2. Fostering green and inclusive productivity growth

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This chapter explains the main ideas underpinning the Schumpeterian growth paradigm and how it provides a new lens to look at the determinants and effects of the growth process. Schumpeter was pessimistic about the future of capitalism. Indeed, his belief was that capitalism was doomed because in his view it was impossible to prevent incumbent firms from barring new innovations, either directly or by exploiting political connections with government authorities. The chapter uses the lenses of the Schumpeterian paradigm to revisit growth policy debates and also to rethink capitalism and its ability to reconcile the promise of sustained prosperity with the quest for greener and more inclusive growth. We argue that the proper functioning of an economy of innovation and creative destruction rests on the triangle between firms that innovate, the state, which is meant to regulate and invest, and civil society, which serves as a watchdog to induce firms and the state to do the right things.

I. Introduction

One can assess paradigms by their ability to shed new light on major economic trends and enigmas, and also to provide a new lens to look at policy design. Ironically, the Washington Consensus, which was perceived to be based on modern economic theory, was rather untethered from any formal paradigm.[1] It has shown its major limitations and as we seek to go beyond it, we have to consider what alternative growth paradigm should be used.

Up until the early 1990s, the dominant theory of economic growth was the neoclassical growth model first developed by Robert Solow.[2] This model predicts that investing in the accumulation of physical capital equipment

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stimulates growth of per capita gross domestic product (GDP) – but only up to a certain point, because of diminishing returns on capital. As Solow explained, generating sustained growth requires technical progress to keep improving the quality of machines, i.e., their productivity. But Solow, and the neoclassical paradigm more generally, did not describe the factors that determine technical progress, and in particular the factors that stimulate or inhibit innovation.

The Schumpeterian growth paradigm, also referred to as the 'creative destruction paradigm', was meant to fill this gap. First, by developing micro-founded models of innovation-led growth that give centre stage to market structure, cross-firm heterogeneity and firm dynamics. And second, by confronting these models with new and rich microdata.

In this chapter, we use the lenses of the Schumpeterian growth paradigm to revisit growth policy debates and also to rethink capitalism and its ability to reconcile the promise of sustained prosperity with the quest for greener and more inclusive growth.

The chapter is organised as follows. First, we summarise the main ideas underlying the Schumpeterian growth paradigm, and then provide several examples illustrating how the paradigm allows us to identify faulty reasoning and to question flawed policy recommendations. The subsequent sections use the lenses of the Schumpeterian paradigm to revisit growth policy debates. First, we discuss the issue of how to reconcile industrial policy with competition policy. Then we focus on green innovation and the energy transition, before looking at whether, and, if so, how, one can make capitalism both more innovative and more inclusive. The final section concludes by arguing that the triangle among firms, the state, and civil society is key to achieving the objective of sustained, green, and equitable prosperity.

II. The Schumpeterian paradigm

The paradigm revolves around three main ideas.[3] The first is that long-term growth results from cumulative innovation, where each new innovator builds upon previous innovations. In particular, institutions that favour the diffusion and codification of knowledge contribute to making innovation cumulative, i.e., they make it unnecessary to climb the same mountain over and over again, like Sisyphus. The second idea is that innovation is motivated by the prospect of innovation rents. Institutions that secure those rents, in particular by protecting intellectual property rights, encourage entrepreneurs to invest more in innovation. And the third idea is creative destruction: that is, new innovations render previous innovations obsolete. In other words, there is a permanent conflict between the old and the new.

One could add that policies that foster productivity growth at the technological frontier are not quite the same as those that foster productivity growth far below it: in particular, product market competition fosters innovation-led growth by frontier firms as they innovate to escape competition

with their rivals; but competition does not necessarily foster imitation-led growth by non-frontier firms.

At the heart of this new growth paradigm lies a contradiction. On the one hand, innovation rents are needed to motivate innovation investments. On the other hand, yesterday's innovators are tempted to use their innovation rents to prevent subsequent innovations as they do not want to suffer from creative destruction themselves.

Regulating capitalism is in part about how to manage this contradiction. Interestingly, even as he saw creative destruction as a potential driving force of growth, Schumpeter himself was quite pessimistic about the future of capitalism, as he anticipated that previous innovators would turn into entrenched conglomerates that would impede new innovations. Even though to some extent recent economic history seems to support Schumpeter's worries, we believe that it is possible to manage this fundamental tension so as to 'save capitalism from the capitalists'.[4]

The Schumpeterian paradigm provides a new lens to look at the determinants and effects of the growth process: it gives centre stage both to firm dynamics and to cross-firm heterogeneity – between incumbents and entrants, between leaders and followers in the various sectors of the economy, and between small and large firms. And, most importantly, it lends itself to a renewed dialogue between theory and empirics, using new firm-level microdata. It is this creative interaction between micro-founded growth theory and empirical analyses based on microdata that provides the best ground for policy analysis and in particular for questioning common wisdoms and identifying potentially erroneous policy prescriptions.

A first such common wisdom is that de-growth is the only way to effectively fight climate change. At a glance, the relationship between growth and CO2 emissions or temperature over the past centuries seems to support that view: namely, temperature and aggregate CO2 emissions worldwide started to increase precisely at the time of the growth take off in the 19th century. And in China and India CO2 emissions began to rise just when those countries embarked on high growth paths. However, we now know what negative growth looks like thanks to pandemic lockdowns. In France, during the first lockdown between March and May 2020, domestic GDP went down by 35%, while CO2 emissions were reduced by only 8%. Fighting climate change through negative growth could be like imposing such a lockdown indefinitely.[5]

A more promising route to reconcile climate conservation with sustained growth and prosperity, is green innovation: looking for cleaner sources of energy, cleaner products, and cleaner production technologies. We discuss how to induce green innovation later in the article.

A second common wisdom we can question with the Schumpeterian paradigm is that automation is bound to increase aggregate unemployment by substituting capital for labour. Hence, to limit the negative effects of automation on aggregate employment, governments should tax robots.

The fear that machines would lead to mass unemployment goes at least back to 1589, when William Lee introduced his knitting machine, but the most famous manifestation came with the Luddite movement in 1811–12, which resisted manufacturers' use of machines for producing textiles. Then, in the 1930s, economists starting with J. M. Keynes expressed concern about the danger of mass 'technological unemployment'.

More recently, the information technology (IT) and artificial intelligence (AI) revolutions have revived the fear that technological progress will make labour increasingly redundant, with the result that economic scholars and policymakers have proposed robots be taxed in order to protect aggregate employment. The dominant view indeed sees robotisation and other forms of automation as primarily destroying jobs, even if this may ultimately result in new job creation taking advantage of the lower equilibrium wage induced by the job destruction. Hence the policy recommendation that robots should be taxed in order to protect aggregate employment and also wages.

