The Effect of Changes in Labor Demand and Entrepreneurship on Income Inequality Through Innovation

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The highly skill-biased technological changes brought about by innovation have changed the employment market greatly. This paper examines the impact of changes in labor demand and entrepreneurship, as a result of technological innovation, on income inequality in the form of a literature review, with analysis of related theoretical and empirical research studies. Innovation is positively correlated with income inequality from two points of view – labor demand and entrepreneurship. Firstly, innovations alter the demand for high-skilled and unskilled labor, and thereby change the skill premia– developments which, in turn, influence income inequality. Secondly, increased entrepreneurship enables entrepreneurs to accumulate more wealth due to higher financial returns. The paper departs from the approach adopted in most traditional papers, which analyze the relationship from a single perspective, by taking a multi-angled approach, with examination of the effect of labor demand and entrepreneurship on income equality from innovations. The study also identifies research gaps in the current literature and direction exploring the effects of innovation on income inequality going forward.

Keywords: innovation, income inequality, labor demand, entrepreneurship

INTRODUCTION

According to the theory presented by the political economist Joseph Schumpeter, entrepreneurs can be regarded as innovators as they possess the ability to utilize existing resources to create new ones (Schumpeter, 2000). Entrepreneurship has increased greatly as a result of innovation. This has, in turn, driven enormous technological changes that have significantly changed how people go about their daily lives, including how they work.

Of particular significance, in this regard, is the skill-biased nature of much technological change. This element of technological change, which sees skilled labor favored over unskilled labor, has a significant impact on people's professional roles, issues relating to the supply and demand of labor, educational and skill requirements, and workers' salaries, to name a just a few things. Of the many changes brought about by the rising levels of entrepreneurship that have resulted from innovation, the increased demand for highly skilled labor and the increasing number of self-employed businesses in existence are among the most significant. These changes have brought about huge shifts in people's professional roles and the premium that is placed on certain skills. As a consequence, they have influenced financial returns and wages in ways that have served to widen income disparities within societies. This review paper specifically examines two areas – labor demand and entrepreneurship – that have witnessed major change as a result of technological innovation, and how shifts in these areas have impacted on income inequality.

Theoretical Perspectives Research

Changes in Demand for Different Skilled Labor as a Result of Innovation

One of the most significant changes brought about by innovation has been an increased demand for skilled workers in various fields. Acemoglu and Restrepo (2018) have explored and summarized the two main effects that the highly skill-biased nature of technological innovation has had on the labor market, and their assumptions have widely accepted. Firstly, they have drawn attention to the so-called "displacement effect", which refers to how technological innovation has enabled capital to replace the role(s) previously played by labor in the production process (Acemoglu & Restrepo, 2018). In this way, developments in automation innovations, including computerization and industrial robots, are directly linked to a reduced need for unskilled labor (Hémous & Olsen, 2022) and will always reduce the share of unskilled skilled labor in value added to an industry or economy (Acemoglu & Restrepo, 2018).

However, Acemoglu and Restrepo also assert that the effects of automation are offset, or counterbalanced, by the fact that any shift towards greater automation necessarily involves the creation of new tasks in which labor needs to be employed. This effect, which Acemoglu and Restrepo term the "reinstatement effect", requires that labor be redeployed in a broad range of new tasks – a shift that, in direct contrast to the displacement effect, serves to increase both labor demand and income (Acemoglu & Restrepo, 2018). This is because a shift to innovation and automation has an aggregate scale effect, with reduced production costs serving to increase productivity across the economy as a whole (Hémous & Olsen, 2022). Thus, as the economy grows, labor demand and labor share also increase. However, it is important to recognize that, due to the requirement for high-level skills in the process of developing innovations, together with changes in task content brought about by the innovations and entrepreneurship, this higher demand for labor is primarily focused on highly skilled sections of the labor market.

Both the displacement effect and the reinstatement effect, therefore, have a significant influence on the labor market, and the premium that is placed on skills in particular. In so doing, they contribute to increased income inequality. Based on the theoretical analysis conducted by major economists, widening income inequality has principally been driven by two factors. The first of these is from increased wages in certain sectors of the economy (Van Reenen, 1996) – a development which is linked to improved firm quality as a result of technological innovation. The second is from an increased demand for highly skilled labor in the innovation market (Hémous & Olsen, 2022).

