Innovation, income inequality, and social mobility

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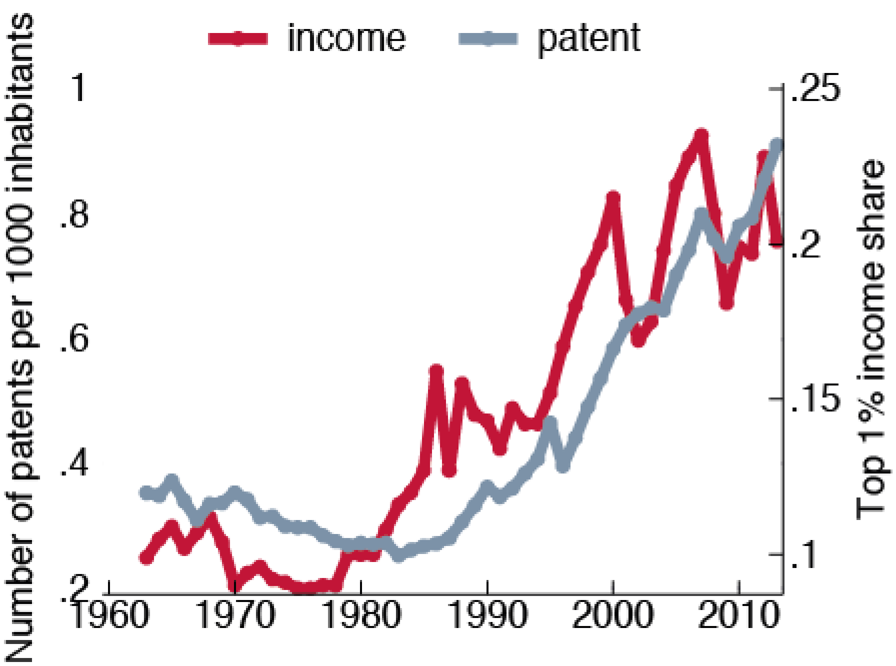
In recent decades, there has been an accelerated increase in top income inequality, particularly in developed countries. This column argues that innovation partly accounts for the surge in top income inequality and fosters social mobility. In particular, the positive effect of innovation on social mobility is due to new innovators.

Introduction

Over the past decades, we have seen an accelerated increase in top income inequality worldwide, particularly in developed countries (Goldin and Katz 2008, Deaton 2013, Piketty 2013). In recent research (Aghion et al. 2015), we argue that in developed countries, starting with the US, innovation is an unavoidable part of the story. Thus, if we look at innovation (measured by the annual flow of patents) and top income inequality (measured by the top 1% income share) in the US since the 1960s, we see that these two follow parallel evolutions.

Figure 1. Top income share and patenting in the US, 1963-2013



Note: The figure plots the number of patent applications per 1000 inhabitant against the top 1% income share for the USA as a whole. Observations span the years between 1963 and 2013.
Source: Aghion et al. (2015).

Why does knowing whether or not innovation partly accounts for the surge in top income inequality matter? As it turns out, innovation has virtues which other potential sources of top income inequality do not have.

- First, innovation drives productivity growth in developed economies (see Aghion et al. 2014).

But in addition, as we argue below:

- Even if the social surplus of innovation may initially be captured by those who generate it, eventually it is shared broadly as the innovation diffuses through the economy; and

- Innovation fosters social mobility as a result of creative destruction, the process whereby new technologies always replace old technologies.

The argument

That innovation should both increase top income inequality and foster social mobility relies on the following intuition, which we formalise using a Schumpeterian growth model – each new technological innovation allows the innovator to increase his technological advantage over the competitive fringe. It also allows the entrepreneur to reduce his demand for labour. Both of these contribute to increasing the entrepreneurs' share of income at the expense of the workers' share of income, at least temporarily until the fringe catches up with the new technology; hence, a positive effect of innovation on top income inequality. But at the same time, more innovation implies more creative destruction, i.e. more scope for having new innovators ('entrants') replace current firm owners ('incumbents'). This, in turn, implies that any type of activity by incumbents aimed at increasing entry barriers (for example, lobbying), will dampen the positive effect of innovation on social mobility, and should therefore be fought against if the objective is to achieve more inclusive innovation-led growth.

