

THE ECONOMICS OF CREATIVE DESTRUCTION

The Economics of Creative Destruction

New Research on Themes from Aghion and Howitt

UFUK AKCIGIT *and* JOHN VAN REENEN

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We dedicate this book to Emmanuel Farbi, who began the journey with us in 2018 when we were in the planning stages. We sorely miss him, as does the wider community of scholars of which he was such an integral part.

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Foreword

EMMANUEL MACRON

We are in a time that begs for a fundamental redefinition of economic doctrine. For more than forty years, most of the world's economies have been organized according to the same precepts, commonly referred to as the "Washington Consensus." This doctrine insists on openness, privatization, deregulation. It was probably appropriate for a historic moment at the end of the twentieth century, and it is undeniable that it has produced results, lifting hundreds of millions of people out of material poverty, especially in the least-developed countries. But now its shortcomings are glaring. It is too short-term. It finds itself very poorly equipped to face the challenges of our time: the threats to the environment, rising inequalities, demographic changes, technological revolutions, the weakening of our democracies—a weakening that is the direct and indirect consequence of the other revolutions.

The global pandemic has bluntly revealed the flaws that are eroding our societies, as Philippe Aghion and his coauthors rightly emphasize in their latest book. On one hand, in countries of "cutthroat capitalism," often Anglo-Saxon, we see the harms of inadequate social protection, and the harms of policies that have allowed inequalities to widen, in all their dimensions. On the other hand, in countries of "cuddly capitalism," often in continental Europe, the crisis has exposed the cost to society of research and innovation policies that are not ambitious or innovative enough.

We must therefore build a new way of thinking, a new consensus. And I think the Schumpeterian paradigm must be a key part of this new consensus. A renewed Schumpeterian paradigm, which dares to tackle the challenges of the twenty-first century head-on. This is why the work by Philippe Aghion and Peter Howitt is especially useful and relevant, including their seminal article written in 1987, "A Model of Growth through Creative Destruction."

Creative destruction is the vital energy of the “spirited horse” of capitalism. If we know how to tame it and steer its path, then it is possible to reconnect with shared prosperity while protecting our common goods.

The chapters in this volume address a large number of issues and economic enigmas on which the Schumpeterian dynamic sheds a new light, in areas as diverse as development, employment, competition, trade, the environment, business dynamism, and innovation. The breadth of these topics shows the extent to which it is a paradigm at the heart of economic life. I would like to highlight three strong messages from this work.

First, it reinstates a growth objective. We have given in too much to defeatism, by taking growth as exogenous and lamenting its slowdown. If we believe in creative destruction, we know we can influence the rate of growth, through more work and more innovation. We can also influence the course of innovation to make this growth inclusive and sustainable. This conviction also reinstates public policies, after forty years of dominant beliefs in a great automatic moderation.

Next, inequalities must be reduced while preserving the incentives to innovate. Professors Aghion’s and Howitt’s results, and the work that followed, clearly demonstrate that it is possible, and that it is highly desirable, because the two objectives are mutually reinforcing, contrary again to popular beliefs. The freedom to research and the freedom to *entreprendre*, if you allow me to use this French word, are critical drivers of social mobility. To combat inequalities effectively, we must combine a well-designed monetary redistribution scheme with other levers that act directly on equal access to opportunities, provide support to families since early childhood, enable access to good education, integrate through work and activity, enable access to good jobs, support training and retraining, and expose to innovation, given that exposure to innovation helps develop a taste for innovation itself. It is a very demanding multidimensional agenda. In my opinion, it is the only one that can fundamentally reform our economic models and prevent the gradual collapse of our liberal democracies.

