Inequality

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Innovation and inequalities

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Introduction

Innovation can affect inequalities in many ways – increasing some inequalities and decreasing others. An innovation can introduce a new good, improve the quality of existing goods, or lead to new ways of doing things. It can be produced by large firms, by small firms, by individuals working in their garden shed, by the public sector or by charities or non-governmental agencies. The impact of any particular innovation on inequalities will depend importantly on who controls the property rights to exploit the innovation and what they decide to do with it. The introduction of an innovation can affect the power of different actors in a market, the way markets work, and the returns to different attributes of actors in the market. All of these factors and more will influence how innovation affects inequalities.

In this commentary, we briefly discuss the broader issues of the impact that innovation can have on inequalities, and what we know (or don't know) about how innovation might affect different inequalities. We then focus most of our attention on the impact of firm-level innovation on income inequality. On the one hand, innovation increases top income inequality, as it generates innovation rents. On the other hand, because it involves creative destruction, that is, new entrants replacing old incumbent jobs or firms, innovation also increases social mobility. In addition, innovating firms tend to create more 'good jobs', which involve longer tenure, more intense training on the job, and steeper dynamic wage profiles. There are two caveats however. The first caveat is that yesterday's innovators tend to become entrenched incumbents today, and can then try to prevent future innovation and new entry. The decline in US productivity growth, together with the increase in concentration and rents since the early 2000s, illustrates this fact. This speaks to the importance of having competition policy – in particular to regulation to mergers and acquisitions – that does not allow superstar firms to become hegemonic and thereby discourage innovation and entry by other firms. The second caveat is that not everyone has an equal opportunity to become an innovator: parental income, parental education and parental occupation each play an important role in the probability for an individual to become an innovator.

The broader impact of innovation on inequalities

In the UK, in common with most other OECD countries, the majority of R&D is financed and conducted by business, followed by higher education, other parts of government and non-profit organisations.[2] While we can't point to direct evidence on this, research in the public sector and in charities seems more likely to be inequality-reducing. For example, the impact on inequalities of a

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[2] See ONS, 'Gross domestic expenditure on research and development, UK: 2018', https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2018, and OECD.Stat, Main Science and Technology Indicators, https://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB.

medical charity discovering a way to eradicate malaria or cure cancer will differ considerably from the impact of a pharmaceutical firm creating a new opioid-based painkiller. Public sector innovations in medicine and health care are often inequality-reducing, particularly in countries with universal state-provided health care, such as the UK. Innovations to tackle big societal challenges, such as reducing greenhouse gases, will probably reduce inequalities, as lower-income people are more likely to be harmed by the impact of global warming (e.g. see Islam and Winkel, 2017).

The public sector accounts for around one-third of the UK economy. Although difficult to measure (Arundel, Bloch and Ferguson, 2019), there has been a lot of innovation in public sector management over the past few decades (United Nations, 2017), which has likely led to reductions in inequalities as the state has become more efficient at providing social insurance and public services.

Private sector innovations are likely to have more complicated effects on inequalities.

An innovation can increase the returns to some types of skills in the labour market more than others, thus changing relative wages of skilled versus unskilled workers. Most evidence suggests that changes over the last few decades in the technology of production have favoured higher-skilled workers (Krusell et al., 2000; Acemoglu, 2002; Goldin and Katz, 2010; Acemoglu and Autor, 2011).

Changes in technology can change the bargaining power of workers relative to owners of capital, thus changing labour's share of value added (Autor et al., 2020).

Innovation can increase the market power of some firms relative to others, and so increase the rents the owners of the advantaged firms earn, relative to other firms, and possibly at the cost of workers or customers (Aghion et al., 2019a; Autor et al., 2020; De Loecker, Eeckhout and Unger, 2020).

The introduction of new goods or improvements in the quality or attributes of existing goods can lead to gains in consumer surplus for some consumers and potentially changes relative prices, and so relative incomes. For example, innovations that brought down the cost of food production were probably inequality-reducing in that they brought down food prices, and so increased the real incomes of low-income households more than for the rich (because of a bigger budget share). Technological innovations that introduce new goods, such as mobile telephony, can be important equalisers in terms of providing access to fast and cheap communication that is affordable to everyone. Technological innovations that led to the prevalence of social media have undoubtedly had major impacts on political participation – have they increased or decreased inequalities? There is a body of literature on this that we do not survey here.