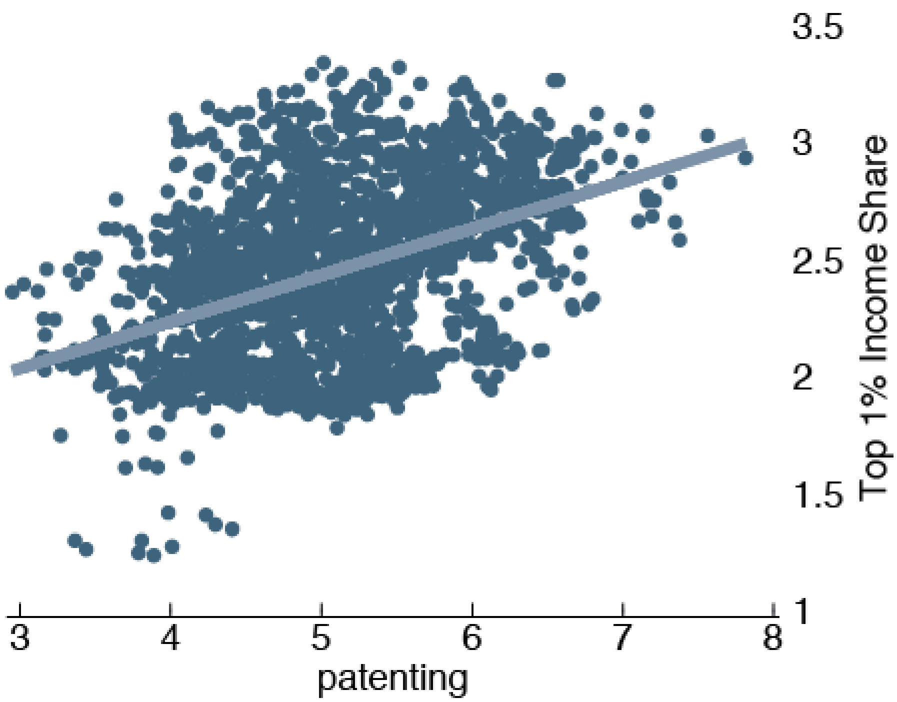
The prediction that more innovativeness should foster both top income inequality and social mobility is nicely illustrated by the fact that the most innovative state in the US, California, has both top 1% incomes shares and a level of social mobility that are much higher than those in the least innovative state, Alabama (Chetty et al. 2015).

Innovation and top income inequality

We measure top income inequality by the top 1% income share, using data from Frank (2009). To measure current innovation in a US state, we first use the annual number of new patents per capita in that state (we refer to this measure as 'patent count'). Then, we exploit the information in the USPTO database to construct various measures of quality-weighted innovation based on patent citations.

We use cross-US-state panel data over the period 1975-2010 to look at the effect of innovativeness on top income inequality, where innovativeness is measured by the flow of (quality-weighted) patented innovations in the corresponding US state, and top income inequality is measured by the share of income held by the top 1%.

Figure 2. Top income share and patenting in the US, 1970-2010



Note: The figure plots the logarithm of the number of patent applications per capita (x-axis) against the logarithm of the top 1% income share (y-axis). Observations are computed at the US state level from 1975 to 2010.
Source: Aghion et al. (2015).

Figure 2 shows that the top 1% income share in a given US state in a given year is positively and significantly correlated with the state's degree of innovativeness computed using patent counts.

In our paper, we go further and show that this correlation reflects a causal effect from innovation to top income inequality, and this is true for all the measures of innovation. We establish this causality result using two different ways of instrumenting for innovativeness in a state. The first strategy uses data on the appropriation committee of the Senate (following Aghion et al. 2009), the idea being that a new appointee on the appropriation committee will push for allocating federal funds to research in her state. The second strategy uses information on innovation in other states, the idea being that innovating activities in other states have knowledge spillovers and therefore reduce the innovation cost in a particular state.