Finally, and this my third remark, to achieve this dual objective of greater prosperity and greater equality through creative destruction, a strong ecosystem of innovation must emerge. This is certainly one of the major challenges that France and Europe must face in the aftermath of the pandemic. To go beyond an easy mantra, the work in this volume is crucial in characterizing what a “strong innovation ecosystem” means in practice, because it ventures behind the scenes of innovation. Innovations do not fall

from the sky, they are not exogenous. We must act at each level of the long process of idea generation: from fundamental research, to which we must provide sufficient resources and the necessary academic freedom, to applied R&D, which must be encouraged in companies, funded, and for which healthy competition must be guaranteed. The public authorities have a major role to play in this process, and its exact positioning must be carefully chosen: It is up to the public authorities to identify the “major challenges” to which it is urgent to respond, and they must provide adequate means for maximizing the probability of breakthrough innovations. This is key, especially for France and Europe.

If I chose to emphasize these three powerful ideas, among the many threads to be drawn from the work undertaken by Philippe Aghion and Peter Howitt and the research that followed, it is because they strike me as central to building a new economic consensus, and yet they are far from being consensual today in our public debate. Indeed, the debate is often too polarized in quarrels filled with prejudice, for instance: “are we for or against capitalism.” I am deeply convinced that we can make our societies fairer and more sustainable. I am convinced that this requires a policy of well-redesigned growth, and that this is how to generate real equality and social mobility, a growth based on ideas and permanent innovation. Creative destruction has never been so relevant to the challenges of our time. It is up to all of us to continue to unravel its mysteries, and to continue to apply its teachings.

THE ECONOMICS OF CREATIVE DESTRUCTION

Introduction

UFUK AKCIGIT *and* JOHN VAN REENEN

In 1992, Philippe Aghion and Peter Howitt published their seminal paper, “A Model of Growth through Creative Destruction.” Citations are not the only metric of success, but it is striking that the paper has over 15,000 citations on Google Scholar,¹ a very impressive achievement. The paper fundamentally changed the way that economists thought about growth. It formalized the idea that to understand the success of modern economies, we must not only recognize that innovation is a deliberate choice of firms facing a changing and uncertain environment, but also that the process is highly disruptive. Innovating firms necessarily make older ideas, lines of business, and forms of organization obsolete. Research and Development (R&D) is by nature both creative and destructive.

This notion of growth owed much to Joseph Schumpeter (1942), but his insights were notoriously difficult to incorporate into formal economic models. Aghion and Howitt’s endogenous growth framework elegantly showed how this could be done, combining insights from several fields of economics, above all by integrating industrial organization into macroeconomics.

The Aghion and Howitt (1992) paper created a new space for theoretical and empirical work that has reverberated through almost every field of economics and into other disciplines. Nearly three decades after the publication

¹ https://scholar.google.com/scholar?hl=en&cas_sdt=0%2C5&q=philippe+aghion&btnG=

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of the paper, in June 2021, we brought together over a hundred scholars (including eleven Nobel Laureates) to present their views on how the creative destruction framework has influenced our discipline. We uncovered a strong narrative linking many of the papers, so we then commissioned chapters from many of these presenters to chart a course through modern economics. This book is the result.

Organization of the Book

We have organized the book to reflect the many areas where the Aghion-Howitt framework has had a major influence on scholarship. All chapters are original contributions by the authors. Some are analytical reviews of the literature; others offer novel theoretical or empirical contributions. We hope the reader finds all of them immensely stimulating.

In the overview of the book (Part I), Nobel Laureate Edmund Phelps (Chapter 1) reflects on how our thinking about growth policies has fundamentally changed due to Aghion and Howitt. He echoes the themes of several other chapters that innovation is not simply the product of scientists—it involves entrepreneurs, managers, and workers. Indeed, he views the well-spring of sustained innovation in a country as intimately tied to cultural values, especially of individualism and rewards to effort and talent. The importance of norms is stressed in many other chapters (e.g., by Besley and Persson in Chapter 14 and by Mokyr in Chapter 26). History and sociology are also increasingly being woven into models of creative destruction, and we expect much more exciting work along these lines in the future.

Next, in Chapter 2, Akcigit sketches out the essential elements of the Aghion-Howitt framework, how it built on the shoulders of giants, but also how its originality fundamentally advanced our understanding of growth. The chapter shows how the basic architecture of the model paved the way for new possibilities in many different areas of economic research.

