market failures but by actively creating and shaping (new) markets, while regulating existing ones. It must direct the economy towards new 'techno-economic paradigms', in the words of the technology and innovation scholar Carlota Perez. Usually, these directions are not generated spontaneously from market forces; they are largely the result of strategic public-sector decision making.

Indeed, nearly all the technological revolutions in the past—from the Internet to today's green tech revolution—required a massive push by the State. Silicon Valley's techno-libertarians might be surprised to find out that Uncle Sam funded many of the innovations behind the information technology revolution. The iPhone is often heralded as the quintessential example of what happens when a hands-off government allows genius entrepreneurs to flourish, and yet the development of the features that make the iPhone a smartphone rather than a stupid phone was publicly funded. The iPhone depends on the Internet; the progenitor of the Internet was ARPANET, a program funded in the 1960s by the Defense Advanced Research Projects Agency (DARPA), which is part of the Defense Department. The Global Positioning System (GPS) began as a 1970s US military program called NAVSTAR. The iPhone's touchscreen technology was created by the company FingerWorks, which was founded by a professor at the publicly funded University of Delaware and one of his doctoral candidates, who received grants from the National Science Foundation and the CIA. Even SIRI, the iPhone's cheery, voice-recognizing personal assistant, can trace its lineage to the US government: it is a spinoff of a DARPA artificial-intelligence project.

And this is not just about the military-industrial complex. It is just as true in health and energy. As the physician Marcia Angell has shown, many of the most promising new drugs trace their origins to research done by the taxpayer-funded National Institutes of Health (NIH), which has an annual budget of some \$30 billion. Private pharmaceutical companies, meanwhile, tend to focus more on the D than the R part of R&D, and some slight variations of existing drugs and marketing.

And more recently, despite the myths about the shale gas boom being driven by wildcatting entrepreneurs operating independently from the State, the US federal government invested heavily in the technologies that unleashed it (Shellenberger, Nordhaus, Trembath and Jenkins, 2012). When in 1976, the Morgantown Energy Research Center (owned and operated by the US Department of Energy) and the Bureau of Mines launched the Eastern Gas Shales Project, which demonstrated how natural gas could be recovered from shale formations, the federal government opened the Gas Research Institute, funded through a tax on natural gas production, and spent billions of dollars on research into shale gas. In this same period, the Sandia National Laboratories, also part of the US Department of Energy, developed the 3-D geologic mapping technology used for fracking operations.

The story of State-funded energy innovation is being repeated today, not just in renewable energy but even in the ‘green’ companies themselves. Tesla Motors, SolarCity and SpaceX, all led by entrepreneur Elon Musk, are currently surfing a new wave of state technology. Together, these high-tech ventures have benefited from \$4.9 billion in local, state and federal government support, such as grants, tax breaks, investments in factory construction and subsidized loans. The State also forges demand—*creates* the market—for their products by granting tax credits and rebates to consumers for solar panels and electric vehicles and by contracting \$5.5 billion worth of procurement contracts with SpaceX and \$5.5 billion for the National Aeronautics and Space Administration (NASA) and the US Air Force. While some of this governmental support has recently been the focus of news articles, two things have passed relatively unnoticed (Hirsch 2015). First, that Tesla Motors also benefitted for a massive publicly funded guaranteed loan of \$465 million. Secondly Tesla, SolarCity, and SpaceX have also benefitted from *direct investments* in radical technologies by the US Department of Energy, in the case of battery technologies and solar panels, and by NASA, in the case of rocket technologies. Technologies that SpaceX is now using in its business dealings with the International Space Station. This shouldn’t come as a surprise—the State has been behind the development of many key technologies that are later integrated by the private sector into breakthrough innovations. These companies are of course helping to push the innovation frontier by further developing State-funded technologies, and, crucially, contributing to a transition to a more environmentally sustainable economy. But all we hear in the media is the one-sided myth of the lone entrepreneur.