However, there is an alternative view: namely, that firms that automate become more productive, which enables them to lower their quality-adjusted prices and therefore to increase the market for their products, perhaps in part by taking business from other firms – domestic or foreign – that did not automate. This productivity effect may more than offset the direct substitution effect of automation (i.e., the replacement of workers by machines), in which case, automation will result in higher labour demand by the automating firms.

In previous work we have considered various measures of industrial capital, including Daron Acemoglu and Pascual Restrepo's 'industrial automation' measure, showing that an increase in any of these measures results in higher firm-level employment.[6] This confirms an older line of research showing the benefits of firm-level technological innovation for jobs.[7] Taxing robots would reduce firms' incentives to become more productive through automation, and therefore increase their market worldwide and their labour demand. That means the end result of taxing robots may in fact be to reduce aggregate domestic employment – not protect it.

A third common wisdom to be questioned is the idea that subsidising incumbent firms, or relaxing the credit constraints they face, should always be growth-enhancing. By contrast, Schumpeterian models have shown that subsidising incumbent firms research and development (R&D) investments may be detrimental to aggregate innovation and growth if it discourages entry by potentially more innovative firms.[8] Similarly, relaxing the credit constraints faced by incumbent firms may discourage entry by more efficient innovators.[9] Indeed, the Additional Credit Claims programme introduced by the European Central Bank in 2011 to prevent a post-crisis recession by relaxing credit constraints on a subgroup of European incumbent firms resulted in reduced exit by the least efficient firms, thereby discouraging entry by new innovating firms.[10] Getting the balance right between encouraging the new and safeguarding overall economic stability is often hard, but the emphasis is all too often on powerful incumbent interests rather than smaller new entrants.

III. Competition and industrial policy

Empirical studies from the 1990s that used panel data of firms in the United Kingdom pointed to a positive correlation between product market competition and innovation.[11] Subsequent work has shown that more intense competition enhances innovation in 'frontier' firms, which innovate to escape competition with their rivals, but may discourage it in 'non-frontier' firms.[12] One important implication is that competition should be more growth-enhancing in countries that are closer to the world technology frontier, as more firms in these countries are close to the leading edge of technology in their sectors. The idea that growth-enhancing policies are not the same for advanced countries and for less developed countries is in fact more general, and we return to it later in the chapter.

That impediments to competition should be detrimental to innovation and productivity growth is well illustrated by the recent growth history of the United States. Why, after a boost between 1995 and 2005, has US productivity growth fallen since 2005? Why has it fallen despite the IT and AI revolutions? And why have firms' markups increased over the same period? Different explanations for the growth decline have been explored, for example, the view that new ideas may be harder to come by, or the fact that growth may be mismeasured – and there is good evidence supporting both claims.[13] Another complementary explanation is that during the past decades the US economy has experienced a rising hegemony of so-called 'superstar' firms. Studies have shown a sharp rise in market concentration in all sectors of the US economy since the early 1980s.[14]

The ascent of superstar firms has been facilitated by the IT revolution, which allowed them to perform a broader range of activities, but also by loopholes in competition policy that allowed them to expand almost without bound through mergers and acquisitions.[15]

To the extent that superstar firms were more productive – having accumulated social capital and know-how, or developed networks that other firms could not emulate – their rising influence contributed to the surge in productivity growth between 1995 and 2005. It also explains the surge in rents as superstar firms tend to have higher markups than other firms. The flip side is that, as they became hegemonic, superstar firms ended up discouraging innovation and entry by other firms, hence the observed decline in growth and entry since the early 2000s.[16]

That competition is key to sustained productivity growth had been acknowledged by policymakers on both sides of the Atlantic long before the aforementioned studies came out. What's more, it was in the name of competition that industrial policy came under strong criticism in the 1980s.

Until then, and particularly in the years following World War II, national champions were at the forefront of industrial policy in many developed countries. In France, this pro-champion policy was a pillar of the reconstruction of the economy, and of the 30 years of post-war growth.

In the United States, it played a decisive role in particular for the defence, aeronautics, and aerospace industries in the pursuit of supremacy over the Soviet Union. At the same time, the World Bank, under the direction of Robert McNamara, supported trade protection and import substitution in developing countries to allow them to nurture their infant industries. In the UK, the 1970s were the era of champions, such as British Leyland, the ill-fated car maker.

However, over time, industrial policy fell out of favour. Economists had been long aware of the problems it creates in practice. First, it favours existing large domestic firms – the national champions – thus limiting or distorting competition. This is the entrenched incumbent we discussed in the last section, who can hold back entrants. Second, governments are not great at picking winners – that is, choosing which firms they should support with subsidies or tariffs – as they do not have access to all of the relevant information. Furthermore, they may be unduly receptive to lobbying by large incumbent firms. The greater these firms' resources, the more they are in a position to influence public policy.[17]

This challenge led to a preference for what are known as 'horizontal' policies for stimulating innovation and growth, meaning policies that apply to all sectors of the economy. Among the main types of horizontal policy are (1) investing in the knowledge economy (especially higher education and research), (2) reforming labour and product markets to make them more dynamic, through appropriate policies for competition, unemployment insurance, and professional training, and (3) developing venture capital and private equity to provide funding for innovation.

Do these horizontal actions suffice? Or does the state still have a role to play in industry, and, if so, what is that role? Objections to industrial policy from the 1950s and through the 1980s are difficult to counter, not least because later work identified several sources of inefficiency in state intervention, due to asymmetric information or the potential for collusion between private actors and the state.[18]

Still, this alone does not suffice to disqualify state intervention, which remains legitimate for several reasons. One is the existence of positive knowledge externalities, or the fact that the benefits others receive from innovative efforts far exceed those appropriated by the agent who exerted the effort. An individual deciding whether to invest in education or in R&D does not take into account the positive externalities on their coworkers or on the economy as a whole. As a consequence, individuals tend to underinvest in education and in R&D. Moreover, credit constraints exacerbate this tendency. However, this alone does not justify state intervention that is not purely horizontal.