The main body of the book consists of eight more parts: Part II, Competition and International Trade; Part III, Inequality and Labor Markets; Part IV, Growth Measurement and Growth Decline; Part V, The Environment: Green Innovation and Climate Change; Part VI, Development and Political Economy; Part VII, Finance; Part VIII, Taxation; and Part IX, Science.

The Conclusion, by Aghion and Howitt, reflects on our book as a whole.

Competition and International Trade

Creative destruction implies that the structure of product markets is critical for innovation. The existing frameworks, which abstracted away from the strategic interaction between firms, had no way to adequately integrate competition with growth. Griffith and Van Reenen (Chapter 3) discuss the intellectual history leading up to the famous “Inverted-U” paper, which used the creative destruction framework to argue that intermediate levels of competition would maximize an economy’s total innovation. At high levels of competition, the marginal effect of further competitive intensity would be negative (as Schumpeter argued), but at lower levels of competition, an increase in competitive intensity would boost innovation (as Arrow argued).

Griffith and Van Reenen emphasize the dialectic between empirical findings and theoretical developments, and how modern structural industrial organization models have been influenced by creative destruction. An important point, often overlooked in policy debates, is that although the relationship is nonlinear, the average effect of competition on innovation tends to be positive (consistent with earlier work, such as by Blundell et al. 1999). Indeed, for the cases most often examined by antitrust authorities, competition is already low, so we are on the part of the Inverted-U where further reductions in competition are likely not only to put upward pressure on prices but also to chill innovation.

Chapter 4, by Gilbert, Riis, and Riis, focuses more squarely on one aspect of competition policy: mergers and acquisitions. It discusses how merger rules must be adapted to consider potential downward pressure on innovation. The current merger regimes focus on upward pricing pressure, which is important for static losses, but it misses the much more important dynamic changes to productivity. As more of the modern economy moves into high-tech industries and as so-called “superstar firms” (such as Facebook, Apple, and Google) increase their reach (see Autor et al. 2020), competition authorities need to take innovation more seriously in their enforcement activities. The authors of this chapter develop a new model used to address such issues around mergers.

Understanding competition requires thinking about the complex network of interactions, often deeply personal, that influence innovation. In Chapter 5, Jackson, Mayerowitz, and Tagade apply network theory insights to an

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empirical analysis of coauthorship in patenting. They find that patenting and the number of coauthors also follows an inverted-U. This reflects the trade-off between the benefits of collaboration and the threat that your presently friendly co-innovators may become your future rivals.

Trade can be a strong mechanism for increasing competition through the threat of entry from foreign firms. However, there are many other channels through which trade can influence innovation. These are thoroughly documented in Chapter 6 by Melitz and Redding, who look at theoretical and empirical work in this area. They emphasize that competition is only one mechanism through which trade matters. For example, global integration also increases market size, which increases the return to innovative investments (e.g., enabling the fixed costs of R&D to be spread over a larger revenue base). Furthermore, more sophisticated high-quality inputs can be sourced from overseas—often through global value chains—which will also stimulate innovation. Globalization can thus lead to dynamic gains in addition to the standard benefits from improved allocation of resources. Because of this, the recent tide of deglobalization and supply chain disruption caused by Brexit, Trump’s trade wars, COVID-19, and the war in Ukraine are likely to be another headwind against global growth.