The role of the State is massive not only on the supply side, but also on the demand side, that is, the deployment and diffusion of new technologies. Even in cases where private markets seemed to play a leading role, such as in the automobile revolution, it was the State that established the enabling conditions for car *diffusion* (new street regulations, road construction works, licensing and traffic rules, etc.). In the mass-production revolution, for instance, the State invested in both the underlying technologies and their diffusion across the economy. On the supply side, defence investments in the United States, beginning in World War II, led to improvements in aerospace, electronics and materials. On the demand side, the US government's post-World War II subsidization of suburban living—by building roads, backing mortgages and guaranteeing incomes through the welfare state—enabled workers to own homes, buy cars and consume other mass-produced goods. And today, more of Tesla's electric cars are sold in Norway than in the United States due to the Norwegian government's policies stimulating the purchase of 'green' products. Supply-side support from the US government, demand-side support by the Norwegian government. Hardly a lone entrepreneur!

For policymakers, then, the question should not be whether to pick winners or not. Everything of relevance has been picked! From the Internet to fracking technology. What should become more central to the policy debate is *how* to pick broadly defined directions, within which bottom-up experimentation can take place. But private investments will only kick in after those directions have been picked, creating expectations in business about future growth opportunities in particular areas. Such directionality will of course involve some failures here and there, but the advantages that result from those supply-side and demand-side pushes will be more than worth the wait—creating decades of growth. Rather, the question should be how to do so in a way that is democratically accountable and that solves the most pressing social and technological challenges.

EVALUATING PUBLIC POLICIES

Indeed, State spending on innovation tends to be assessed in exactly the wrong way. Under the prevailing economic framework, market failures are identified and particular government investments are proposed. Their value is then appraised through a narrow calculation that involves heavy guesswork: will the benefits of a particular intervention

exceed the costs associated with both the offending market failure and the implementation of the fix (i.e. costs associated with possible government failures)? Such a method is far too static to evaluate something as dynamic as innovation. By failing to account for the possibility that the State can create economic and technological opportunities that never existed before, and take massive risks in doing so, it gives short shrift to governments' efforts in this area. No wonder economists often characterize the public sector as nothing more than an inefficient version of the private sector.

This incomplete way of measuring public investment leads to accusations that by entering certain sectors, governments are crowding out private investment. Instead, the truth is that government investment often has the effect of 'crowding in', meaning that it stimulates private investment that would otherwise not have happened. And in doing so, expands the overall pie of national output, which benefits both private and public investors. But more important, public investments should aim not only to kick-start the economy but also and possibly more importantly *to do things that are not even envisioned and therefore not done at all*. No private companies were trying to put a man on the moon when NASA undertook the Apollo project, which resulted not only in the accomplishment of the mission, but in many breakthroughs that make up what we today call the information and communication technological revolution.

Currently, private companies like Elon Musk's SpaceX and Jeff Bezos's (of Amazon) Blue Origin are drawing on NASA's technology shelves (and benefitting from the agency's procurement contracts) to explore low-earth orbit and the space beyond. As I have emphasized in a recent project commissioned by NASA (publication forthcoming) on the emerging low-earth orbit economy, the danger is that we socialize the risks of space exploration, but once again let the rewards of the venture be privatized. This can put future innovation at risk, as the state agencies responsible for innovation do not share in the rewards.

Creating a symbiotic (more mutualistic) public-private innovation ecosystem thus requires new methods, metrics and indicators to evaluate public investments and their results. Without the right tools for evaluating investments, governments have a hard time knowing when they are merely operating in existing spaces and when they are making things happen that would not have happened otherwise. The result: investments that are too narrow, constrained by the prevailing path-dependent, techno-economic paradigm. A better way of evaluating a

given investment would be to consider the different types of 'spillovers', including the creation of new skills and capabilities, and whether it led to the creation of new technologies, sectors and markets. When it comes to government spending on life sciences and health research, for example, it might make sense to move past the private pharmaceutical sector's fixation on drugs and fund more work on diagnostics, surgical treatments and lifestyle changes, key overlooked areas that offer great potential to improve the world population's health condition.