There is some indication that, in the US, medical innovations have favoured the more-educated over the less-educated (see Lleras-Muney and Glied, 2008). It is less clear what their impact on inequalities is when health care is publicly provided.

Innovation in the UK

In the UK in 2018, total expenditure on R&D was £37.1 billion (1.7% of GDP). The private sector performed about 68%, most of which it funded itself. The public sector performed around 30% of R&D, with the higher education sector accounting for the bulk of this. The industry that

performed the most R&D in the UK was pharmaceuticals, worth £4.8 billion, followed by the automotive manufacturing industry, worth £3.4 billion (Hutton, 2021).

Looking at which UK companies performed the most R&D (counting their worldwide activities), we see the dominance of pharmaceuticals. Surprisingly, two banking firms are in the top five UK R&D performing firms (see Table 1).

Table 1. The top five UK R&D performing firms

World ranking	Company	Industry	R&D (£bn)
29	GlaxoSmithKline	Pharmaceuticals	4.4
32	AstraZeneca	Pharmaceuticals	4.1
84	HSBC	Banking	1.6
123	Rolls-Royce	Aerospace	1.1
135	Lloyds	Banking	1.0

Source: The 2020 EU Industrial R&D Investment Scoreboard, https://iri.jrc.ec.europa.eu/scoreboard/2020-eu-industrial-rd-investment-scoreboard; exchange rate €1 = £0.86.

The impact of firm-level technological innovations on income inequality

We focus on the impact of firm-level technological innovation on income inequality.

Innovation increases top incomes

Aghion et al. (2019b) show that the top 1% income share is correlated with innovation, looking across US states over time (see their figure 1). They show that this correlation reflects a causal effect from innovation to top income inequality using a variety of measures of innovation.[3] They show, however, that innovativeness is uncorrelated with the Gini coefficient (see their figure 2). The reason for this is that innovation fosters top income inequality, but at the same time it enhances social mobility. Kline et al. (2019) show that higher-paid workers capture more of the economic rents from innovation than lower-paid workers.

[3] They use two instrumental variable strategies: the first strategy uses data on the appropriation committee of the Senate, based on the view that a new appointee on the appropriation committee will push for allocating federal funds to research in her state; the second strategy uses innovating activities in other states as instrument.

Innovation increases productivity

Innovation drives productivity growth, as emphasised by the endogenous growth literature and as shown by empirical evidence – for two examples, see Griffith, Redding and Van Reenen (2004) and Akcigit, Hanley and Serrano-Velarde (2021) – thus increasing economic wealth. This leaves open the possibility that redistributive policies could potentially share out the gains from innovation more equally.

Innovation can foster social mobility

Aghion et al. (2019b) show that innovation fosters social mobility as a result of creative destruction, the process whereby new technologies replace old technologies. Social mobility is a dynamic measure of inequality – a lower correlation between parents' income and children's income reflects a higher degree of social mobility in the economy and less inequality. Aghion et al. (2019b) show that it is entrant innovation (i.e., innovation by new innovators) that has a positive and significant effect on social mobility, whereas the effect of incumbent innovation on social mobility is not significant. This is in line with the view that innovation fosters social mobility when it is associated with creative destruction.

There is also recent evidence that innovations might benefit some workers on low incomes, with the possibility that policy could increase the number of low-income workers who benefit. Aghion et al. (2018) show that blue collar workers benefit from up to a quarter of the gains from innovation. In ongoing work, Aghion et al. (2021) show that innovation can also benefit some low-educated workers through the creation of 'good jobs'. They show that, in innovative firms, workers in occupations that require little formal education experience stronger wage progression than in other firms. Aghion et al. (2021) show evidence that this finding is consistent with the idea that these workers are complementary with workers in high-educated occupations, and that the firm provides training and learning on the job that is productivity-enhancing to the low-educated workers. However, the impact on overall income inequality is unclear, and possibly very small, as there are not a large number of jobs of this type.