Inequality and Labor Markets

Many people, politicians especially, bristle at the notion of creative destruction—and perhaps for good reasons. Innovation is disruptive, not only for firms who lose market positions but also for their workers, who see their jobs, wages, and skills threatened. Because of this, the shaking up of labor markets by new technology may create more inequality and unemployment. In Chapter 7, Blundell, Jaravel, and Toivanen begin Part III by examining the relation between innovation and inequality. They argue against a monocausal approach. Although innovation can certainly raise inequality through, for example, monopoly rents or increasing the demand for the skilled who earn more, there are countervailing forces. New opportunities are created by innovation, and if new entrants rather than incumbents seize these chances, this process will foster social mobility and so reduce inequality. They emphasize the many policies that could both increase innovation and reduce inequality (or at least inequality of opportunity). Data from several countries and periods show that children born to the

richest parents are more likely to grow up to be inventors than those born to parents in the bottom half of the distribution (Aghion et al. 2016, 2023; Akcigit et al. 2020). For example, US data show that children born to the richest 1 percent of parents are ten times more likely to grow up to be inventors than those born in the bottom half of the income distribution (Bell et al. 2019). The vast majority of this correlation is not due to lower intrinsic ability. Improving access to education and exposing “lost Einsteins and Marie Curies” to the possibility of becoming inventors (Bell et al. 2019) would both reduce inequality and raise the growth rate, with education having positive effects across generations (Aghion et al. 2023; Akcigit et al. 2020; Toivanen and Väänänen, 2016). Such policies would be good for growth and equity.

The next two chapters focus on labor markets and the main way in which rewards are distributed to individuals in a market economy. Chapter 8 by Bilal, Engbom, Mongey, and Violante takes a macroeconomic approach, focusing on the role of technological imitation in raising growth. Entrant firms creatively destroy incumbents by poaching their workers. These authors examine what happens when imitation becomes harder—consistent with the work of Bloom et al. (2020) that ideas have become harder to find. They show that this framework matches many trends in the US over the past three decades: lower firm entry, less employment response to productivity shocks, and falling job-to-job transitions. Despite this, the authors of Chapter 8 find that lower imitation does not produce much lower productivity growth through more misallocation, because the slower rate of obsolescence induces productive growing firms to invest more in costly hiring.

In Chapter 9, Skans, Choné, and Kramarz look at the very rich administrative data from Sweden to show that skill is highly multidimensional. They argue that recent innovations have tended to “unbundle” these skills, making it easier to outsource tasks to specialists. Rather than have a general manager in charge of scheduling, monitoring, organizing suppliers, finding buyers, and so forth, each of these skills is performed by a specialist sometimes inside the organization, but often outside it (or even automated by software). This specialization generates a much tighter sorting of workers in different firms and increases competition among specialists, driving down their wages. This leads to increased inequality, with generalists earning much higher market wages than specialists do. It also helps explain why the economy seems bifurcated into “good” firms, where all workers seem highly

paid, and “bad” firms, where all workers are poorly paid (the so-called “McKinsey-McDonalds economy”).

Growth Measurement and Growth Decline

One of the most worrying trends in recent years has been the decline in productivity growth, which occurred after the mid-1970s oil shocks. This was eventually reversed by the Information and Communications Technology-based productivity acceleration during 1995–2004. Unfortunately, productivity growth has again slowed since then and has remained lackluster for two decades. Chapter 8 by Bilal et al., discussed in the previous section, matched the falling business dynamism trends but could not account for the productivity slowdown. The chapters in this section take this issue head-on.

Chapter 10 by Boppart and Li examines ways of improving the measurement of growth to incorporate creative destruction. They document considerable mismeasurement problems that generally cause us to underestimate growth, which is good news. However, the measurement problems have always been there, and the mismeasurement has not increased so severely since the mid-2000s that it could account for the magnitude of the recent decline in growth. This is the bad news.

Next, Bergeaud, Cette, and Lecat (Chapter 11) examine the role of monetary policy, considering that interest rates could be both an effect and a cause of slower growth. Until recently, the slowdown of productivity growth has gone hand-in-hand with a decline in long-term real interest rates around the world. Conventionally, if long-term productivity growth declines, then the real return on capital investment has fallen, and therefore, so too will interest rates. However, the authors also consider how there may be a reverse channel from lower interest rates to growth through the lens of creative destruction. Lower interest rates may make it easier for low-productivity firms to survive (so-called “zombie firms”), and this will drag down the growth rate. The authors find evidence for these mutually reinforcing trends and argue that demographic aging is what has driven the shift. This is a rather pessimistic conclusion for our future productivity prospects.