BUILDING DYNAMIC PUBLIC ORGANIZATIONS

Governments suffer from another, related problem when it comes to contemplating investment: as a result of the dominant view that they should stick to fixing market failures, they are often ill-equipped to do much more than that. To avoid such problems as a regulatory agency getting captured by business, the thinking goes, the State must insulate itself from the private sector. That's why governments have increasingly outsourced key jobs to the private sector. But that trend often rids them of the knowledge necessary for devising a smart strategy for transforming the particular agency into one that can attract top talent. It creates a self-fulfilling prophecy: the less big thinking a government does, the less expertise it is able to attract, the worse it performs, and the less big thinking it is allowed to do and capable of doing. Had there been more information-technology capacity within the US government, the Obama administration would probably not have had such difficulty rolling out HealthCare.gov, yet that failure will likely lead to only more outsourcing.

In order to create and shape technologies, sectors and markets, the State must be armed with the intelligence necessary to envision and enact bold policies. This does not mean that the State will always succeed; indeed, the uncertainty inherent in the innovation process means that it will often fail. But it needs to learn from failed investments and continuously improve its structures and practices. As the economist Albert Hirschman emphasized, the policymaking *process* is by its nature messy, so it is important for public institutions to welcome the process of trial and error. Governments should pay as much attention to the business school topics of strategic management and organizational behavior as private companies do. Yet by dismissing the role of the public sector as not important, the focus inevitably is *not* on making the government more competent and smarter but on making it smaller or

absent entirely. Indeed, the desire to *make things happen that otherwise would not* requires not just bureaucratic skills (though these are critical, as pointed out by Max Weber)¹ but real technology-specific and sector-specific *expertise*. It is only through an exciting vision of the State's role that such expertise can be recruited, and is then able to map out the landscape in the relevant space (indeed it is not a coincidence that the Department of Energy, which played a critical role in the 2009 US stimulus program, was run by Nobel Prize-winning physicist Steven Chu).

RISKS AND REWARDS

Admitting the role of the State as lead risk taker and innovator means also admitting the massive risks it must take, under extreme uncertainty, and hence the high probability of failure. This requires a particular type of deal between business and the State that recognizes that since the public sector often undertakes courageous spending during the riskiest parts of the innovation process, it is only fair that it not only pick up the bill during the downside, but also make something on the upside: that is, socialize *both* risks and rewards.² The US Small Business Innovation Research (SBIR) program, for example, offers high-risk financing to companies at much earlier stages than most private venture capital firms do; it funded Compaq and Intel when they were start-ups. Similarly, the Small Business Investment Company program, an initiative under the auspices of the US Small Business Administration, has provided crucial loans and grants to early-stage companies, including

1. Evans and Rauch (1999) show, for instance, that a Weberian-type State bureaucracy that employs meritocratic recruitment and offers predictable, rewarding long-term careers enhances prospects for growth, even when controlling for initial levels of GDP per capita and human capital.

2. Despite the negative connotation of 'socialization' for the American public, due to a purported association with socialist regimes, this concept need not be value-laden. In fact, in one of his books published in the aftermath of the recent economic and financial crisis (*Freefall: America, Free Markets, and the Sinking of the World Economy*, New York: W. W. Norton & Company, 2010), Nobel laureate American economist Joseph Stiglitz criticized American capitalism for privatizing gains from financial speculation but socializing the losses accrued from the crisis (as it was taxpayers' money that bailed out the banks). Also Andrew Haldane, chief economist of the Bank of England—not the most 'socialist' of institutions—also criticizes the financial system for enabling a 'socialization of risks' but the privatization of rewards.

Apple in 1978 (see Chapter 8). In fact, the need for such long-term investments has only increased over time as venture capital firms have become more short-term in their outlook, emphasizing finding an ‘exit’ for each of their investments (usually through a public offering or a sale to another company) within three years. Real innovation can take decades.

And here it is fundamental to remember it is in the nature of early-stage investing in technologies with uncertain prospects that some investments will be winners, while many others will be losers. For every Internet (a success story of US government financing), there are many Concordes (a white elephant funded by the British and French governments), including the failed American Supersonic Transport project. Consider the twin tales of Solyndra and Tesla Motors. In 2009, Solyndra, a solar-power-panel start-up, received a \$535 million guaranteed loan from the Department of Energy; that same year, Tesla, the electric car manufacturer, got approval for a similar loan, for \$465 million. In the years afterward, Tesla was to a great degree successful, and the firm repaid its loan in 2013. Solyndra, by contrast, filed for bankruptcy in 2011 and, among fiscal conservatives, became a byword for the government’s sorry track record when it comes to ‘picking winners’. Of course, if the government is to act like a venture capitalist, it will necessarily encounter many failures. The problem, however, is that governments, unlike venture capital firms, are often saddled with the costs of the failures while earning next to nothing from the successes. Taxpayers footed the bill for Solyndra’s losses—yet got hardly any of Tesla’s profits.