A first argument in support of a vertical industrial policy is that, left entirely to their own choices, firms may not spontaneously innovate in the right direction. For example, car manufacturers that innovated in combustion engine technology in the past will tend to innovate in that same technology in the future – despite it being a 'dirty' technology.[19]

Another argument has to do with problems of coordination. Several studies have suggested that government action can help resolve coordination problems, thereby enabling or accelerating entry into strategic sectors where the initial fixed costs of entry are high.[20] Consider a new potential market where entry is costly and where future profits are uncertain and depend on information (such as the level of consumer demand) that cannot be known until the market is active. No single firm wants to be the first to pay the fixed costs of entry. Every firm prefers to let other firms bear the fixed costs first and then to benefit from the information they generate, without bearing the risk and cost of acquiring this information themselves. In other words, the absence of state intervention leads to the 'free rider' phenomenon, which results in delay or even an impasse in creating the market. To solve this problem, the state can subsidise the first entrant, which encourages other firms to follow its example.[21]

This argument explains the success of state intervention in the aeronautics industry (for example, with Boeing and Airbus), where fixed costs are high and demand is uncertain. It also explains the success of the Defense Advanced Research Projects Agency programme established in the United States in 1958 to facilitate the transition from basic to applied research, and also marketing for breakthrough innovations where this transition entails substantial fixed costs and requires coordinated efforts by various economic actors.[22]

But once we recognise that industrial policy can be useful, how can we determine in which sectors the state should intervene? Policymakers should first address economic and social priorities, such as fighting climate change and developing renewable energies, health, and defence. After that, they should focus on sectors using highly skilled labour or having a high degree of competition. A study analysing international microeconomic data showed that public investments targeting skill-intensive sectors are more effective in stimulating productivity growth.[23] Similarly, a study based on Chinese data showed that targeting more competitive sectors helps stimulate productivity growth.[24]

The question then arises of the governance of sectoral state aids. Sectoral aids stimulate productivity growth more when they are not concentrated on a single firm or a small number of firms – in other words, if the aid operates to maintain or increase competition in the sector. Furthermore, such aids should be regularly reassessed in order to avoid the perpetuation of programmes that prove to be ineffective. Co-financing by state and private investors, such as development banks, can facilitate the establishment of adequate exit mechanisms. Finally, as we will explain in greater detail, subsidising established firms can hinder the entrance of new, more innovative firms as a result of a reallocation effect: incumbent firms increase the cost of skilled labour and other factors of production. The state should thus implement sectoral aid that does not impede new entrants and that reconciles, as much as possible, industrial policy and competition policy.

Our work has shown how industrial policy could be effective in stimulating growth, by looking at the effects of the changing European Union state aid rules that effectively randomised certain geographical areas in and out of eligibility for investment subsidies.[25] Importantly, these subsidies were not effective for large incumbents, but very effective when targeted at smaller businesses. Similarly, fiscal incentives for R&D tend to have larger impacts on smaller firms, as shown by one study that exploited the British expansion of the R&D tax credit system to small- and medium-sized enterprises in a discontinuity design.[26]

Overall, industrial policy is not a 'yes-or-no' issue. Rather, the challenge is to redesign the governance of industrial policy to make it compatible with competition, and more generally with innovation-led growth.

IV. The middle-income trap

In 1890, Argentina enjoyed a GDP per capita approximately 40% that of the United States, making it a middle-income country. This level was three times the GDP per capita of Brazil and Colombia, and equivalent to that of Japan at the time. Argentina sustained this GDP per capita relative to the US through most of the 1930s – until 1938, since Argentina's productivity consistently and substantially declined relative to American levels. What explains this drop-off?

Schumpeterian growth theory offers an explanation. Countries like Argentina either had institutions or policies (in particular import-substitution) that fostered growth by accumulation of capital and economic catch-up. They did not, however, adapt their institutions to enable them to become innovating economies. As argued in the joint work of Daron Acemoglu and Fabrizio Zilibotti, the greater the level of development in a country – i.e., the closer it gets to the technology frontier – the greater the role of cutting-edge innovation as the engine of growth, replacing accumulation and technological catch-up.[27]

Japan, where the state has always tightly controlled competition, is another example. Japan's Ministry of Economy, Trade and Industry caps the number of import permits, and the state subsidises investment by the industrial-financial consortia known as *keiretsu*. It is thus not surprising that Japan's growth has fallen from an extremely high level between 1945 and 1985 – the envy of other developed countries – to a very low level thereafter.

In our previous discussion we mentioned some recent evidence for the prediction that competition and free-entry should be more growth-enhancing in frontier firms, which implies that they should be more growth-enhancing in countries that are more economically advanced, since those have a larger proportion of frontier firms. Indeed, one study that used a cross-country panel of more than 100 countries over the 1960–2000 period showed both that average growth should decrease more rapidly as a country approaches the world frontier when openness is low, and that high entry barriers become increasingly detrimental to growth as the country approaches the frontier.[28]

Such empirical exercises point to the importance of testing for interactions between institutions or policies with technological variables in growth regressions, because openness is particularly growth-enhancing in countries that are closer to the technological frontier, and entry is more growth-enhancing in countries or sectors that are closer to the technological frontier.

Similarly, to the extent that frontier innovation makes greater use of research education than imitation, the prediction is that the more frontier an economy is, the more growth in this economy relies on research education. And indeed, we have shown that tertiary education is more growth-enhancing in more advanced countries.[29]

Some developing countries have policies and institutions that foster technological catch-up and imitation, while others fail to take off. Among those that catch up, however, some get stuck midstream. This is the case in particular for countries that are too slow – or fail altogether – to adapt their institutions to transform their economies from catch-up economies to frontier innovation economies. The reason for this is that vested interests and incumbent firms block not only the entry of new competitors but also any reform that would increase competition and more generally help the country move from imitation-led growth to growth driven by frontier innovation. The occurrence of a crisis, as well as international economic competition, can help nations to escape the middle-income trap by compelling the government to undertake the appropriate structural reforms. Thus, by weakening incumbent firms, the financial crisis of 1997–98 opened Korean firms to competition and helped South Korea to enter the club of innovative countries.

V. Green innovation

Why can't we rely on firms alone to generate green innovation? The reason is that those incumbent firms that innovated in dirty technologies in the past tend to continue to innovate in dirty technologies in the future. This phenomenon has been referred to as 'path-dependence'.[30]

We provided the first evidence of such path-dependence by studying data for patents filed by automobile companies from 80 countries between 1978 and 2005.[31] The analysis distinguished between 'green' innovations, which support the development of electric vehicles, and polluting innovations, which support the development of combustion engines. Using these data, we identified which factors determine a firm's propensity to make green innovations rather than polluting innovations.

One might think that a firm that has innovated in combustion engines in the past but is now faced with decreasing returns on this type of innovation would decide to turn to electric vehicles. But we found that this is not the case. The more a firm has innovated in combustion engines in the past, the more it continues to innovate in combustion engines today. In other words, firms persevere in the fields where they have already acquired a comparative advantage. This path-dependence implies that, left to their own choices, firms

that have acquired experience in combustion engines will not spontaneously choose to focus on electric vehicles. Therefore, state intervention is necessary to incentivise these firms to redirect their innovative activity from polluting technologies to green technologies.

To determine whether a patent, and thus an innovation, is green or polluting, we used the International Patent Classification, focusing on patents representing a significant advance in knowledge. For this purpose, we examined triadic patents, i.e., those registered in the United States Patent Office, the European Patent Office, and the Japanese Patent Office.