On the first point, it is clear that technological innovation influences the salaries that are offered by firms (Van Reenen, 1996). Innovations are highly and positively correlated with the premium that is placed on skills within companies, because of the increased quality of the labor force and company brand that arise as a result of innovation (Van Reenen, 1996). As a result of the stronger background and financial return that comes from the adoption of technological innovation, companies that innovate have the ability to offer higher wages. In addition, innovative firms are able to stimulate further innovation – and thereby increase profitability still further – by sharing their profits with employees in the form of higher wages (Van Reenen, 1996).

On the second point – relating to how an increased demand for highly skilled labor has driven income inequality – we have already seen the significant roles that the displacement reinstatement effects play in this regard. Automation involves the introduction of new technologies that replace unskilled labor in the tasks they were previously performing – for instance, from production processes in manufacturing industries. On the other hand, developing innovations requires the completion of tasks that require the involvement of highly skilled members of the labor market, such as software developers, application designers, and computer programmers. In other words, these changes stimulate an increased demand for highly skilled labor while, at the same time, reducing the demand for unskilled labor. According to the labor demand and supply model, increasing the demand for highly skilled labor while the level of supply remain stable inevitably entails higher salaries being paid to highly skilled workers. As a direct consequence, the highly skill-biased nature of technological innovation alters the employment market – and the labor structure that underpins it – in ways that lead to wider income gaps between skilled and unskilled workers than previous existed.

Based on what has been discussed in this paper so far, increasing levels of innovation serve to increase the wages of highly skilled workers due to increased demand for skilled workers in companies that wish to reap the benefits of innovation. In comparison, the wages of unskilled workers remain far more ambiguous, with their rise or fall dependent on the relative impact of the reinstatement and displacement effects in individual companies. What is clear, however, is that it is impossible for the wages of highly skilled and unskilled workers to grow at the same rate, in the long term, when the prevailing conditions are shaped by constant innovation (Hémous & Olsen, 2022). In addition, we know that unskilled labor will constitute a progressively smaller share of the total labor share over time as automation replaces unskilled labor in various tasks. Innovation cannot fully replace unskilled labor in some sectors, and there will therefore remain some demand for unskilled workers (Manning, 2004), but this demand for unskilled labor will be broadly negative as a result of increasing innovation, while the opposite is true for highly skilled workers. These contrasting fortunes will consequently enlarge existing wage differences between skilled and unskilled workers, thus widening the income inequalities that already exist between them.

Entrepreneurship and Innovation

Emerging innovations have incentivized the shift to self-employed work and driven an increase in both the number of self-employed businesses and entrepreneurs (Atems & Shand, 2018). Innovations serve to expand the global market with technology and entrepreneurship, providing innovators with the environment, resources, and networking they need to convert their creativity into business opportunities (Okpara, 2007). The overall atmosphere in today's innovative economic market is one characterized by encouragement and incentives for people to start turning their original ideas into practical business opportunities. On the one hand, rising levels of entrepreneurship can be seen to take markets and societies to a higher level of prosperity by utilizing existing resources to produce new products or solutions (Okpara, 2007). However, it can also be seen to drive income and wealth inequalities.

According to previous related research studies, rising levels of entrepreneurship can widen income and wealth inequalities in two main ways. Conclusively, the first of these owes to the increasing appetite for – and incentives to – accumulate wealth that sits at the heart of entrepreneurship. And the second relates to the endogeneity of wealth.

To start with the first of these, it is evident that entrepreneurship – as an occupation – fosters a number of incentives for wealth accumulation. At a macro level, entrepreneurship, when driven by new innovations, can increase the aggregate income of societies at large due to the enormous profits that innovative companies can generate (Atems & Shand, 2018). However, the distribution of that income is distributed unequally across the individuals that make up a society. One reason for this is the borrowing constraints that entrepreneurs face. Borrowing is often a key means through which entrepreneurs can obtain sufficient financial investment to start and sustain their business(es) and entrepreneurial activity. The amount of investment and capital available to such entrepreneurs is directly linked to the size and nature of their business, with the amounts that can be borrowed determined by observable characteristics and the assets that the entrepreneur or business possess (Cagetti & De Nardi, 2006). Borrowing constraints thus serve as an incentive for entrepreneurs to accumulate wealth, so that sufficient funding can be obtained for the business to survive and thrive (Atems & Shand, 2018) and so that the company can build increasing trust in the credit market.