Economists may argue that the State already receives a return on its investments by taxing the resulting profits. The truth is more complicated. Large corporations are masters of tax evasion. Google—whose game-changing search algorithm was developed with funding from the National Science Foundation—has lowered its US tax bill by funneling some of its profits through Ireland. Apple does the same by taking advantage of a race to the bottom among US states: in 2006, the company, which is based in Cupertino, California, set up an investment subsidiary in Reno, Nevada, to save money. This is why proposals for increasing the wealth tax as a way to curb inequality and generate cash for the State to invest in the innovation and economic process—such as put forth by the French economist Thomas Piketty—are not enough. Bolder and more creative proposals are needed.

Fixing the problem is not just a matter of fixing the loopholes. Tax rates in the United States and other Western countries have been

falling over the past several decades precisely due to an errant narrative about how the private sector serves as the sole wealth creator.³ Government revenues have also shrunk due to tax incentives aimed at promoting innovation, few of which have been shown to produce any R&D that would not have happened otherwise.⁴ And capital is more mobile than ever. A particular government that has funded a given company might not be able to tax it since it may have moved abroad. And although taxes are effective at paying for the basics, such as education, healthcare and research, they don't begin to cover the cost of making direct investments in companies or specific technologies. If the State is being asked to make such investments—as will increasingly be the case as financial markets become even more focused on the short-term—then it should be allowed to recover the inevitable losses that arise from this process.

Had the US government had a stake in Tesla, it would have been able to more than cover its losses from Solyndra. The year Tesla received its government loan, the company went public at an opening price of \$17 a share; that figure had risen to \$93 by the time the loan was repaid. In 2013, shares in Tesla traded above \$200 (today it is priced slightly below this level). The prospect of the State owning a stake in a private corporation may be anathema to many parts of the capitalist world, but given that governments are already investing in the private sector, they may as well earn a return on those investments (something even fiscal conservatives might find attractive). The State need not hold a controlling stake, but it could hold equity in the form of preferred stocks that get priority in receiving dividends (as usual, caution with political vested interests would be needed in setting up such a scheme). The returns could be used to fund future innovation. There are of course other ways in which we can socialize not only the

3. I have recently criticized the UK Labour Party for espousing this view as well, when after the they lost the 2015 election, many claimed it was because the 'wealth creators' (business) had not been embraced enough. Available online at <http://www.theguardian.com/science/political-science/2015/jun/15/a-new-wealth-creating-agenda-for-the-labour-party>.

4. Tax incentives are given to companies that declare past engagement in R&D and innovation. In this sense, they do not stimulate *new* R&D; they reward R&D already carried out—and companies are very competent in declaring activities that have nothing to do with and do not lead to invention and innovation as R&D investments. See critique of the patent box tax policy in Chapter 2

risks but also the rewards of innovation (as discussed in Chapter 9). The main point here being that politicians, economists and the media have been too quick to criticize public investments when things go wrong and too slow to reward them when things go right.

SECULAR STAGNATION IS NOT INEVITABLE

Today we are in the midst of an economic stagnation that some (like American economist Larry Summers) call ‘secular stagnation’, which implies that a long-term period of near zero-growth rates is inevitable and persistent. But this somewhat doom-laden diagnosis misses the underlying causes of the disease. The causes are not the exhaustion of profitable technological opportunities or a lack of effective demand per se (declining levels of income per capita). The fundamental causes are related to what the State is doing—or, better, what it is *not* doing.

