

Forward to “The Economics of Creative Destruction”

Ufuk Akcigit and John Van Reenen

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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 14,000 citations on Google Scholar¹, at time of writing in July 2022 – 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 was a deliberate choice of firms facing a changing and uncertain environment, but also that the process was highly disruptive. Innovating firms necessarily made obsolete older ideas, lines of business and forms of organization. Research and Development (R&D) was by nature an endeavour that was both creative and destructive.

This notion of growth owed much to Joseph Schumpeter (1943), 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 insights from industrial organization into macroeconomics.

The paper created a new space for theoretical and empirical work that has reverberated through almost every field of economics and into other disciplines. Three decades years after the publication of the paper, we brought together over a hundred scholars (including eleven Nobel Laureates) in June 2021, 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 of that endeavour.

Organization of the Book

We have organized the book to reflect the many areas where the Aghion-Howitt framework has had a major influence. All of the chapters are original contributions by the authors. Some are

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

analytical reviews of the literature, other offer novel theoretical or empirical contributions. We hope the reader finds all of them immensely stimulating.

In our first chapter, we begin with an **Introduction** to creative destruction to frame the later discussion. Akgigit sketches out the essential elements of the Aghion and 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 opened new possibilities in many different fields.

Next, Nobel Laureate Edmund Phelps reflects on how our thinking about growth policies has fundamentally changed due to Aghion and Howitt. He echoes the themes of several chapters that innovation is not simply the product of scientists – it involves entrepreneurs, managers and workers. Indeed, he views the wellspring 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 and by Mokyr). 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.

We then move on to the main part of the book consisting of nine major sections: (1) Competition and International Trade, (2) Inequality and Labour Markets, (3) Productivity Growth: Decline and Measurement, (4) The Environment, (5) Development and Political Economy, (6) Finance, (7) Taxation and (8) Science.

The final chapter is by Aghion and Howitt reflecting on our book as a whole.

1. Competition and International Trade

The first section focuses on **Competition and Trade**. Creative destruction implies that the structure of product markets is critical for innovation and 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 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).

They emphasise 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 is positive (consistent with earlier work, such as by Blundell et al., 1999). Indeed, for the cases most often examined by anti-trust authorities, competition is already low, so we are on the part of the Inverted U where further reductions in competition are likely to not only put upward pressure on prices, but also to chill innovation.

The next chapter by Gilbert, Rils and Rils focuses more squarely on one aspect of competition policy: Merger and Acquisitions (M&A). It discusses how merger rules must be adapted to consider downward pressure on innovation. The current merger regimes focus on upwards pricing pressure, which is important for static losses, but misses the potentially 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 (e.g. Autor et al, 2020), competition authorities need to take innovation more seriously in their enforcement activities. The authors develop a new model used to address issues around mergers.

Understanding competition requires thinking about the complex network of interactions, often deeply personal, that influence innovation. Jackson, Mayerowitz and Tagade apply network theory insights to an empirical analysis of co-authorship in patenting. They find that patenting and the number of co-authors 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 of increasing competition through the threat of entry from foreign firms. However, there are many other channels through which trade can influence innovation and these are thoroughly documented in the chapter by Melitz and Redding who look at theoretical and empirical work in this area. They emphasise 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 more sales units). 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 de-globalization and supply chain disruption caused by Brexit, Trump's trade wars, Covid and Ukraine are likely to be another headwind against global growth.

2. Labor Markets and Inequality

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.

Blundell, Jaravel and Toivanen begin this section by examining the relation between innovation and inequality. They argue against a monocausal approach. Although innovation can certainly raise inequality through, for example, 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 the current incumbents seize these chances, this process will foster social mobility and so reduce inequality. They emphasise the many policies that could both increase innovation and reduce inequality (or at least inequality of opportunity). For example, US data shows that children born to the richest one 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 is not due to lower intrinsic ability. Improving schools and neighborhoods for these underrepresented groups and exposing these "Lost Einsteins and Marie Curies" to the possibility of becoming innovators would both reduce inequality and raise the growth rate: a policy that is good for growth and equity.

The next two chapters focus in on labor markets, the main way in which rewards are distributed to individuals in a market economy. Skans, Chone 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, etc. 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 between the specialists driving down their wages. This leads to increased inequality, with generalists earning much higher market wages than specialists. 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 low paid (the so-called “McKinsey-McDonalds economy”).

The next chapter by Bilal, Engbom, Mongey and Violante takes a more macro-economic approach, focusing on the role of technological imitation in raising growth. New entrant firms creatively destroy incumbents by poaching their workers. They examine what happens when imitation becomes harder – consistent with work of Bloom et al. (2020) that ideas have become harder to find. They show this framework matches many trends in the US over the last three decades: lower firm entry, less employment response to productivity shocks and falling job-to-job transitions. Despite this, they 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.

II.3 Productivity Growth: Decline and Measurement

One of the most worrying trends in recent years has been the **decline** in productivity growth. This occurred after the mid-1970s Oil Shocks and seemed to reverse in the ICT-based productivity acceleration 1995-2004. Unfortunately, growth slowed since then and has remained lacklustre for almost two decades. The Bilals et al chapter mentioned in the previous section matched the falling business dynamism trends but could not account for the slowdown. The chapters in this section take this issue head-on.

Li and Boppart examine ways of improving the **measurement** of growth to incorporate creative destruction. They document considerable mismeasurement problems generally causing 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 the of the recent decline in growth.

Next, Cette, Bergeaud and Lecat examine the role of monetary policy, considering that interest rates could be both an effect and a cause of slower growth. 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, this means that the real return on capital investment has fallen and therefore so too will interest rates. However, the authors also consider how there may also 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 the demographic aging is what has driven the shift: a rather pessimistic conclusion for future productivity prospects.

