**URWC**

**"Artificial Intelligence and Rising Inequality"**
**By James Hadley**

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**Artificial Intelligence and Rising Inequality**

*1. Introduction:*

The development of artificial intelligence (AI) has the potential to accelerate wealth

generation to a much faster rate than previously observed in human history. Research by Casares

suggests that "the current rate of disruption [of industries] is now faster than any of those

[previous large-scale economic transformations]" (Casares 12). AI technology could impact the

economy at a scale much larger than previous revolutions over a much shorter time-frame. The

shifts in social order observed during previous revolutions might then occur at a similar large

scale and rapid pace.

The entire impact which AI technology may have on society presents a very wide scope;

instead, this paper will focus on wealth inequality and how the government should respond to it.

Historical estimates show that inequality has already been on the rise in the United States, and

research suggests industrial revolutions specifically tend to accelerate the upwards trend in

wealth inequality (United States Census Bureau; Mokyr, Vickers, and Ziebarth 36). The rise of

inequality is the next technological revolution the US may face, and along with increased

productivity it promises to continue the trend of accelerating inequality.

The question which this paper will attempt to address is the following: How should the

government respond to the impact which AI technology will have on future inequality? The next

three sections will separate this question into three component questions: how might AI

technology impact inequality? How will this impact affect society? What should the government

do to respond? The hypothesis for these sections is that AI technology will increase inequality

between unemployed workers and innovators. Furthermore, the government should respond by

focusing on the equity of standard of living, using the new wealth generated by AI technology to provide for the basic necessities of its unemployed citizens.

The first section of this paper argues that AI technology will worsen inequality. The work of Deaton and Di Maggio suggest that inequality often increases in times of increasing capital income. The increase in capital income due to the productivity of AI technology should then lead to an increase in inequality in the future. Furthermore AI technology is capable of creating "technological unemployment," or unemployment due to automation (Brynjolfsson, McAfee 2014). People who are technologically unemployed lose their ability to earn an income, which creates more inequality in a society of otherwise increasing incomes. Another argument is that work quality and pay will worsen, which works again to reduce the income of part of society while overall income increases, and thus worsens inequality.

How these effects impact different parts of society are discussed in the next section, which uses Casares's division of society into innovators, consumers, and displaced workers to see how this inequality will take form. Through the winner-take-all market system, innovators will be able to capture most of the wealth generated by AI technology, allowing them to become much wealthier than the rest of society. Consumers, which can apply to all of society, will be benefitted overall by the increased productivity and lower costs of goods. Finally, displaced workers will be afflicted with unemployment that causes them to be worse off. The starkest inequality that will be seen will be between those whose innovations in AI led to the automation of tasks and those whose jobs are now done by AI.

The third section addresses how the government should respond. The goal of eliminating inequality would likely cost too much economically, as dictated by Okun's trade-off between

equity and efficiency. Instead, the government should focus on a balance between equity and efficiency. The optimal balance would be that of a welfare state that provides for primary goods, creating equity in the standard of living, in a way that continues to incentivise innovation. This could be achieved through Mazzucato's suggestion of an innovative state: a government which invests in innovation itself and uses the income generated to support the population. Such a model would allow the government to treat both innovation and necessities as public goods which it provides to the public, creating a more equitable standard of living without significantly reducing efficiency.

*2. Acceleration in Inequality*

This section will attempt to address the relationship which AI may have with inequality. Like other technologies, AI has the potential to have diverse impacts on the economy in ways that are sometimes unpredictable. This section will seeks to incorporate the research of other authors on inequality to examine how AI itself might have impacts on inequality.

Inequality often worsens during times of economic expansion. Angus Deaton notes that "Many of the great episodes of human progress, including those that are usually described as being entirely good, have left behind them a legacy of inequality" (Deaton 4). Periods of economic expansion, which may be seen favorably as human progress, often tend to increase inequality. This concept is generalised by Di Maggio, who writes that "time periods that generate large increases in capital income and capital gains can be associated with rising inequality" (Di Maggio 43). Di Maggio links inequality with the increases in capital income which underlie episodes of human progress. The reasoning behind this is that capital

gains benefit owners of capital, who typically are a wealthy minority of the population. This association between increases in capital income and economic inequality can be used to examine the impacts that AI technology may have on future wealth distribution.