Arresting this drift into secular stagnation requires policies that aim at *smart*, innovation-led growth and *inclusive* growth at the same time. It requires the State to think big. It has, however, become harder and harder for governments to do so for the reasons I have described. The notion of the State as a mere facilitator, administrator and regulator may have first started to gain widespread currency in the 1970s, but it has taken on newfound popularity in the wake of the global financial crisis. Overlooking that it was private debt and speculation that led to the meltdown, across the globe policymakers have targeted public debt, arguing that cutting government spending will spur private investment. As a result, the very State agencies—such as DARPA and the NIH in the United States—that have been responsible for the technological revolutions of the past have seen their budgets shrink. In the United States, the budget ‘sequestration’ process, which was signed into law in 2011 by a Democratic president and Democrat-controlled Senate, will result in \$95 billion worth of cuts to federal R&D spending from 2013 to 2021. In Europe, the European Union’s ‘fiscal compact’, which requires states to drop their fiscal deficits down to 3 per cent of GDP, is squeezing education and R&D spending.

On top of this we are witnessing an increased financialization of the business sector, with many companies spending more on share buybacks—to boost their stock prices, stock options, and executive pay—than on areas like human capital and R&D. As the work of Lazosnick (2014) has shown, in the last decade, nearly \$4 trillion has been spent on share buybacks by Fortune 500 companies. The companies

leading in share buybacks, in pharmaceuticals and energy, claim this practice is due to there being ‘no opportunities’ for investment. Yet it is clear this is far from reality, when we witness the billions being poured into renewable energy and pharmaceutical innovation through public-sector organizations. So the problem is not only one about ‘short-termism’ but also about the way in which we have not struck the right ‘deal’ between government and business.

In the end, an increasingly timid (and sometimes austerity-driven) public sector and an increasingly financialized business sector will surely get us secular stagnation. But that is our choice, and we can go into reverse gear.

A NEW LANGUAGE AND RHETORIC

While innovation is not the State’s main role, illustrating its potential innovative and dynamic character—its historical ability, in some countries, to play an *entrepreneurial* role in society—is perhaps the most effective way to defend its existence, and size, in a proactive way. To change the way we talk about the State is not just about changing rhetoric—it is about *changing the way we reason about the State, its role and its structure*.

The way that I interpret Judt’s challenge is that we must start using new words to describe the State. ‘Crowding in’ is a concept that—while defending the public sector—is still using the negative as a benchmark: the possibility that government investment crowds out private investment by competing for the same limited amount of savings. If we want to describe something positive and visionary, a word that is bolder and offensive, not defensive, should be used. Rather than analysing the State’s active role through its correction of ‘market failures’ (emphasized by many ‘progressive’ economists who rightly see many failures), it is necessary to build a theory of the State’s role in *shaping* and *creating* markets—more in line with the work of Karl Polanyi (1944) who emphasized how the capitalist ‘market’ has from the start been heavily shaped by State actions. In innovation, the State not only ‘crowds in’ business investment but also ‘dynamizes it in’—creating the vision, the mission and the plan.

The book offers a new way of talking and thinking about the State, in order to expand our vision of what it can do—it takes on Judt’s ‘discursive battle’: from an inertial bureaucratic ‘leviathan’ to the very catalyst for new business investment, from market ‘fixer’ to market shaper and creator, from simply ‘de-risking’ the private sector to welcoming

and taking on risk due to the opportunities it presents for future growth. Against all odds.

STRUCTURE OF THE BOOK

The book is structured as follows:

Chapter 1 begins by confronting the popular image of the State as a bureaucratic machine with a different image of the State as lead risk taker. Rather than understanding State risk taking through the usual lens of ‘market failures’ – with the State acting as an inert bandage for areas underserved by the market – the concept of its entrepreneurial risk taking is introduced. The State does not ‘de-risk’ as if it has a magic wand that makes risks disappear. It *takes on* risks, shaping and creating new markets. The fact that economists have no words for this role has limited our understanding of what the State has done in the past – in areas like Silicon Valley – and the role that it can play in the future, in areas like the ‘green revolution’.⁵

Chapter 2 provides background to the discussion by looking at how economists understand the role of innovation and technology in economic growth. Whereas a generation ago, technological advance was seen as something that was externally given in economic models, there is now extensive literature to show that actually it is the rate – and direction – of innovation that drives the ability of economies to grow. The chapter juxtaposes two very different frameworks for understanding the role of the State in innovation-led growth – both framed in terms of different types of ‘failures’ that the State corrects. The first is the ‘market failure’ approach, in which the State is simply remedying the wedge between private and social returns. The second is the ‘systems of innovation’ approach, which looks at R&D spending in a more holistic way, as part of a system in which knowledge is not only produced but also diffused throughout an economy. But even in this second approach the State is mainly fixing failures, this time ‘system failures’ – with the conclusion being that it is ‘facilitating’ innovation by ‘creating the conditions’ for it. These frameworks have provided the