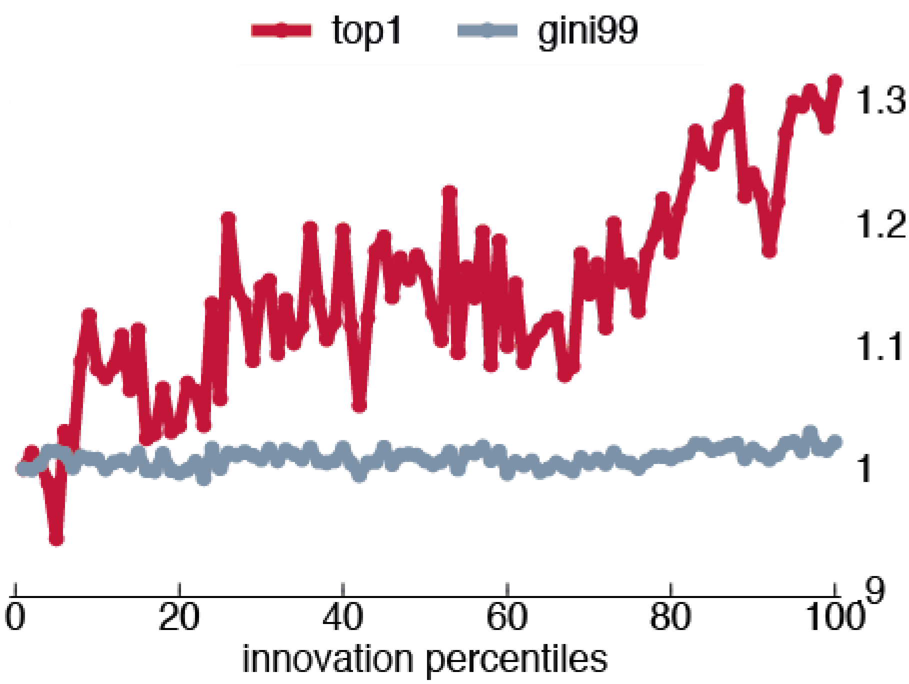
As it turns out, both instruments, even though they are unrelated, deliver similar significant coefficients. For example, when measured by the number of patents per capita, the increase in innovativeness accounts on average for around 17% of the total increase in the top 1% income share between 1975 and 2010, whether we use the appropriation committee or knowledge spillovers as instruments. This is a significantly large number, especially if we bear in mind the fact that innovators often move from one state to another when innovating, or that some of the rents from innovation may increase the income of individuals not located in the state. None of these enters the 17% figure!

Innovation and broader measures of income inequality

Figure 3 shows that innovativeness is neither positively nor negatively correlated with a broader measure of inequality such as the Gini, which does not emphasise the very top incomes. Figure 3 groups all state-year observations into percentiles and plots the average income share of top 1% and the average Gini index of the corresponding innovation percentile. To facilitate the comparison, each series is normalised by its initial value. The figure shows that moving from the lowest to highest innovation percentile increases the share of the top 1% by 30%, whereas the bottom-99 Gini remains unchanged across all innovation percentiles. We show that the same is true when considering other measures of inequality like the top 2-10% income share (i.e. excluding the top 1%), or measures of inequality like the Atkinson index.

- In other words, while discouraging productivity growth, deterring innovation does not help improve the overall income distribution.