Chapter 12, the final chapter in this section, is by Ates, who reviews the models of competition and step-by-step innovation introduced in Chapter 2. He then focuses on knowledge diffusion and shows that a decline in this margin does go a long way toward accounting for the broad trends of de-

clining dynamism discussed by Bilal et al. in Chapter 8. The key mechanism that underlies these results is the combination of endogenous responses of firms to a decline in knowledge diffusion (incentive effect) and the ensuing shift in the sectoral composition of the economy (composition effect). Falls in diffusion weaken the incentives of laggards to innovate, which in turn reduces pressure on leaders. This leads to an increase in the relative size of sectors that are highly concentrated with high markups. These two forces reinforce the trends toward lower innovation and growth. This dynamic also potentially explains the low interest rates discussed by Bergeaud et al. in Chapter 11. Ates then links these forces with industrial policy and the importance of encouraging foreign competition between global firms.

The Environment: Green Innovation and Climate Change

Climate change is the biggest long-term challenge facing the human race. Tackling climate change will require innovation—reducing carbon consumption through higher prices and tougher regulation are unlikely to be successful without more frontier innovation and speedier adoption of clean technologies. Part V on the environment brings together four perspectives on the issue of green innovation as a form of directed technical change, leveraging the power of the Aghion-Howitt framework.

Lord Nicholas Stern wrote a landmark review on the importance of climate change (Stern, 2007). In Chapter 13, he opens this section with a policy-focused approach, emphasizing the need for urgent action on climate change and showing that this strategy easily passes a cost-benefit test. Part of this action is a requirement to invest heavily in subsidizing R&D to direct technologies away from dirty technologies and toward clean technologies.

Besley and Persson (Chapter 14) emphasize another mechanism for stimulating green innovation that operates through the social values and norms held by individuals. They show in the data that there is a shift in attitudes—particularly among the young—toward more pro-green preferences. This shift will affect demand, as consumers will prefer environmentally friendly products and services. These authors also show that the attitudinal shift has supply-side effects. First, as the expected market size for green products becomes larger, inventors direct more efforts toward this market. Besley and Persson then focus on a second channel: As scientists themselves are “motivated agents,” concerned with their mission as well as with money, they will want to do more R&D in this area. This may help push technical change in

a clean direction and implies that the battle for “hearts and minds” has direct economic and environmental implications.

Despite the optimism that can arise when we consider how technology can support the transition, there is a serious risk that it may be too little, too late. The COP-26 (Conference of the Parties) meetings in Glasgow in 2021 showed how difficult it is to get international climate change agreements. If global cooperation fails to produce the transition to net zero, humanity needs a Plan B. Fuglesang and Hassler (Chapter 15) take on this challenge, suggesting geoengineering solutions in case emissions are not cut sufficiently. They favor the approach of launching thousands of sunscreens (“solar kites”) into space between the earth and the sun to divert dangerous solar emissions and keep global warming to manageable levels. They sketch the costs of this bold proposal and argue that it is both technically feasible and cost effective. They then analyze a game-theoretic model to deal with the objection that creating such a Plan B would undermine Plan A—a global agreement to cut emissions. They concede that this is a danger but argue that the greater risk is that we may end up with no way of preventing the earth from heating up dangerously.

In Chapter 16, Dechezleprêtre and Hémous show how Lord Stern’s conclusion in Chapter 13 arises from an extension to the endogenous growth framework allowing for directed technical change. When there is an existing installed base of dirty technologies, the shift to clean technologies becomes a lot harder, because dirty innovation is locked in. For example, current innovators will tend to “build on the shoulders of giants” of past inventions, and since the current stock of ideas is mainly in fossil fuels, the natural evolution is to do more dirty innovation. Dechezleprêtre and Hémous show that shifting toward clean R&D requires not only a carbon tax but also direct subsidies with intense action early on. The good news is that as the installed base of clean technologies widens, the long-term costs are even lower. These authors illustrate this with several recent econometric studies, such as the move to electric/hybrid vehicle innovation and away from the internal combustion engine (see Aghion et al. 2016).