On top of this, entrepreneurs have a higher implicit rate of return (Cagetti & De Nardi, 2006) due to the nature of their occupation when compared with standard employees – whose income remains (relatively) stable regardless of fluctuating profits. This single change in income that falls on entrepreneurs enables them to earn more (and acquire higher incentives to save) while sustaining the salary of working groups at fairly stable levels, a factor which serves to widen levels of income inequality between entrepreneurs and employees.

In regard to the second point, it is widely recognized that wealth creation is strongly endogenous (Kerr & Nanda, 2009). In this way, people who possess high-level skills and abilities – as well as tertiary education qualifications – are more likely to save more money as they are able to take on higher-paying jobs and, in many instances, even become entrepreneurs themselves. Many researchers have found that

individuals from higher-income households have a higher tendency to choose entrepreneurship as their occupation (Lecuna, 2020). Entrepreneurs generally possess a disproportionate amount of a society's wealth due to the borrowing constraints explored earlier in this paper. Although there is no solid connection between the entry rate of self-employed business and the wealth of households, except of the richest households (Fairlie & Krashinsky, 2012), the large amounts of wealth which they possess seem to enable individuals from higher-income households to achieve greater social mobility (Aghion, et.al., 2015). In practical terms, this means that those who come from higher-income households and become entrepreneurs are well positioned to move into the higher echelons of the social classes (Quadrini, 1999), a move that further increases their opportunities to establish strong social networks, to enter higher education, and to develop their careers. The solid financial situation and higher social mobility that such individuals benefit from, in turn, provides them and their households with the means to become entrepreneurs and expand their entrepreneurial activities over time.

In this sense, family background is considered by some researchers as an essential determination for entrepreneurship. Due to the asymmetric nature of information that is available to access in the market, the general background of the individuals and households involved in entrepreneurial activity serves as an indicator of their reliability (Cagetti & De Nardi, 2006), thereby providing them with greater credibility in the eyes of banks, suppliers, and buyers they borrow from and sell to (Cagetti & De Nardi, 2006). The wealth that entrepreneurs possess thereby largely reduces the asymmetric information problems that innovators often face during the start-up process, increasing the likelihood that they will succeed in the medium and long term (Cagetti & De Nardi, 2006).

In addition to all of the above, the higher-income households from which many entrepreneurs come are also more able, and have a natural pre-disposition, to establish self-employed businesses as an initial career step. This, in turn, enables them to accumulate more wealth than the average employed worker due to the higher returns and saving rates available to self-employed workers. In other words, entrepreneurs from higher-income households are well positioned to not only maintain their financial advantage over general employees – whose income remains relatively constant over time – but also to increase this advantage over time. This situation serves to increase existing income equalities still further.

Empirical Studies

Various empirical studies have shown that there is a positive correlation between innovation and income inequality (Aghion, et.al., 2015; Aghion, et.al., 2019 Quadrini, 1999; Breau, Kogler & Bolton, 2014; Liu & Lawell, 2015). As highlighted earlier, technological innovation impacts on people's financial situations by altering their employment roles and salaries, and these changes can combine in ways that enable higher-income households to become richer while normal households become more economically disadvantaged. Several empirical studies have demonstrated the link between increased demand for highly skilled labor and increased rates of entrepreneurship, on the one hand, and increased income inequality on the other. These studies can broadly be split into the following two categories, which correspond to the theoretical framework we mentioned earlier.

Studies on the Effect(S) of Innovation on Highly Skilled Labor and Income Inequality

Some empirical studies have shown that innovation leads to a decline of unskilled labor in the labor market, with a corresponding increase in high-skilled labor. Using higher education as an indicator of workers' differing skill levels – namely, taking the attainment of a colleague degree as the essential measure – the study conducted by Acemoglu & Restrepo (2018) demonstrated that, due to the skill-biased nature of technological change brought about through innovation, the percentage of college graduates employed in the US labor market rose from 6.1% in the 1940s to 24% in the 1990s. In a similar vein, the wages earned by college graduates also increased, over the same period, as a percentage of the total wage bill. These findings are supported by those presented in another empirical study, which found that the share of highly skilled labor in the labor market rose dramatically – from 13.7% to 63.8% – as R&D spend by innovative companies increased (Aghion & Griffith, 2017). This change in the number of highly skilled workers and

unskilled workers was mirrored by changes to the levels of income each group received (Aghion & Griffith, 2017; Acemoglu & Restrepo, 2018).