Figure 3. Innovation and Top 1% share and bottom 99% Gini

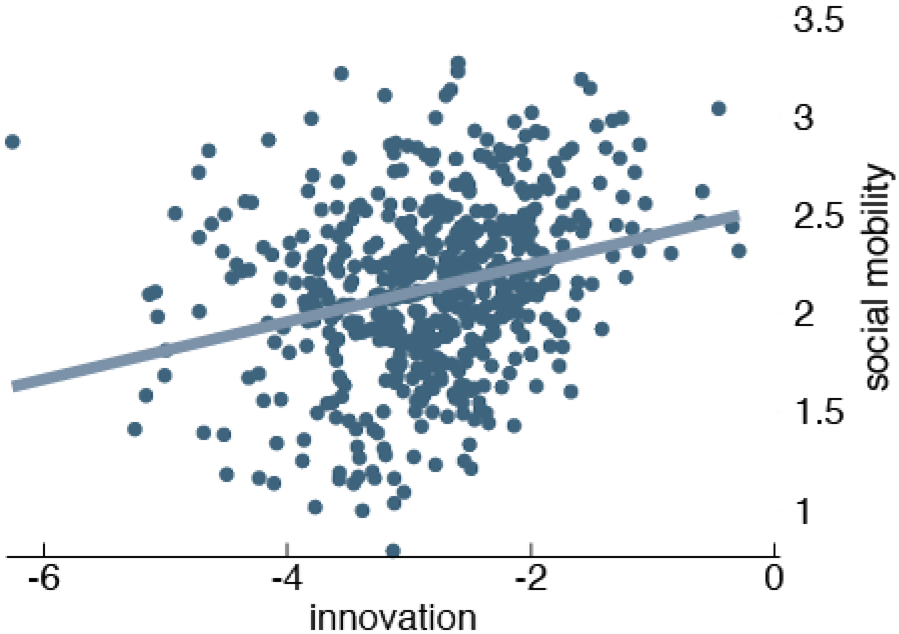


Note: The figure plots the average top-1% income share and the bottom 99% Gini index as a function of their corresponding innovation percentiles. The bottom 99% Gini is the Gini coefficient when the top 1% of the income distribution is removed. Innovation percentiles are computed using the US state-year pairs from 1975 to 2010. Each series is normalized by their values in the lowest innovation percentile.
Source: Aghion et al. (2015).

Innovation, creative destruction, and social mobility

Next, we look at how innovativeness affects social mobility across US commuting zones (CZs), using the measures of social mobility in Chetty et al. (2014) combined with local measures of innovation (using the fact that the USPTO database provides information on the address and zip codes of patent inventors). Chetty et al. define absolute upward mobility as the expected percentile or 'rank' (from 0 to 100) for someone aged 30 in 2011-2012 whose parents belonged to some percentile of the income in 1996 when the person was aged 16.

Figure 4. Innovation and social mobility in the US



Note: The figure plots the logarithm of the number of patent applications per capita (x-axis) against the logarithm social mobility (y-axis). Social mobility is computed as the probability to belong to the highest quintile of the income distribution in 2010 (when aged env. 30) when parents belonged to the lowest quintile in 1996 (when aged env. 16). Observations are computed at the Commuting Zones level (569 observations). The number of patents is averaged from 2006 to 2010.
Source: Aghion et al. (2015).

Figure 4 shows a positive correlation between patent count and social mobility. This is consistent with the prediction that innovativeness increases mobility at the top.

Next, we consider separately the effect of 'entrant innovation' and the effect of 'incumbent innovation' on social mobility. We find that:

- Entrant innovation has a positive and significant effect on social mobility, whereas the effect of incumbent innovation on social mobility is not significant;
- When regressing social mobility on both entrant innovation and incumbent innovation simultaneously, i.e. when performing a 'horse race' between entrant innovation and incumbent innovation, all the effect of innovation on social mobility is associated with entrant innovation, i.e. with creative destruction.

Lobbying as a dampening factor

Lobbying activities typically help incumbents prevent new entry, thus the conjecture is that in locations with higher lobbying intensity, innovativeness should have a lower effect on social mobility.

The Open Secrets project provides sector-specific lobbying expenditure at the national level. In order to measure lobbying intensity at the local level, we construct a Bartik variable for each commuting zone as the weighted average of lobbying expenditure in the different sectors, with weights corresponding to sector shares in the state's total employment from the US Census Bureau.

Next, we look at how lobbying intensity impacts the effect of innovativeness on social mobility across commuting zones. We find that:

- The effect of entrant innovativeness on social mobility is positive and significant only for zones that are below the median in terms of lobbying intensity;
- Incumbent innovation has no effect on social mobility, whether we look at zones above or below the median in terms of lobbying intensity.

These results confirm the idea that lobbying dampens the impact of innovativeness on social mobility by reducing the effect of entrant innovation.

Conclusion

In our recent paper (Aghion et al. 2015), we analyse the effect of innovation-led growth on top incomes and on social mobility. We find positive and significant correlations between innovativeness on the one hand, and top income shares or social mobility on the other hand.

Our study has potentially important policy implications for innovation in tax policy design and combining tax policy with other policy instruments (competition and entry policy, patent policy, R&D subsidies) to achieve more inclusive growth.

Another extension will be to look at innovation beyond patenting. As a first step in that direction, we looked at the relationship between top income inequality and frontier versus non-frontier growth, where frontier growth is defined as growth in states where labour productivity is closer than the median to the productivity in the most productive US state that year. Preliminary cross-state panel OLS regressions show a positive and significant correlation between top income inequality and frontier growth, but a negative correlation between top income inequality and non-frontier growth. Overall, these two findings are consistent with the view that the positive correlation between top inequality and growth, if any, is driven by innovation-led growth.

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