Development and Political Economy

The discussion of solutions to climate change in the previous section highlights the political constraints on economic analysis. Just as the creative destruction paradigm opens up the analytical space to consider issues like

competition, inequality, and the environment, it also allows a reexamination of classical issues in Development and Political Economy. In Chapter 17, Peters and Zilibotti give a magisterial overview of the profound impact of the paradigm on development. They emphasize that the set of social and political institutions that help maximize growth during an initial catch-up period are quite different from those needed at a later stage. For example, catch-up institutions for diffusion are distinct from those required to push the technological frontier forward.

Roland (Chapter 18) takes on the big-picture question of what modes of industrial societies succeed in the long run. In the 1950s, there were fears that the Soviet Union would surpass the United States in technological prowess, as symbolized by the successful launch of Sputnik. Yet Communism failed to deliver sustained technological advance, collapsing under the weight of its own contradictions. Many suspect that despite China's current growth rates, it will go the same way as the USSR. Roland is less sanguine. He sees Russia's key economic failure as the suppression of entrepreneurialism that allows creative destruction to be the engine of growth. China, unlike the USSR, has a vibrant entrepreneurial sector, even though it has a politically repressive Communist regime. It is not obvious why this entrepreneurial culture will wane and hence, why China will not continue to pull away from the West in terms of its economic mass. This trend is having a profound effect on geopolitics.

In addition to studying the growth of China itself, an enormous body of work looks at the impact of the "China shock" on Western economies. As Griffith and Van Reenen discuss in Chapter 3 on competition and innovation, although the effects on jobs in domestic sectors of competing with Chinese imports is clearly negative, the impact on innovation is more heterogeneous, with many studies documenting strong positive effects of Chinese competition. Bombardini, Cutinelli-Rendina, and Trebbi (Chapter 19) investigate lobbying by US firms. They argue that although more productive firms respond positively in response to increased Chinese import competition by innovating (e.g., as found by Bloom et al. 2016), firms well below the productivity frontier will tend to respond instead by lobbying for protection and subsidies. This is because such firms both find it relatively hard to innovate to escape competition and more attractive to collude after the China shock.

Baslandze (Chapter 20) continues the theme of analyzing the tension between market entrants and incumbents. She discusses her model in Akcigit

et al. (2023) where entrants try to replace incumbents through creative destruction and incumbent firms respond to this by investing in innovation or in political connections to maintain their market power. She uses rich data on Italian firms to show that market leaders are less innovation intensive and more politically connected. Political connection at the firm level is associated with higher employment growth but not productivity growth. Those sectors that have more politically connected incumbents feature lower business dynamism.

As a whole, this section shows how politics and economics are profoundly entwined and cannot be studied separately. The Aghion-Howitt framework enables a deeper understanding of these connections and offers a tractable way to build political economy into our models of growth and development.

Finance

Schumpeter emphasized the importance of imperfections in financial markets, which can hold back the ability of entrepreneurs and innovators to commercialize and develop their ideas. Chapter 21 by Kalemli-Özcan and Saffie reviews this literature. They show how firm heterogeneity is crucial for understanding the important role of finance in influencing innovation, as the financial system is meant to be allocating capital to its most profitable uses. When this system becomes impaired—such as after the Global Financial Crisis—it can have long-run effects through failing to channel resources toward innovative firms (e.g., new entrants, which are often found to be creators of the most radical inventors). The authors develop a tractable framework that allows for creative destruction and firm dynamics to be integrated into the workhorse quantitative models of international finance. The model generates the “hysteresis” effects of downturns (i.e., that the effect of recessions can persist a long time after the economy has started to recover) through financial markets and firms rather than the traditional labor market models focused on unemployment persistence. Celik (Chapter 22) takes a more micro approach, reviewing the literature on finance and firm dynamics, especially on how it relates to the discovery, reallocation, and implementation of new ideas. He presents a new endogenous growth model with collateral constraints to highlight the interaction of financial frictions with firm innovation.