For each innovator, whether a firm or an individual, and for each year from 1978 until 2005, we know not only the number of green and polluting patents obtained by the innovator that year, but also the history of patents that have been granted to the same innovator. This information enables us to analyse the extent to which a firm's propensity to innovate in green or in polluting technologies depends on the green and/or polluting patents it has accumulated in the past.

We found that the probability that a firm would produce a green patent increased by 5% if more than 10% of its past patents were green. In a symmetrical fashion, a firm that has registered more polluting patents in the past has a higher probability to produce a polluting patent today. Firms thus exhibit path-dependence when choosing what innovation to pursue, and we cannot rely solely on the private sector to redirect innovation towards green technologies without the intervention of the state.

The good news is that public policy can be effective in redirecting innovation towards green technologies. We showed that a 10% increase in the fuel price that a firm faces increases by 10% its likelihood of innovating in green technologies.

A first implication of path-dependence is that creative destruction should help: by definition, new entrants are not subject to path-dependence, since they were not around in the past. In other words, in an economy where incumbent firms innovated mainly in dirty technologies in the past, by its very nature creative destruction favours greener innovation.

A second implication is that outside intervention is needed to redirect incumbent firm's innovation towards clean technologies. There are multiple channels and instruments that can be activated for that purpose. Some channels rely primarily on state intervention: carbon taxes and tariffs; subsidies to green innovation; and industrial policy. But other channels also involve civil society: social norms and how much citizens value the environment; consumers' information about the CO2 content of firms' production and inputs; and shareholders' concern for corporate social responsibility. In countries with higher concern for civil society and the environment, more intense competition policy implemented by the state will induce firms to innovate in green technologies in order to escape competition from potential rivals.[32]

In the end, the key to successfully fighting climate change lies both with creative destruction, since new entrants are not subject to the path-dependence, and with the triangle among innovative firms that innovate, the state, which is meant to regulate and invest, and civil society, which serves as a watchdog to induce firms and the state to do the right things.

VI. Rethinking capitalism

The COVID-19 crisis revealed different weaknesses of capitalism on both sides of the Atlantic. In the United States it shed light on the deficiencies of a social system that cannot adequately protect the most vulnerable against the consequences of a big aggregate shock, and/or against the consequences of becoming unemployed.[33] Meanwhile in Europe it revealed the limits of an innovation system that was unable to mass produce messenger RNA vaccines even though the underlying basic research had been conducted in Europe.

This contrast illustrates the extent to which the Western world is currently divided between 'cut-throat capitalism' and 'cuddly capitalism'.[34] The United States is an incarnation of the former, being more innovative but less protective and inclusive, while the Scandinavian countries, and to a lesser extent Germany, are the representatives of the latter, more protective and inclusive but less innovative.

One view is the 'either/or': namely one cannot be both highly innovative and highly protective and inclusive. The argument runs that, insofar as innovation at the technological frontier relies on strong monetary incentives and requires high sunk investments and high risk-taking, the countries that aim for frontier innovation should forego the goals of insurance and equality: in other words, they should renounce cuddly capitalism in favour of cut-throat capitalism. On the other hand, those countries that choose cuddly capitalism have no alternative but growth through imitation of technologies invented by the frontier countries. These countries provide their citizens with greater equality and insurance, but their growth ultimately depends on the growth of the cut-throat countries, which, one might say, work for the benefit of the rest of the world.[35]

We depart from this either/or view for two reasons. First, the strong belief that capitalism cannot be fully dynamic unless it is inclusive, and that it cannot be fully innovative if vested interests prevent the emergence of new talents. And second, the existence of policies that can help move capitalism both towards greater innovation *and* towards more protection or inclusiveness. Here we shall focus policies in three areas: labour market, education, and competition.[36]

Start with labour market policy. Not long ago, Anne Case and Angus Deaton pointed to a worrisome phenomenon: after a long period of decline, mortality within the middle-aged, non-Hispanic white population in the United States began to rise in the early 2000s, with a distinct acceleration since 2011–12.[37] The other striking fact emphasised by Case and Deaton was the increase in

so-called 'deaths of despair' in this cohort, meaning deaths resulting from suicide or substance abuse compared to the average mortality rate for the same age range in other developed countries.

The authors' explanation for this trend reversal in the mortality of non-Hispanic whites is heightened job insecurity, one consequence of which is increased family instability. Creative destruction in the United States threatened in particular the so-called 'working class aristocracy' of the 1970s[38] with an increased risk of unemployment and loss of status accompanied by earnings loss. The resulting anxiety led to increased consumption of anti-anxiety medication, opioids, and alcohol, thereby increasing the risk of overdose, alcohol-induced coma, and liver disease, as well as of suicide, which accounts for the observed increase in mortality.

Nothing of the sort happened in Denmark: one study that analysed the effects of job displacement on health in Denmark showed that, in a country with safety nets to protect people in the event of job loss, being laid off has no negative effect on health.[39] Indeed, a noticeable difference between Denmark and the United States is that in 1993 Denmark introduced a system called 'flexicurity' to regulate its labour market. This system has two pillars. First, the labour market was made more flexible by simplifying dismissal procedures for firms. This means, for example, that severance pay is limited, and litigation is rare. To offset this flexibility, there are two forms of security: unemployment benefits equal to 90% of salary – subject to a ceiling – for a maximum of three years, and massive government investment in professional training to give workers the skills they need to re-enter the labour market quickly.

The study in Denmark compared the health of workers whose place of employment closed between 2001 and 2006 with workers otherwise identical but whose employing firms did not close. Firm closure did not seem to impact the various indicators of health status, such as consumption of antidepressants or anti-pain medication, or consulting a general practitioner. Similarly, the study found firm closure had no significant effect on mortality of workers in the firm.

This finding is all the more important because the introduction of the flexicurity system made Denmark not only more protective but also more innovative, by making it easier for Danish workers to move from one job to another, which in turn encouraged more, and more efficient, creative destruction.

Regarding competition policy, in the previous discussion, we argued that by increasing the number of product lines controlled by superstar firms, the IT revolution ended up reducing innovation and growth in the overall economy in the long run. What is more, inadequate competition policy in the US favoured this evolution: in the absence of regulations on mergers and acquisitions, the superstar firms could grow and expand without limit, thereby discouraging entry and innovation by other firms in the economy. Competition policy should be reformed so as to better account for the effects of mergers and acquisitions on future innovation and entry, thereby fostering

innovation-led growth and making that growth more inclusive by allowing innovative entrepreneurs to enter the market.[40]

Finally, regarding innovation policy, recent studies have pointed to the fact that parental income and education influences an individual's probability of becoming an innovator. This in turn leads to a so-called 'lost Einsteins', or 'Marie Curie', phenomenon: namely, that highly talented children, who could have become innovators if born to wealthy or well-educated parents, fail to innovate if born to poor or low-educated families.[41] The reason cited was that parents with greater education transmit knowledge and aspirations to their children, both of which are needed to become an innovator. An interesting example can be found in Finland, which in 1970 reformed its education system to make it more inclusive. As it turns out, parental income or education does not affect the probability of becoming an inventor for those individuals that started school after the reform – but it did for those that experienced the pre-reform schooling system.[42] This suggests that investing in a more inclusive and high-quality education system should both stimulate innovation-led growth *and* make growth more inclusive, simply by allowing more talented individuals to become innovators. In other words, by reducing the number of lost Einsteins.