The final chapter in this section is by Ates, who reviews the models of competition and step-by-step innovation introduced above in section 1. He then focuses on knowledge diffusion and shows that a decline in this margin does go a long way to account for the broad trends of declining dynamism discussed by Bilals et al. The key mechanism that underlies these results lies in 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 composition of highly concentrated, high markup sectors of the economy. These two forces reinforce the trends to lower innovation and growth. This also gives a potential explanation for the low interest rates discussed by Cette et al. Ates then links these with industrial policy and the importance of encouraging foreign competition between global firms.

4. 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 prices and tougher regulation are

unlikely to be successful without more frontier innovation and speedier adoption of clean technologies. This section 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 in 2006. He opens this section with a policy-focused approach, emphasising the need for urgent action on climate change and shows 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 towards clean technologies. Hémous and Dechezleprêtre show how this conclusion 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 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. They show that shifting towards clean R&D requires more than just 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. They 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).

Besley and Persson emphasise 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 - towards more pro-green preferences. This will affect demand, as consumers will prefer environmentally friendly products and services. They show that additionally, the attitudinal shift also has supply-side effects. First, as the expected market size for green products is larger, inventors direct more efforts towards this market. They 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 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. Hassler and Fuglesang take on this challenge, suggesting geo-engineering solutions in case emissions are not cut sufficiently. They favour 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 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.

5. Development and Political Economy

The discussion of solutions to climate change in the last 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 re-examination of classical issues in **Development and Political economy**. First, Peters and Zilibotti give a magisterial overview of the profound impact on development. They emphasise that the set of social and political institutions that help maximise 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 takes on the big picture question of what modes of industrial societies succeed in the long run. In the 1950s, there were fears in 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 a 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 is having a profound effect on geopolitics.

In addition to studying the growth of China itself, there is an enormous body of work looking at the impact of the “China shock” on Western economies. As Griffith and Van Reenen discussed in their chapter 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 and Cutinelli-Rendina investigate lobbying by US firms. They argue that although firms that are more productive 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 that collusion more attractive after the China shock.

Baslandze continues the theme of analysing the innovation-lobbying trade off. She discusses a model where firms can invest in innovation or political connections in order to advance their performance, and to overcome market frictions. She uses rich data on Italian firms to show the extensive network of political connections and document how politically connected firms tend to exhibit much worse dynamic growth. Lobbying helps firms survive and obtain higher profitability, but stifles productivity growth.

The section as a whole 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 in political economy into our models of growth and development.

6. Finance

Schumpeter emphasised the importance of imperfections in **financial markets**, which can hold back the ability of entrepreneurs and innovators from being able to commercialize and develop their ideas. The chapter by Kalemia-Ozcan and Saffie reviews this literature. They show how firm

heterogeneity is crucial in 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 it becomes impaired – such as after the Global Financial Crisis - this can have long-run effects through failing to channel resources towards 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 to 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 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.

7. Taxation

One important potential lever to affect innovation is through **taxation**. Stantcheva gives a detailed overview of this area looking both at the corporate and individual side. There is an extensive empirical literature on R&D tax credits (see the survey by Hall, 2022) suggesting that they are indeed an effective policy to raise R&D and innovation (e.g. Dechezleprêtre et al. 2022). By contrast, Stantcheva emphasises a more recent literature suggesting that individual taxes (and the overall level of corporate taxation) also seem to play an important role. She sketches the theory underlying this claim and looks at how her own empirical work (Akcigit et al, 2022) using rich data on a century of innovation in the US that supports this view. Although state-specific taxes generate much re-location, she argues that lower top rates of personal tax also have a positive effect on aggregate innovation.

In his chapter, Jones emphasises that three key factors have been important in understanding the modern analysis of growth. Creative destruction as emphasised by Aghion and Howitt is certainly important, but so is the non-rivalry of ideas and misallocation of talent. Drawing on all of these, he 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 ability, 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 public finance static calculus.

Both Stantcheva and Jones show that increasing the top tax rate could be self-defeating. Nevertheless, there is considerable uncertainty regarding the magnitude of the impact of such changes on behavior. In addition, Stantcheva shows, there are far fewer innovators in the top 1% and 0.1% of the income distribution than most people think. If people with inherited wealth made up a lot of this group, for example, as is the case in many countries, the incentive effects are much less obvious. Indeed, policies towards 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-my-neighbor approach of cutting top tax rates.

8. Science

The Aghion-Howitt framework focuses on the incentives for profit-maximising firms to perform R&D, but there is also a science base behind this often driven by other incentives (as emphasised in the earlier Besley-Persson chapter on Green Innovation). The interaction between the academic **science** base and entrepreneurial startups in the focus of the chapter by Kolev, Murray and Stern. They show that since 2000, top American university research has become increasingly important for startups. Analysing a new database of patents from these top US universities show 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. Given the general picture of declining dynamism discussed in other sectors, this is a more optimistic take emphasising the role of academia in helping stimulate growth, not just indirectly via the analysis in this volume, but directly in terms of entrepreneurship.

Mokyr looks at these issues in a broader historical context focusing on the industrial revolution as the case study par excellence in 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 co-evolution affect 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 firm belief in progress. Perhaps the loss of this belief is what has chilled growth in recent decades in the West.

Conclusions

The many contributions in the volume help give a flavor of the endurance and adaptability of the creative destruction paradigm launched three decades ago. The final chapter by Aghion and Howitt themselves, reflects upon 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.

We dedicate this book to Emmanuel Farhi 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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