AI technology fits the role of a catalyst for capital income--and thus a catalyst for inequality. Brynjolfsson and McAfee generalise AI into what they call digital technologies--referring to all the technology brought on by computing--and suggest it will bring on a Second Machine Age characterised by dramatic increases in the productivity of capital and decreases in the marginal costs of goods and services (Brynjolfsson and McAfee 2014). Casares describes the implications of this rise in digital technologies to "expand well beyond the digital economy, reaching a wide range of products, services, and industrial sectors… [which] may remain the most relevant economic driver for a significant portion of the 21st century" characterised by a "radical decrease in marginal production costs as a result of technological transformation" (Casares 8). Casares believes that as the cost of production falls, the impact of digital technologies will spread to more and more sectors of the economy. An increase in productivity due to AI technology as described by Brynjolfsson, McAfee, and Casares would directly increase the income associated with capital using this technology. This dramatic increase in capital income will be accompanied by an acceleration of inequality as the increased productivity feeds the incomes of the owners of capital technology.

The inequality-producing effects of AI are not just limited to the associated increase in wealth production and capital income. As AI works to replace the need for human labour, more and more workers find themselves unable to generate an income. While Mokyr, Vickers, and Ziebarth write that "modern anxieties about long-term, ineradicable technological

unemployment… seem highly unlikely to come to pass," they recognise "the path of transition to this economy of the future may be disruptively painful for some workers and industries" (Mokyr, Vickers, and Ziebarth 47). In other words, though AI might not create long term unemployment issues, in the short term there will be a displacement of workers in automatable fields preventing them from earning an income. This period of unemployment would contribute to inequality by taking away part of the population's means of earning an income. Nevertheless, Spencer suggests an alternative view on the effect AI will have on unemployment, writing that "the proliferation of digital technologies can be associated with the growth of insecure, episodic, intensive and low-paid work" (Spencer 148). Instead of a fall in employment, Spencer sees new technology as being used to expand insecure and low-paid work. The result, however, is still the proliferation of inequality--whether by creating a population of unemployed labour or by expanding the amount of low-paid work, AI technology may result in reduced incomes for labourers. When taken together with the increase in capital income, AI technology poses to worsen the gap between owners of capital and labour.

The multifacetedness of the impact AI technology may have on society complicates the overall effect on society. In the next section, the interaction between the falling costs of production, increase overall productivity and temporary unemployment will be discussed to predict the overall impact on society. The fourth section will then look at how the government might respond to these developments.

*3. Impact on Society*

To analyse the impact that AI technology may have on inequality, it is necessary to

examine the direct impact it has on society and how these effects lead to inequality. Casares introduces a categorisation of society into three nonexclusive groups based their role in the economy; innovators, consumers, and displaced workers (Casares 11). Each of these groups is impacted distinctly by innovation--a trait that, when combined with the ability of AI technology to increase or reduce the ability to generate wealth, leads to the creation of inequality. This section will focus on the analysis of this discriminatory behaviour associated with innovation using Casares's division of society.

The first group which Casares describes are the innovators, or "direct creators and contributors to a disruptive technology" (Casares 11). For the purposes of this paper the disruptive technology Casares describes can be seen as equivalent to AI technology, thus making the innovating class the future owners of AI technology. As Casares describes, the US economy functions as a winner-take-all economy, which prevents wealth from becoming hereditary and instead rewards those with the highest productivity (Casares 12). This allows successful innovators to capture all of the capital income associated with their technology. Casares describes an example of this dynamic with "the case of Travis Kalanick and the value of his personal shareholding ownership in Uber, the company that he founded in 2009, currently estimated at over US$5 billion" (Casares, 11). As an innovator, Travis Kalanick was rewarded for his innovation by the income associated with his shareholding ownership in Uber. While this case involved innovation unrelated to AI technology, the same dynamic applies with disruptive technology associated with AI. Innovators are then affected by the AI revolution very positively--the dramatic increase in their incomes may actually increase inequality since the wealth distribution becomes skewed towards them.

The second group which Casares describes are consumers "who enjoy the benefits of a new technological development" (Casares, 11). Given that all participants in an economy are in some form consumers, this category applies to all of society. The benefits of new technological development are described by Mokyr, Vickers, and Ziebarth, who write that "so much high-quality leisure activity can be accessed by all at low average cost and near-zero marginal cost" and that "the long-term trend toward greater leisure will continue" (Mokyr, Vickers, and Ziebarth 44; 48). Mokyr, Vickers, and Ziebarth note that new technologies reduce the cost of leisure, thereby increasing the standard of living of the entire population. The long term trend which they describe is based on the historical trends during previous technological revolutions, noting that "it may be a net gain to human welfare… to watch dramas or sports of a mind-boggling variety on a high-definition flat screen; to attend virtual rock concerts or operas with high-quality sound; to defeat the Trojans or win the tank battle of Kursk from a living room sofa using a joystick, or to 'network' with friends through social media" (Mokyr, Vickers, and Ziebarth 44). Mokyr, Vickers, and Ziebarth describe some of the numerous real and predicted advances in leisure that to arise through technology as an example of how consumers (or society as a whole) benefits from innovation. The fall in the cost of leisure means that more and more consumers can benefit from the same pastimes. While this doesn't affect the income, and therefore doesn't impact income inequality, the expansion of the leisure class reduces inequalities in the standard of living.