Overall, we are not condemned to choose between innovation and inclusion. Rather, we can activate forces that will make our economies both more innovative and more inclusive, by constantly favouring the entry of new innovative firms and the emergence of new talents.

VII. The triangle among firms, the state and civil society

As previously discussed, Schumpeter was pessimistic about the future of capitalism. Indeed, his belief was that capitalism was doomed because in his view it was impossible to prevent incumbent firms from barring new innovations, either directly or by exploiting political connections with government authorities.

One can argue that Schumpeter was underplaying the role of state intervention. For example, our discussion on stagnant productivity growth in the United States suggested that more appropriate competition policies would limit the power of superstar firms to expand and control most sectors of the economy, thereby encouraging innovation by other firms and thus fostering aggregate productivity growth.

However, nothing guarantees that the government will do what it is supposed to do, nor that it will resist lobbying pressures from incumbent firms. The United States, where lobbying activities have successfully delayed action on competition policy to curb the power of superstar firms, is an illustrative example.[43] Hence the role for civil society and democracy to limit the scope of collusion between public officials and incumbent firms seeking to maintain their rents.

Overall, the proper functioning of an economy of innovation and creative destruction rests on the triangle among firms, the state, and civil society. The market provides incentives to innovate and constitutes the framework within which innovative firms compete. The state is there to protect property rights on innovations, to enforce contracts, and to act as an investor and insurer. Finally, civil society – the media, labour unions, voters – generates or calls for the enforcement of constitutional provisions intended to check executive power and ensure greater efficiency, ethics, and justice in the operation of the market. Indeed, history shows that a mobilised civil society has contributed greatly to the evolution of capitalism towards a system that is better regulated, more inclusive, and more protective of citizens. And, as we have argued, the triangle between firms, the state, and civil society is also key to reconciling prosperity with the environment and the necessary ecological transition.

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Notes

[1] For example, see Hausmann et al. (2008). The Washington Consensus refers to the view – shared by the IMF, the World Bank, and the US Treasury in the early 1990s – that anywhere in the world growth relies primarily on the combination of macroeconomic stabilisation, market liberalisation, and broad-based firm privatisation.

[2] Solow (1956).

[3] Aghion and Howitt (1992); Aghion et al. (2014).

[4] Rajan and Zingales (2004).

[5] Major et al. (2021).

[6] Aghion et al. (2023a); Acemoglu and Restrepo (2022).

[7] For example, Van Reenen (1997).

[8] Klette and Kortum (2004); Acemoglu et al. (2018).

[9] Aghion et al. (2019a).

[10] Aghion et al. (2019a).

[11] Blundell et al. (1995); Blundell et al. (1999); Nickell (1996).

[12] Aghion et al. (2005); Aghion et al. (2009).

[13] Bloom et al. (2020); Aghion et al. (2019b).

[14] Autor et al. (2020); Autor et al. (2023).

[15] Aghion et al. (2023b); Ridder (2021).

[16] In emerging market economies, large firms can also prevent the necessary move from imitation-enhancing institutions to more innovation-enhancing institutions, as we argue later in this chapter.

[17] Krueger (1993).

[18] Laffont and Tirole (1993).

[19] Aghion et al. (2016).

[20] Bolton and Farrell (1990); Rob (1991).

[21] There is close parallel here with what in development economics is known as the self-discovery problem. See Hausmann and Rodrik (2003).

[22] Azoulay et al. (2019); Moretti et al. (2023); Howell et al. (2022).

[23] Nunn and Trefler (2010).

[24] Aghion et al. (2015).

[25] Criscuolo et al. (2019).

[26] Dechezlepretre et al. (2023).

[27] Acemoglu et al. (2006).

[28] Acemoglu et al. (2006).

[29] Aghion et al. (2006).

[30] Acemoglu et al. (2012).

[31] Aghion et al. (2016).

[32] Aghion et al. (2023c).

[33] Aghion et al. (2021).

[34] Acemoglu et al. (2017).

[35] Acemoglu et al. (2017).

[36] Finance could be mentioned as a fourth policy. Indeed, higher financial development both offers better insurance to individuals against risks, starting with the risk of losing one's job, while also making it easier for firms to borrow against future returns in order to finance innovation. The lack of finance is more likely to be a problem in emerging market economies, where capital markets are more imperfect, making the case for 'cuddlier' institutions even stronger in these economies.

[37] Case and Deaton (2017).

[38] By which we mean particularly the white non-Hispanic working class (and parts of the lower middle class).

[39] Roulet (2017).

[40] Such reform is advocated by Gilbert in his recent book (2021). That entrant innovation should foster social mobility is shown in Aghion et al. (2019c). For a discussion of reforms see Tirole (2022) and De Loecker et al. (2022).

[41] Bell et al. (2019).

[42] Aghion et al. (2023b).

[43] Lancieri et al. (2023).

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Response to Philippe Aghion and John Van Reenen by Diane Coyle

Innovation is the dynamo of productivity, or in other words getting more valuable economic output from the same or fewer resources; and productivity matters because it is a necessary condition for improvements in living standards over the long run. Both economic history and growth theory underline the importance of innovation for progress.[1] New ideas and techniques have increased the quantity of economic output but more importantly have transformed the quality of life, including the fundamentals of health and longevity.

In their chapter, Philippe Aghion and John Van Reenen describe the role of ideas and innovation as a cumulative process involving 'Schumpeterian' creative destruction.[2] The process is societal, involving not only individual entrepreneurs and firms but also the state, as well as consumers and civil society organisations. These various economic actors have different motivations, incentives, and knowledge.

Yet what Will Baumol vividly characterised as the 'free market innovation machine' has broken down in the 21st century.[3] There is certainly still massive innovation in technologies, including digital, energy, materials, biomedicine and parts of high-value manufacturing, despite some prominent claims that its pace or impact have slowed.[4] For example, even before taking account of advances in generative AI, the cost of computing has continued to fall dramatically, even if the pace has slowed.[5] However, technological advance is not translating into productivity growth or improving living standards. In many advanced economies productivity growth has slowed to a crawl. In most, median earners have experienced little real income growth for a decade. As people live in specific places and tend not to be all that mobile, income inequality has a geography; spatial inequalities are high and some places have entered a spiral of decline.