In addition to the increased demand for highly skilled labor, other studies have shown that the endogeneity of highly skilled labor also plays an essential role in widening income inequality. Studies have tended to explain this by drawing attention to two factors: firstly, the endogenous benefits that are derived from higher level education and, secondly, the types of companies that highly skilled workers tend to enter.

Starting with the first of these points, it has been amply demonstrated that there is a very positive correlation between undertaking higher education – which highly skilled workers generally do – with earning a higher salary once in employment (Devroye & Freeman, 2000). There is also evidence of there being a positive correlation, in both the United States and across Europe, between individuals who achieve exceptional results at college going on to receive higher salaries in roles that are categorized as "high skill" (Devroye & Freeman, 2000). The link between higher education and earning power seems to be particularly strong in the United States, with empirical analysis demonstrating that an additional year of education adds approximately 8% to a worker's salary (Devroye & Freeman, 2000). In a similar vein, a study conducted by Backes-Gellner and Werner (2007) found that business owners who had completed a higher education degree were far more likely to successfully navigate through the start-up stage than those who had not undertaken higher education.

In regard to the second point, empirical analysis has also demonstrated that the salaries offered by innovative firms – to which highly skilled workers are often drawn – are much higher than those offered by non-innovative firms. In the UK, for instance, statistical data has shown that the average hourly wage is £3 higher in innovative firms than in non-innovative firms (Aghion & Griffith, 2017). In addition, it has also been shown that there is a strong correlation between a company's R&D spend and the amount it pays its employees, with Aghion and Griffith (2017) demonstrating that a 1% increase in R&D spending equates to an average 11.7% rise in salaries. As innovative companies tend to employ more highly skilled workers than unskilled workers, it is clear to see how this situation serves to further entrench the skills premium and extend the income gap that already exists between highly skilled and unskilled labor.

Studies on the Effect(s) of Innovation on Entrepreneurship and Income Inequality

There are also a variety of empirical studies focusing on the relationship between entrepreneurship and income inequality. Of particular pertinence to our theoretical framework that the majority of wealth in economic markets is concentrated around entrepreneurs are the findings of the 1989 Survey of Consumer Finance, which showed that business owners and self-employed workers possessed 59.2% of total wealth in the United States, even though those groups only made up around 16.7% of the country's population (Cagetti & De Nardi, 2006). Another study adds further weight to this hypothesis by demonstrating that individuals from households with established entrepreneurial experience are approximately 20% more likely to become self-employed or business owners than those from households without such experience (Quadrini, 1999). As a result, individuals from households with prior entrepreneurial experience are well positioned to accumulate more wealth – or become richer – as a result of their profession.

Most empirical studies also show that income inequality within societies tends to increase at the same rate as the number of entrepreneurs does. According to the empirical analysis conducted by Atems and Shand (2018), for instance, there is a very strong correlation between levels of self-employment and income inequality in the United States, when measured using the Gini index (which measures the degree of inequality in the distribution of family income in a country) (Lecuna, 2020). The study shows that, for every 1% rise in the self-employment rate, the Gini index increases by 0.0354 – a statistically significant amount, constituting around a 5% rise (Atems & Shand, 2018). Interestingly, the study observed an even stronger trend between a rise in the self-employment rate and increasing income inequality when the Theil index was used, with results showing that a 1% increase in the self-employment rate resulted in a 0.12-point increase in income inequality (Atems & Shand, 2018). Taken together, both results show that there is a strong link between an increase in levels of entrepreneurship and increased income inequality across society as a whole.

CONCLUSION

This review paper has analyzed existing research on the effect(s) that technological innovation has had on income inequality through attendant changes to labor demand and entrepreneurship. By having done so, it has been able to prove the hypothesis that the increasing demand for highly skilled labor and the increasing number of active entrepreneurs, which have both been driven by recent technological innovations, have contributed to driving up income inequality across society.

Nevertheless, it has become apparent in the review process that there are several gaps in the existing research, gaps which deserve to be examined by researchers working in related areas in the near future. These gaps can, broadly, be split into two groups: study content and a detailed division of the topic of entrepreneurship.

The first of these gaps – that of study content – relates to the fact that most studies focus on a single aspect of change brought on through innovation, and the impact that that change has had on income inequality. There is, however, much to be gained from adopting a more comprehensive approach to the topic, exploring the issue from a wider range of angles and taking into account multiple factors, in order to develop a more rounded understanding of the relationship between innovation and income inequality.