Taxation

In Chapter 23, Jones emphasizes that three key factors have been important in understanding the modern analysis of growth. Creative destruction as emphasized by Aghion and Howitt (1992) is certainly important, but so is the nonrivalry of ideas and misallocation of talent. Drawing on all of these aspects, Jones takes a more macroeconomic perspective, focusing on the intense arguments about the top rate of taxation. These are often presented in quite a static framework that ends up focusing on how shifts in the top tax affects tax revenues collected. However, to the extent that those in the top income group have become rich through their entrepreneurial and innovative abilities, increasing the top rate will affect the incentives to innovate. Hence, the growth effects of taxation could be large, and such dynamic considerations will swamp the usual static public finance calculus.

In Chapter 24, Stantcheva gives a more detailed account of how taxation affects innovation and provides a detailed overview of this area, looking both at the corporate and individual sides. There is an extensive empirical literature on R&D tax credits (see the survey by Hall 2022), suggesting that they are an effective policy to raise R&D and innovation (e.g., Dechezleprêtre et al. 2023). In contrast, Stantcheva emphasizes a more recent literature suggesting that individual taxes (and the overall level of corporate taxation) also seem to play an important role. She provides a new theoretical framework for thinking about taxation and innovation and looks at her own empirical work (Akcigit et al. 2022), using rich data on a century of innovation in the United States that supports this framework. Although state-specific taxes generate much relocation, she argues that lower top rates of personal tax also have a positive effect on aggregate innovation.

In these two chapters, both Jones and Stantcheva show that the top tax rate plays an important role for innovation. Stantcheva also shows that the top tax rate could be a relatively blunt tool for fostering innovation. For instance, there are far fewer innovators in the top 1 percent of the income distribution than most people think. If people with inherited wealth made up a lot of this group, as is the case in many countries, the incentive effects of top tax rates are muted. Policies aimed at building up the research and human capital infrastructure of a country may be a much more effective innovation

policy than getting involved in a beggar-thy-neighbor approach of cutting tax rates.

Science

The Aghion-Howitt framework focuses on the incentives for profit-maximizing firms to perform R&D, but there is also a science base behind this effort, often driven by other incentives (as emphasized in Chapter 14 by Besley and Persson on green innovation). The interaction between the academic science base and entrepreneurial startups is the focus of Chapter 25 by Kolev, Haughey, Murray, and Stern. They show that since 2000, top American university research has become increasingly important for startups. Analyzing a new database of patents from these top US universities shows that startups have a big advantage over incumbents in terms of the importance and originality of their innovations. Such firms are able to scale up more quickly than established firms. Given the general picture of declining dynamism discussed in other chapters, this is a more optimistic take that emphasizes the role of academia in helping stimulate growth, not just indirectly via the analysis in this volume, but also directly in terms of entrepreneurship.

In Chapter 26, Mokyr looks at these issues in a broader historical context, focusing on the Industrial Revolution as the case study par excellence of creative destruction. He distinguishes between culture (what people believe and think they know) and institutions (the rules and customs that determine their incentives) and shows how their coevolution affects one another in many complex ways. He argues forcefully that in the era of the Industrial Revolution, the central cultural tenet that drove creative destruction was a strong belief in progress. Perhaps the loss of confidence in progress in the West is what has retarded growth in recent decades.

Conclusions

The many contributions in this volume help give a flavor of the endurance and adaptability of the creative destruction paradigm launched three decades ago. The Conclusion by Aghion and Howitt themselves reflects on the history of their work and how its development has important implications for

modern policy (e.g., Aghion et al. 2021; Bloom et al. 2019). Given the vibrancy of the literature, we expect a similar flourishing over the course of the next thirty years.

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