The innovation machine is manifesting other faults, alongside these macro failures. It has become apparent that the growth the world economy experienced during the 20th century was unsustainable – thanks in part to improved measurement of natural capital.[6] The economy uses many or most of nature's resources without paying for them, and while their marginal cost was apparently low in the mid-20th century, it is clearly high now in terms of both climate damage and biodiversity loss.[7] Nature is the binding constraint on future growth.

Secondly, for the first time in some countries, improvements in life expectancy have halted or even reversed for some groups. This is in part due to the COVID-19 pandemic, but beyond that extreme health inequalities and 'deaths of despair' – which are also spatially concentrated.[8] This is all the more startling when medical innovation has been so dramatic, in areas ranging from gene therapy to personalised cancer treatment.

A third malfunction of the innovation machine is the economy's lack of resilience or security of supply, demonstrated by the multiple shocks occurring since 2008. Surprising shortages have emerged as extended global supply chains involve multiple bottlenecks – a phenomenon being explored in the growing literature on production networks.[9] Although global production networks have enabled ever greater division of labour, the gains from specialisation may be reaching their limit as there is less and less competition at each link of the chain.[10]

Taken together, it is not surprising that many citizens are expressing discontent with the state of the economy in populist votes.[11] There is a dual transition under way as a result of the continuing evolution of two general purpose technologies: non-carbon energy and digital. Although people value digital technologies highly as consumers, as in prior episodes, the diffusion of use and therefore productivity gains from major new technologies is highly uneven.[12] Digital technologies exaggerate the unevenness. Not only are there very high returns to scale at the fundamental levels of the technology stack (such as data centres, undersea cables and generative AI models), but there are also significant network effects amplifying the increasing returns. Digital software and data are also non-rival, hence potentially under-produced, and enabling high monopoly rents to those 'superstar' firms able to exclude other users.[13]

The giant leaps forward in productivity through the 19th and 20th century owed much to process (rather than product) innovation – the factory system, the standardisation of the American System of Manufactures, the assembly line, Just-In-Time production, and most recently extended supply chains and the platform business model. However, by their nature, process innovations require firms to reorganise their production, which is never easy and probably harder than ever when intangible capital, such as software (rather than, say, machine tools), is involved.[14] Now there is mounting evidence in the literature that the highest productivity firms are those using digital tools, and that they are pulling ever further away from the rest of the pack.[15] The organisational capabilities are concentrated in the same firms that benefit from huge scale economies, superstar-type network effects, strong intellectual property protection, monopoly rents, and the consequent ability to shape regulation in their own favour.

While their own employees are well paid – with earning dispersion increasing within rather than between sectors – the market power of such firms means their interests and those of their customers are no longer well aligned. This extends beyond the tech sector: the food industry profits from making people obese and despoiling the environment, the pharma industry

requires illness and has scant incentive to promote health, the finance sector largely undertakes zero-sum transactions, and much of the tech sector itself provides its valued services as a by-product of the misinformation and surveillance or privacy loss that generate advertising profits.[16] This description of a malfunctioning economic system is exaggerated – but recognisable.

What shape might a new policy consensus concerning innovation and productivity take? In their chapter, Aghion and Van Reenen cover education policy, labour market policy, and competition policy, all clearly vital in addressing the uneven dispersion of benefits – and costs – involved in the dual transformation in energy and communications technologies currently reshaping the structure of the economy. In this comment I will focus on the competition and innovation policies.

The Schumpeterian process, with a better technology or product creatively disrupting its predecessors, combined with winner-takes-all or superstar markets, implies that competition is now not so much 'in' the market as 'for' the market. Following reassessments of competition policy in digital markets in the European Union, United States and United Kingdom, authorities are updating their practices and guidance to take better account of the business models and dynamics in these markets.[17] For example, the incentive for a digital platform to 'envelop' additional markets in order to exploit their capabilities and capture more spillovers (think Uber extending to Uber Eats, for example), calls for a rethink of the market definition process in a merger inquiry.[18] Platforms will set prices on one or some sides at below marginal cost even in a competitive environment.[19] When markets 'tip' to dominant players, platforms will lose money in their early stages so profitability analysis needs to take account of planned early losses.

Two other points have been less often noted in discussions of the evolution of competition policy.

One is that with market dynamics that tip to a dominant player, any decision by the competition authority – to permit or prevent a merger – will determine the identity of that player. This means other criteria need to be brought to the decision making. Competition policy is in this sense unavoidably more 'political', or market-shaping.[20]

The second is that there are levels of the technology stack where regulators should seek to set common standards to enable interoperability or easy switching. This is similarly not a technical but a normative decision with welfare implications. For example, in the 1980s there was competition between two technical videotape standards, VHS and Betamax. There were presumed gains from the better model winning, but also losses as some consumers bought a soon-to-be defunct technology. A contrast is provided by the industry-devised, EU-mandated Global System for Mobile Communications standard in mobile telephony, which enabled rapid expansion of the market on a global standard, with large gains from learning-by-doing and scale. Mandated common or open standards and interoperability may be desirable

in some of the currently concentrated technology markets, but will require case-by-case analysis.

Two other areas of policy require consensus building. One concerns data policy. Data fuels the digital economy, and there is an extensive, lively debate under way, reflecting a general dissatisfaction with current policy frameworks. By and large, datasets are treated as 'owned' intellectual property (IP); there are already legal cases being brought against new AI models alleging breach of copyright through the use of training data.

As with other forms of IP, the societal optimum will likely require a balance of exclusion (to create incentives to invest in a public good) and access (to enable gains from wider use of a non-rival good). Given that useful data is generally relational – linking an exchange or interaction between more than one agent – new data rules will need to set out access rights, permissions, and responsibilities.[21] While much of the public debate concerns privacy and surveillance, another important social welfare consideration is the distribution of benefits generated by the use of data to the public providing it. For example, I will want my health data to remain private (between me and authorised health professionals), but I might be happy for it to also be used in research to develop new medicines – as long as those can benefit me as well as making profits for the data purchaser.

This leads to the final area of a new consensus on innovation: the direction it takes. For innovation needs to generate benefits widely through society. The direction it takes is endogenous to the structure of markets, and relations between the state and individuals in civil society; innovation is a socio-technical process that can take many directions.[22] Some items in the innovation policy toolkit are particularly well-suited to directing innovation in directions that increase social welfare.[23] These include advance purchase guarantees, procurement policy in general, or innovation prizes; standard setting to de-risk future markets; and regulations decreeing a switchover (for example, to electric vehicles).[24] In the context of the renewed interest in industrial policy, governments might also want to encourage innovation in areas of the nation's specific economic strengths – although identifying these requires policymakers to be robust to lobbying efforts – or of specific supply chain vulnerabilities.