On the second point, is has become apparent in this analysis that most existing studies have neglected to explore the relative size of entrepreneurial endeavors, and how this may impact income inequality in different ways. It is highly likely, for instance, that a proliferation of large-scale enterprises with a focus on innovation may serve to widen income equality, with related income directed, principally, towards the highly skilled workers that tend to constitute the majority of the workforce in such organizations. However, a proliferation of small, self-owned business could have the opposite effect by providing unskilled individuals with additional job opportunities. It is important, therefore, that future studies seek to classify the size of the firms under investigation, along with the extent to which they employ innovative technologies, so that the effects of technological innovation on income inequality can be explored in a more nuanced manner.

If researchers were able to fill these research gaps in regard to effect of labor demand and entrepreneurship on income inequality, it is expected that their findings would help governments to design well-evidenced policies to regulate the innovative market. In so doing, they would help societies to allocate and utilize the resources and benefits brought about by innovation in a more effective and rational manner.

REFERENCES

Acemoglu, D., & Restrepo, P. (2018). Automation and new tasks: the implications of the task content of production for labor demand. *Journal of Economic Perspectives*, *33*(2), 3–30.

Aghion, P., Akcigit, U., Bergeaud, A., Blundell, R., & Hemous, D. (2015). Innovation, income inequality, and social mobility. *Vox CEPR's Policy Portal*, *28*.

Aghion, P., Akcigit, U., Bergeaud, A., Blundell, R., & Hémous, D. (2019). Innovation and top income inequality. *The Review of Economic Studies*, *86*(1), 1–45.

Aghion, P., Bergeaud, A., Blundell, R., & Griffith, R. (2017). *Innovation, firms and wage inequality*. Department of Economics, Harvard University, Working Paper Series. Retrieved from https://scholar. harvard. edu/files/aghion/files/innovations_firms_and_wage. pdf

Atems, B., & Shand, G. (2018). An empirical analysis of the relationship between entrepreneurship and income inequality. *Small Business Economics*, *51*(4), 905–922.

Backes-Gellner, U., & Werner, A. (2007). Entrepreneurial signaling via education: A success factor in innovative start-ups. *Small Business Economics*, *29*(1), 173–190.

Breau, S., Kogler, D.F., & Bolton, K.C. (2014). On the relationship between innovation and wage inequality: New evidence from Canadian cities. *Economic Geography*, *90*(4), 351–373.

Cagetti, M., & De Nardi, M. (2006). Entrepreneurship, frictions, and wealth. *Journal of Political Economy*, *114*(5), 835–870.

Devroye, D., & Freeman, R. (2000). *Does inequality in skills explain inequality of earnings across countries?* Unpublished manuscript, Harvard University (April 2019).
Fairlie, R.W., & Krashinsky, H.A. (2012). Liquidity constraints, household wealth, and entrepreneurship revisited. *Review of Income and Wealth*, *58*(2), 279–306.
Hémous, D., & Olsen, M. (2022). The rise of the machines: Automation, horizontal innovation, and income inequality. *American Economic Journal: Macroeconomics*, *14*(1), 179–223.
Kerr, W., & Nanda, R. (2009). *Financing constraints and entrepreneurship* (No. w15498). National Bureau of Economic Research.
Lecuna, A. (2020). Income inequality and entrepreneurship. *Economic Research-Ekonomska Istraživanja*, *33*(1), 2269–2285.
Liu, Q., & Lawell, C.Y.C.L. (2015). *The effects of innovation on income inequality in China*. Shandong Province Educational Department.
Manning, A. (2004). We can work it out: The impact of technological change on the demand for low-skill workers. *Scottish Journal of Political Economy*, *51*(5), 581–608.
Okpara, F.O. (2007). The value of creativity and innovation in entrepreneurship. *Journal of Asia Entrepreneurship and Sustainability*, *3*(2), 1.
Quadrini, V. (1999). The importance of entrepreneurship for wealth concentration and mobility. *Review of Income and Wealth*, *45*(1), 1–19.
Schumpeter, J.A. (2000). Entrepreneurship as innovation. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.
Van Reenen, J. (1996). The creation and capture of rents: Wages and innovation in a panel of UK companies. *The Quarterly Journal of Economics*, *111*(1), 195–226.