5. Contemporary political economists, such as Chang (2008) and Reinert (2007), who specialize in the history of economic policy, do of course talk about the role of the State in promoting a ‘catching-up’ process, or in actively acting counter-cyclically. Yet these are more in line with a view of the State not as an entrepreneurial risk taker (of first resort) but a more passive entrepreneur of last resort.

justification for increased government spending on innovation, while at the same time—due to the lack of attention on the State as lead risk taker—allowing certain myths to survive. These myths describe the relationship between innovation and growth; the role of small and medium enterprises (SMEs); the meaning of patents in the knowledge economy; the degree to which venture capital is risk-loving; and the degree to which investment in innovation is sensitive to tax cuts of different kinds.

Chapter 3 presents a different view, of an entrepreneurial State acting as lead risk taker and market shaper. This is not a substitute for the view espoused in the other two frameworks, but a complement, and one that, by being ignored, has caused policies informed by the ‘failures’ approach to be limited in nature, and often more ‘ideologically’ driven. Examples are provided from the pharmaceutical industry—where the most revolutionary new drugs are produced mainly with public, not private, funds. I also examine the way in which venture capital has ‘surfing the wave’ of State investments in biotechnology.

Chapter 4 exemplifies the key points of the ‘entrepreneurial State’ by focusing on the recent industrial policy history of the United States, and shows that despite common perceptions, the US State has been extremely proactive and entrepreneurial in the development and commercialization of new technologies. Entrepreneurship by the State can take on many forms. Four examples—the creation of DARPA, the SBIR programme, the Orphan Drug Act of 1983 and recent developments in nanotechnology—are used to illustrate this point. It builds on the notion of the ‘Developmental State’ (Block 2008; Chang 2008; Johnson 1982), pushing it further by focusing on the type of risk that the public sector has been willing to absorb and take on.

While Chapters 3 and 4 look at sectors, Chapter 5 focuses on the history of one particular company—Apple—a company that is often used to laud the power of the market and the genius of the ‘garage tinkerers’: the power of Schumpeterian ‘creative destruction’.⁶ I turn this notion on its head. Apple is far from a product solely of ‘market’ forces. Its success has been highly dependent on patient public finance, which it received early on, and the State-funded technologies behind all its

6. Joseph Schumpeter (1942 [2003]) referred to ‘creative destruction’ as the process by which innovation changes the status quo, allowing the market shares of firms which introduce new products and processes to grow, and those of the firms that resist change to fall.

products. Besides the communication technologies (discussed in Chapter 4), the iPhone is smart because of features such as the Internet, GPS, a touchscreen display and the latest new voice-activated personal assistant (SIRI). While Steve Jobs was no doubt an inspiring genius worthy of praise, the fact that the iPhone/iPad empire was built on these State-funded technologies provides a far more accurate tale of technological and economic change than what is offered by mainstream discussions. Given the critical role of the State in enabling companies like Apple, it is especially curious that the debate surrounding Apple's tax avoidance has tended to overlook this fact. Apple must pay tax not only because it is the right thing to do, but because it is the ultimate example of a company that requires the public purse to be large and risk-loving enough to continue making the investments that entrepreneurs like Jobs will later capitalize on (Mazzucato 2013b).

Chapter 6 looks at the next 'big thing' after the Internet: the green revolution, which is today being led by the State, just as the information technology (IT) revolution was. In 2012, China announced its plan to produce 1,000 GWs of wind power by 2050. That would be approximately equal to replacing the entire existing US electric infrastructure with wind turbines. Are the United States and Europe still able to dream so big? It appears not. In many countries, the State is asked to take a back seat and simply 'subsidize' or incentivize investments for the private sector. We thus fail to build visions for the future similar to those that two decades ago resulted in the mass diffusion of the Internet. The chapter looks at which countries in the world are leading with a green vision, and the role of their States—and the 'patient' finance supplied by State development banks—in creating the 'catalytic' early, and risky, investments necessary to make it happen.