Conclusion: policy for a world of increasing returns

The dynamics shaping the nature of Schumpeterian competition 'for the market' in a world of superstar firms and increasing returns to scale require the approach to policymaking to adapt. It needs to recognise that there are multiple possible equilibrium outcomes, that there are likely to be critical tipping points in market dynamics, and that a key task for policymakers is coordination. There are large potential productivity gains from ongoing process innovations including digital platform business models, and large consumer welfare gains possible from improved matching, choice and time

saving. But these have been massively unevenly shared thanks to rent-seeking and competition and innovation policies that have been ineffective in the context of these now-dominant market dynamics.

Policymakers need to take a strategic approach to market shaping, including shaping the direction of innovation. This can include advance market guarantees, standard setting, direct regulation, public investment in national competitive strengths and complementary infrastructure, and mitigation of supply chain vulnerabilities. It must also include effective competition enforcement. The bottom line is that the out-of-control innovation machine needs steering if the promise of continuing technological advances is to be realised.

Notes

[1] DeLong (2022); McCloskey (2016); Aghion and Howitt (1992).

[2] Aghion et al. (2023).

[3] Baumol (2004).

[4] Gordon (2016).

[5] Coyle and Hampton (2023).

[6] United Nations (2014); World Bank (2021).

[7] Dasgupta (2021).

[8] Marmot et al. (2020); Case and Deaton (2020).

[9] Carvalho and Tahbaz-Salehi (2019).

[10] Coyle (2023).

[11] Rodríguez-Pose (2020).

[12] David (1990); Perez (2003).

[13] Autor et al. (2020); Manyika et al. (2018).

[14] Bessen and Wang (2024).

[15] Tambe et al. (2020); Cathles et al. (2020); Coyle et al. (2022); Andrews et al. (2015); Loecker et al. (2022).

[16] Dimbleby and Lewis (2023).

[17] Crémer et al. (2019); Stigler Center for the Study of the Economy and the State (2019); Furman (2019).

[18] Coyle (2019).

[19] Rochet and Tirole (2003).

[20] Coyle and Dahmen (2024).

[21] Viljoen (2021).

[22] Acemoglu et al. (2012); Johnson and Acemoglu (2023).

[23] Bloom et al. (2019).

[24] Kremer et al. (2022).

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Response to Philippe Aghion and John Van Reenen by Timo Boppart

I. The significance of economic growth

Let me start my response with a quote from the late Robert E. Lucas, Jr, in which he asks:

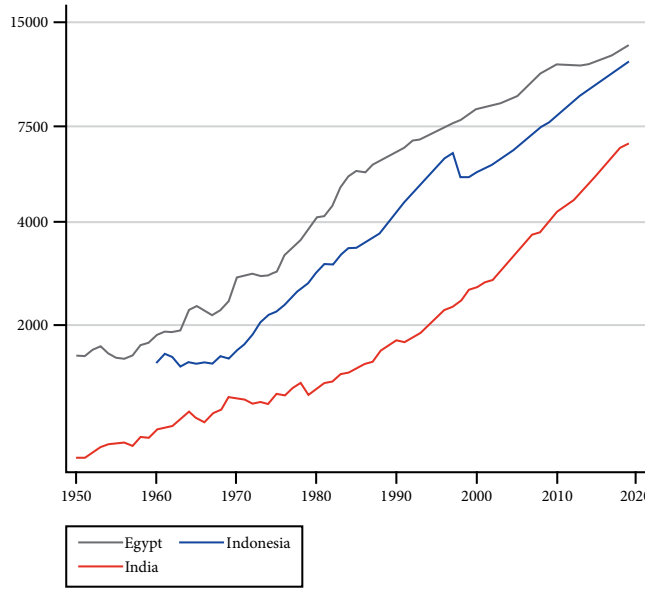
> Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, what, exactly? If not, what is it about the 'nature of India' that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else.[1]

The quote fits well here since the statement was made around the time of the Washington Consensus and precisely concerns the questions of whether and how policy can foster economic growth. And the final sentence underscores the importance of said growth. What also catches the eye is Lucas's selection of countries. Why did Lucas pick India, and why is it compared to Egypt? It is easy to forget from today's perspective that India was indeed once a prime example of a slow growing country. Figure 2.1 shows the GDP per capita of India, Indonesia and Egypt over time on a logarithmic scale such that the slopes of the lines can be interpreted as growth rates. India was consistently growing at a lower rate and falling behind relative to Indonesia and Egypt up until the late 1980s. Remarkably, around the time of Lucas's quote, the growth rate of the Indian economy starts to accelerate and India catches up with the other two countries. There is little doubt that this change in growth trajectory is related to policy reforms in India at the time.[2] Hence, the answer to Lucas's first question has proven to be a clear yes: there definitely are policy actions that affect the long-run growth rate of an economy![3]

When thinking about how many people in India have been lifted out of poverty over the past 30 years the welfare consequences behind Figure 2.1 are indeed simply staggering. Unfortunately, Figure 2.1 also shows a change in the opposite direction: Egypt's growth slowed down around the mid-1980s.

Even though it is easy (and probably right) to criticise the Washington Consensus for neglecting the distributional and environmental consequences of policy actions, economic growth as measured by average GDP per capita is

Figure 2.1: Real GDP (in US$) per capita of India, Indonesia and Egypt on a logarithmic scale, 1950–2020



Source: Penn World Table (PWT) 10.01 (variable rgdpna for GDP).

still a proxy of success that is of first-order importance and will remain so for the years to come – in particular for developing countries.

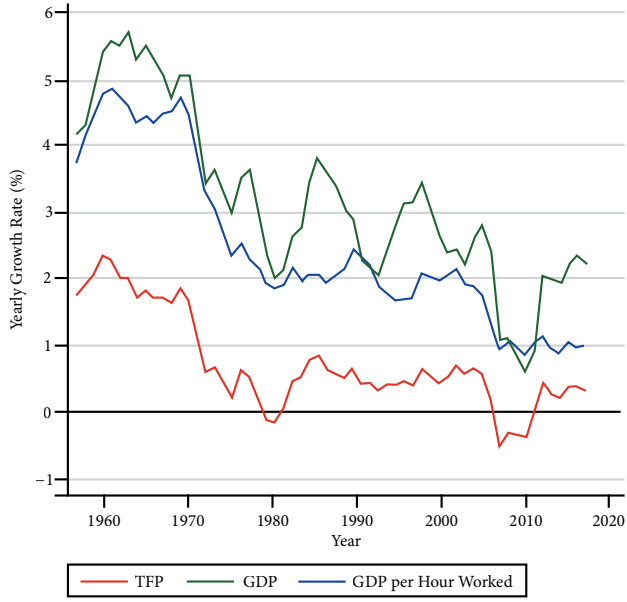
II. What we have learned

Fortunately, over the past decades, the literature has deepened our understanding of economic growth and cross-country income level differences. Back in the 1950s, Robert Solow postulated that all growth is ultimately driven by technological change, and that the lion's share of growth is not accounted for by the primary factors of production (labour and capital).[4] However, Solow's neoclassical growth framework, which assumes that long-run growth happens at an exogenous rate, is simply not designed to study the role of policy in economic growth. It was the modern innovation-led growth literature that set out to change this and to micro-found the process of technical change.[5] The approach of Philippe Aghion and Peter Howitt, which focuses on the disruptive nature of technical change, has proven to be empirically persuasive and sufficiently rich and amenable to speak to the important policy questions.[6] The piece by Aghion and John Van Reenen nicely summarises and celebrates the achievements that came out of this literature.