Contrasting innovation and lobbying

Another source of top income inequality is entry barriers and lobbying: lobbying activities typically help incumbents prevent new entry and thereby preserve their rents. But precisely because they get in the way of new entry and creative destruction, lobbying activities reduce both productivity growth and social mobility.

In fact one can show, using cross US states panel data on lobbying, that: (i) like innovation, lobbying is positively correlated with the top 1% share of income; (ii) unlike innovation, lobbying is negatively correlated with social mobility and entrant innovation; (iii) unlike innovation, lobbying is positively and significantly correlated with the Gini coefficient (i.e., with broad inequality).

Innovation can create barriers to entry

Should we worry that innovation increases top income inequality, now we know that, unlike lobbying, it also enhances social mobility, and consequently does not seem to affect global measures of inequality? In other words, should we worry about the rich? One reason to worry is that the wealthy, including those that have become rich by successfully innovating in the past, can use their wealth to lobby in order to protect their own markets, for example, by preventing new innovators from entering the market.

A number of papers – including Akcgit and Ates (2019) and Aghion et al. (2019a) – study the rise in concentration and rents and the simultaneous fall in productivity growth in the US.

Aghion et al. (2019a) argue that the recent productivity slowdown in the US has a lot to do with the fact that some superstar firms (Amazon, Facebook, Walmart, etc.), the so-called FAMANG, have become so prominent and have invaded so many sectors and product lines that they have discouraged other firms from entering the market and innovating. Thus, if the average markup has gone up in the US over this past decade, it is mainly because the superstar firms, which are also the high markup firms, have taken over many sectors and product lines in the economy. FAMANG firms are more efficient than non-superstar firms (they have better access to networks and have accumulated social capital, which is hard for other firms to imitate). Thus, initially when the IT revolution allowed those firms to expand, we observed a surge in aggregate productivity growth in the US (during the decade 1995–2005). But the long-term effect of this market expansion has been to discourage innovation and entry by other firms; hence, the decline in the growth of total factor productivity since 2005.

The lack of appropriate competition policy in the US, and in particular the absence of a good regulation of mergers and acquisitions, has facilitated this expansion of superstar firms to so many local markets and product lines, and therefore it has fostered the decline in aggregate productivity growth.

De Loecker, Obermeir and Van Reenen (2020) show that many similar trends are present in the UK, including an increase in between-firm differences in productivity, wages, size and markups. They discuss important reasons why these differences might feed through into lower productivity growth, larger wage inequality and higher prices.

Becoming an inventor

The probability of becoming an inventor increases sharply with parental income when parental income reaches the highest income brackets (e.g., Bell et al., 2019). As argued by Aghion et al. (2019b), this partly reflects the fact that richer parents also tend to be more educated. But parental education is a key input in the individual's own education, and obtaining an MSc or a PhD is in turn a key input to becoming an innovator. Richer parents also tend to be more able to transmit 'aspirations' and 'ambitions' to their children, and these are also key inputs to becoming an innovator. Broader access to 'knowledge in the making' is a way to mitigate these important sources of inequality in innovation opportunities across individuals.

Final comments: improving capitalism

Innovation is key source of sustainable growth. A first challenge is to make innovation-led growth more inclusive and also more 'protective'. In short, we want a US eco-system of innovation, together with a Danish system to protect individuals who lose their jobs and to insure all individuals against big macro shocks. On the one hand, the COVID-19 vaccines owe everything to the innovation systems in place in the US and UK, which provided funding both for the basic research and for converting this basic technology into vaccines produced at very large scale within less than a year. On the other hand, COVID-19 hit the most vulnerable individuals in the US and UK very badly.

A second challenge is to encourage innovation while making sure that yesterday's innovators won't use their rents to deter innovation by new entrants, thereby eventually undermining productivity growth and social mobility. Capitalism thus needs to be regulated, or to use this excellent expression from Rajan and Zingales (2003) 'we need to protect capitalism from the capitalists'. This requires that several instruments be used simultaneously: progressive taxation

of course, but also we need to rethink competition policy in light of the IT and digital revolutions and the emergence of the new superstar firms; we also need to closely analyse the organisation and functioning of the lobbying system and the interface between politicians and the private sector (see Bertrand, Bombardini and Trebbi, 2014).

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