Chapter 7 focuses on the role of the 'entrepreneurial', risk-taking State in launching specific clean technologies, in this case wind turbines and solar photovoltaic (PV) panels. It was State funding and the work of particular State agencies that provided the initial push, early-stage, high-risk funding, and institutional environment that could establish these important technologies. While Chapter 5 emphasized the role of the US entrepreneurial State in leading the IT revolution as well as in establishing the foundations of the biotech industry, this chapter emphasizes the role of DARPA's sister organization ARPA-E (in the Department of Energy) in leading innovation in renewable energy, and the role of countries like Germany, Denmark and China in *directing* the green revolution as it spreads across more economies.

Chapters 8 and 9 argue that once we accept the role of the State as lead risk taker—beyond the usual ‘market fixing’ or ‘creating conditions’ approach—the question arises as to whether this role is represented in the risk–reward relationship. In so many cases, public investments have become business giveaways, making individuals and their companies rich but providing little (direct or indirect) return to the economy or to the State. This is most evident in the case of pharmaceuticals, where publicly funded drugs end up being too expensive for the taxpayers (who funded them) to purchase. It is also true in the case of IT, where the State’s active risk-taking investments have fuelled private profits, which are then sheltered and fail to pay taxes back to the governments that supported them. Chapter 8 illustrates this point focusing again on Apple. Chapter 9 considers the points more generally, arguing that in a period of major cutbacks to reduce budget deficits, it is more critical than ever to engage in a discussion of how the State can ensure that its ‘risk taking’ earns back a direct return, beyond easily avoided taxation (as in Piketty’s [2013] proposal). Precisely because State investments are uncertain, there is a high risk that they will fail. But when they are successful, it is naïve and dangerous to allow all the rewards to be privatized. Indeed, criticism of the financial sector for launching the current economic crisis, reaping massive private returns and then socializing risk through bailouts is a general and unpopular feature of dysfunctional modern capitalism that should not become the norm.

Chapter 10 concludes by reflecting on how the core argument in the book—the State as an active, entrepreneurial, risk-taking agent—is not always a reality, but a possibility too often dismissed. The ‘possibility’ is only realized once key assumptions are overturned, from how we envision the State within its own organizations (encouraging departments in the public sector to be entrepreneurial, including the need to ‘welcome’ rather than fear failure), to the relationship between the State and other actors in the innovation system (e.g. by accepting itself as a more active agent, there will be many instances where the State’s role is less about ‘nudging’ and ‘incentivizing’ and more about ‘pushing’). The State’s ability to push and direct is dependent on the kind of talent and expertise it is able to attract. And the irony is that the latter is more of a problem in countries where the State takes a back seat, only ‘administering’ and not leading with dynamic vision. Unless we challenge the numerous ‘myths’ of economic development, and abandon conventional views of the State’s role in it, we cannot hope to address the structural challenges of the twenty-first century or produce

the technological and organizational change we need for long-term sustainable and equitable growth.

Taken as a whole, the book provides a fuller understanding of the public sector's centrality to risk-taking activities and radical technological change, essential to promote growth and development. It offers a very different description of the State from that envisaged by present economic policymakers, which tend to deny the State's leading role in innovation and production. It also challenges conventional industrial policy, which unduly downplays its scope for pioneering and promoting transformational change.

What is needed is a fully fledged understanding of the division of innovative labour in capitalism (described in Chapter 1) and the role that both the private and public sector play in creating, producing and diffusing innovations. The book focuses on innovation not because this is the only or most important thing the State can invest in. The State's role in guaranteeing basic human rights for all citizens—from public healthcare to public education—as well as creating the necessary infrastructure, legal and justice system that allows the economy to function properly are equally if not more important activities. The focus on innovation is due in part to the fact that it is a point of discussion where the State is most frequently attacked for its role. While the role of the private sector has typically been hyped up, the public sector's role has been hyped down. The State is often being cast as the problem, whether it is investing in new technology or improving market function. A key aspect of the challenge is therefore to rebalance our understanding of how economies really work. Only once that is done can we begin to formulate the kinds of policies that work, rather than reproduce stereotypes and images which serve only ideological ends.