The last group Casares describes is displaced workers, or workers "whose occupations are directly or indirectly disrupted, and in some cases completely replaced by the new cognitive machines" (Casares, 11). Displaced workers lose their incomes in the short run due to

innovation, worsening the inequality gap between them and innovators. Boyd and Holton write that "while there is plenty of evidence of changes in service employment across the range of skills involved, there is no clear evidence of a general threat… accountancy positions have a 95% vulnerability to extinction due to robotics and AI, whereas for hairdressers the figure is 33% and for economists only 10%" (Boyd and Holton 6). Boyd and Holton suggest that the displacement of workers is likely limited to only certain fields; the fields that are vulnerable however, such as accountancy positions, are very likely to become extinct due to robotics. This leaves a significant population of labourers who are technologically unemployed. Brynjolfsson and McAfee suggest that unemployment derives from a "wrong" education, and that technological unemployment is remediable through new education (Brynjolfsson and McAfee 2014). Nevertheless, this education costs money and time, making it difficult for displaced workers to adapt in the short run. While displaced workers are also consumers who benefit from the increase in standards of living, their lack of an income worsens their condition, in contrast to the improving conditions of the rest of society.

As discussed before, Spencer has a different take on displacement due to technology. Spencer argues that new technologies will lead to more, lower quality work, rather than unemployment. According to Spencer, capitalists "can get workers to wear electronic devices that measure and monitor, on a moment-by-moment basis, their health and well-being. These devices are often marketed as part of 'wellness' programmes; however, their aim and effect is to increase the amount of work performed by workers" (Spencer, 146). Technology, according to Spencer, will be used in ways that force workers to work more rather than replace workers. The argument that technology worsens conditions is mirrored by Mokyr, Vickers, and Ziebarth's

suggestion that during the Industrial revolution "the problem with the factories was not in the low quantity of work they offered, by the low quality of work in the mills" (Mokyr, Vickers, and Ziebarth 35). Nevertheless, they note that "the mechanisation of the early 19th century could only replace a limited number of activities" and "by disrupting the demand for certain types of labour, the Industrial Revolution caused considerable distress… handloom weavers and frame knitters with their little workshops were quite rapidly wiped out by factories after 1815" (Mokyr, Vickers, and Ziebarth 36; 35). This suggests that technology also poses a significant threat to certain jobs, such as it did to weaving in Industrial England. The AI revolution, which has a much larger capacity to replace activities than the Industrial Revolution, will likewise be more capable of eliminating jobs. The argument that work conditions may worsen is a valid one, but unlike Spencer claims it doesn't replace the argument for unemployment, but rather will coexist with it--as in the Industrial revolution, but with a scale comparable to that of the AI revolution.

While AI technology is likely going to lower the cost of leisure for the entire population, its disparate impacts on those who innovate and those whose fields are automated or working conditions worsened by AI will generate a worsening gap in inequality. How these effects will interact with preexisting inequality is a topic where further research may be needed. The winner-take-all dynamics underlying the economy as well as the widespread access to education means that innovation can come from almost any participant in the economy, making it hard to predict who will be consisting of the innovators of AI technology. Likewise, the future brings both unemployment and new employment opportunities that make it hard to predict. Nevertheless, it can be seen that in the short run there will be a section of society afflicted with unemployment accompanied by increased productivity where income is funneled to a small

group of innovators. Whether and how the government should intervene in the resulting inequality is the topic of the next section.

4. *Government Intervention*

Before addressing how the government should intervene, it is important to establish if it should and why. By defining the reasons and goals for government intervention a set of guidelines can be established. Since the wider, philosophical aspects of the debate on inequality are of such a wide scope, this paper will focus on the political and economic debate on the subject.

The idea of inequality as an inherent inefficiency in society is not shared by all. While economist Arthur Okun believe that equity is a desirable goal, he suggested that there was a trade-off between equality and efficiency in society caused by a "leaky bucket" in the system of transfer payments used to reduce inequality (Okun 1975). In other words, the process of reducing inequality itself was inefficient but still desirable because equity was desirable. Mankiw uses this to argue that inequality is not necessarily a bad thing, writing that "concern about income inequality, especially growth in incomes of the top 1 percent, cannot be founded primarily on concern about inefficiency and inequality of opportunity… If [inequality is] to be a focus of public policy, it must be because [it] is a problem in and of itself" (Mankiw 26). Mankiw's argument is that we shouldn't be so concerned with inequality given that, according to him, it's not a matter of inefficiency. Yet, Okun's argument that inequality is undesirable suggests that, in Mankiw's words, it "is a problem in and of itself," countering Mankiw's suggestion that it should be tolerated. Mankiw and Okun make a strong case that inequality isn't inherently inefficient;