Another major moment in the literature was the negative result from the development accounting literature, i.e., the finding that human and physical capital differences cannot – at least not from a purely neoclassical perspective

– account for observed income differences across countries.[7] This observation shifted the focus of the literature on cross-country income difference from studying differences in physical and human capital to studying technological differences and differences in the allocative efficiency of production factors across plants and firms.[8] As developing countries are typically not thought of as driving the technological frontier but rather adopting technologies invented elsewhere, the literature on innovation-led growth may appear to have less relevance for the developing world. However, the process of technology adoption is often also characterised by vested interests.[9] Hence, the 'Schumpeterian' mechanism by which incumbent firms have an incentive to block entry and growth – often even with the help of government intervention – is highly relevant for developing countries, too. As a consequence, the literature on misallocation of production factors and differences in life cycle firm growth nicely complements the Schumpeterian perspective.[10]

Figure 2.2: Growth rates, in GDP, GDP per hour worked, and TFP for OECD countries, 1960–2020

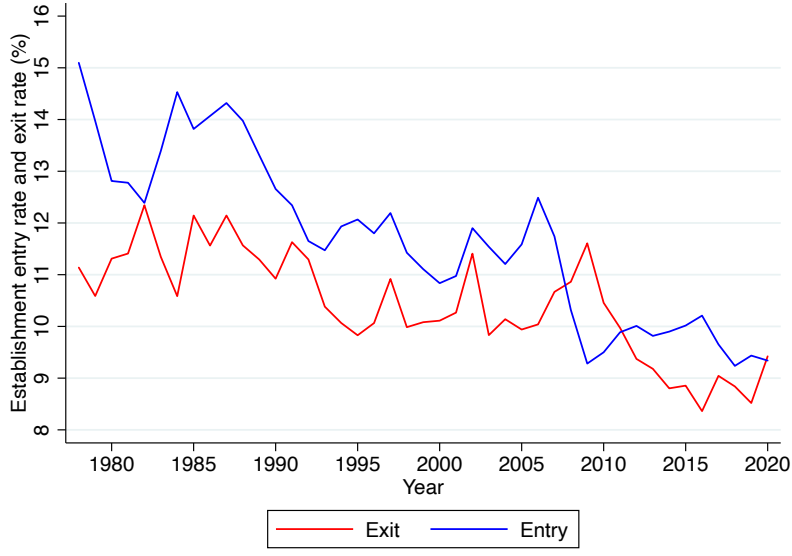


Source: This is an updated version of the figure in Boppart and Li (2023). Data: PWT 10.01 using the following variables: GDP = 'rgdpna', TFP = 'rtfpna', hours = 'avh' times 'emp', GDP per hours = 'rgdpna' divided by hours. 5 year centred moving averages. Averages across countries are weighted by real GDP.

III. Do not take growth for granted

Recently, the relationship between policy and growth has become topical in advanced economies, too. After a period of remarkably stable growth rates, there has been a significant productivity slowdown since the early 2000s (Figure 2.2 illustrates for the OECD countries). The slowdown is visible in labour productivity as well as in total factor productivity (TFP), and it does not seem to be a statistical artefact of output getting harder to measure.[11]

Figure 2.3: US establishment entry and exit rates (%), 1980–2020



Source: Business Dynamics Statistics. Establishment entry/exit rates are defined as the count of entering/exiting establishments in year t divided by the average count of employment active establishments in year t and t – 1.

What is behind this productivity slowdown? And is there a policy mix that can undo it? I think the jury is still out. But a very active recent literature has emerged that builds on the pioneering work of Aghion and Howitt to study these important questions. In line with the Schumpeterian paradigm, the productivity slowdown was accompanied by falling establishment entry and exit rates (Figure 2.3 shows the US entry and exit rates). A major insight of the Schumpeterian perspective is that excessively dominant incumbent firms can actually hamper growth.[12] Generally, an important take-away message is that there is no iron law of steady growth in advanced economies either and economic growth should not be taken for granted.

IV. Complementary aspects and concluding remarks

Despite the achievements of the literature, it is fair to say that we have not yet solved the mystery of economic growth. The Schumpeterian growth paradigm that features centre stage in the piece by Aghion and Van Reenen is empirically persuasive but does not explain all the variations observed in long-run growth rates.

Demographics is another aspect that has been emphasised in the debate about the recent productivity slowdown.[13] To the extent that smaller birth cohorts decrease start-up rates and dynamism of the economy, demographics could indeed become a major drag on future growth. Another potentially fundamental challenge is the extent to which the growth potential has been exhausted or ideas are getting harder to find.[14] As mentioned above, from a purely neoclassical perspective schooling can be rejected as a major driver of growth. However, as schooling might generate important spillovers – which are not captured in a neoclassical framework – it feels premature to completely dismiss the role of human capital. In particular, how an economy's pool of talent is 'used,' i.e., allocated to different firms and tasks, may have a significant effect on output. As a consequence, there is also no conflict between inclusion and economic growth; rather, they should go hand in hand.

At the global level, over the past three decades, output growth was heavily influenced by the catch-up process of the populous countries of China and India. As these countries are now slowing down, a big question is whether a similar transformation will next take place in Africa.

Notes

[1] Lucas (1988).

[2] See, e.g., Aghion et al. (2008).

[3] Whether or not the reforms in India were in line with the Washington Consensus is a different question – Rodrik (2006) argues that this is not the case.

[4] Solow (1956; 1957).

[5] Romer (1990).

[6] Aghion and Howitt (1992).

[7] See Klenow and Rodriguez-Clare (1997) and the large literature that followed them.

[8] See, for example, Hsieh and Klenow (2009; 2014).

[9] Parente and Prescott (2002).

[10] A powerful example of this is when production factors that drive the innovation process (e.g., R&D labour) are misallocated across firms (see, for example, Aghion et al. (2022)).

[11] Aghion et al. (2023).

[12] See, for example, Aghion et al. (2023) and Akcigit and Ates (2023).

[13] See Hopenhayn et al. (2022) and Peters and Walsh (2022).

[14] Gordon (2017); Bloom et al. (2020).

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