however, pure inequality is still undesirable because it creates inequality in opportunity. The role of government should be to create increase the equity in opportunity as efficiently as possible. The ultimate goals of a government response to the inequality of the future should be to find the right balance between efficiency and equity. Spencer argues for complete equity, suggesting that "moving beyond capitalism, the case can be made for forms of collective and shared ownership of production" (Spencer 149). Spencer's view is that the optimal solution is a complete even distribution of the income from production to workers, following Marxist ideals. Nevertheless, there are many critiques on Marxist policies, including Okun's societal trade-off between equality and efficiency mentioned earlier. The transfer of control which Spencer argues for would still be a leaky bucket which would decrease the overall efficiency of the economy. While Spencer's claim is that the trade-off is lower than the benefit of equity, Mokyr, Vickers, and Ziebarth offer a different perspective on the optimal balance between efficiency and equity. They suggest that "if these kinds of technological developments lead to an economy where an ever-larger share of the population works for relatively low wages but can still enjoy a high standard of living through a variety of low-cost leisure opportunities, political disruption may be minimal" (Mokyr, Vickers, and Ziebarth 45). In other words, they argue that a dramatic political change, such as the one Spencer describes, may be unnecessary if an economically unequal society with equal access to leisure is attainable. The ideal would be a situation when the needs of citizens are satisfied, allowing for equality of opportunity and minimising the differences in standard of living.

  With the goals of maximising equality in the standard in living in mind, the next step is to determine how the government should intervene. Mokyr, Vickers, and Ziebarth suggest that

"there is a distinct possibility that wages for some classes of workers may need to be

supplemented through some income redistribution. In addition, it may be necessary to expand the

set of publicly provided goods to include certain 'primary goods' such as food, housing,

education, and health care that are necessary for a modern life to go well" . The model for an

"innovative state" proposed by Mazzucato could be used to help fund these new programs.

Mazzucato suggests that governments "should strike agreements that allow them to share in the

profit(Mokyr, Vickers, and Ziebarth 47). Under this circumstance, the fall in income afflicting

displaced workers is ameliorated by providing necessities such as food and even housing to those

in need. While these goals may seem rather overreaching, they are founded on the assumption

that AI technology will also significantly lower the marginal cost of these primary goods as well

as create an unprecedented amount of income that is distributed among only the wealthiests from

their successful investments… [and] build the public agencies of the future, turning them into

hotbeds of creativity, adaption, and exploration" (Mazzucato 6). Mazzucato believes that if the

government were to participate in the innovative process, the generated income becomes

publicly owned and could then be used to support the less fortunate. Turning to government

investment in private innovation, Mazzucato argues for a plan that "would allow the state to

retain equity in the companies it supports… Had the U.S. government had a stake in Tesla

[which it helped start with a loan], it would have been able to more than cover its losses from

Solyndra," referring to a failed company the government also invested in (Mazzucato 5-6). The

suggestion is that not only is the government capable of funding innovation but that it would

generate a surplus if allowed to profit from its investments--a surplus which could be used to

fund welfare programs like those Mokyr, Vickers, and Ziebarth describe.

Though there are calls for more drastic action against inequality, the model suggested by Arthur Okun calls for the more moderate actions described by Mokyr, Vickers, and Ziebarth which modify the capitalist system of our society rather than replace it. The idea of an innovative state which Mazzucato puts forward could help fund the welfare programs which could be used to ensure that the population has equity in the standard of living. By considering both innovation and primary goods public goods, the government can generate the income it needs to provide the necessities of society and reduce inequality in the standard of living, thus achieving the optimal balance between efficiency and equity Okun describes.

*5. Concluding Thoughts*

The society we live in is going to experience a technological revolution due to artificial intelligence at a scale both large and faster than previously observed in human history. The claim this paper defends is that AI technology will cause an increase in inequality. AI technology has the potential to generate enough income through its productivity to make its owners much wealthier than the rest of society. Furthermore, this productivity threatens to work to worsen work conditions as well as replace certain forms of labour. The AI revolution will create a wealthy class of innovators and a separate class of displaced workers who don't have the education required to compete in still existing fields. The rest of society--those who keep their jobs but don't successfully innovate--will benefit by the falling costs of goods but may have to endure lower wages as capital productivity increases. The inequality that results from this system may not be inherently bad; however, the conditions of displaced workers will require government intervention. Given the inefficiency of complete wealth redistribution, the

government should focus on supplying primary needs to its citizens to create an equality of

opportunity and standard of living. The US could invest in AI technology and use the generated

income generated to support the living conditions of all workers, creating a more equitable

standard of living while maintaining incentives for innovation. Policy makers of the future

should focus on creating a future which uses AI productivity to sustain society and increase

equity in standard of living across the country.

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