

# Appendix V

## Automation

### Evidence from the Industrial revolution

Robert C Allen of Oxford University has studied the economic effects of the Industrial Revolution, and, in particular, its impact on ordinary workers.

He concludes<sup>57</sup>:

*“The prime mover was technical progress beginning with the famous inventions of the eighteenth century including mechanical spinning, coke smelting, iron puddling, and the steam engine.*

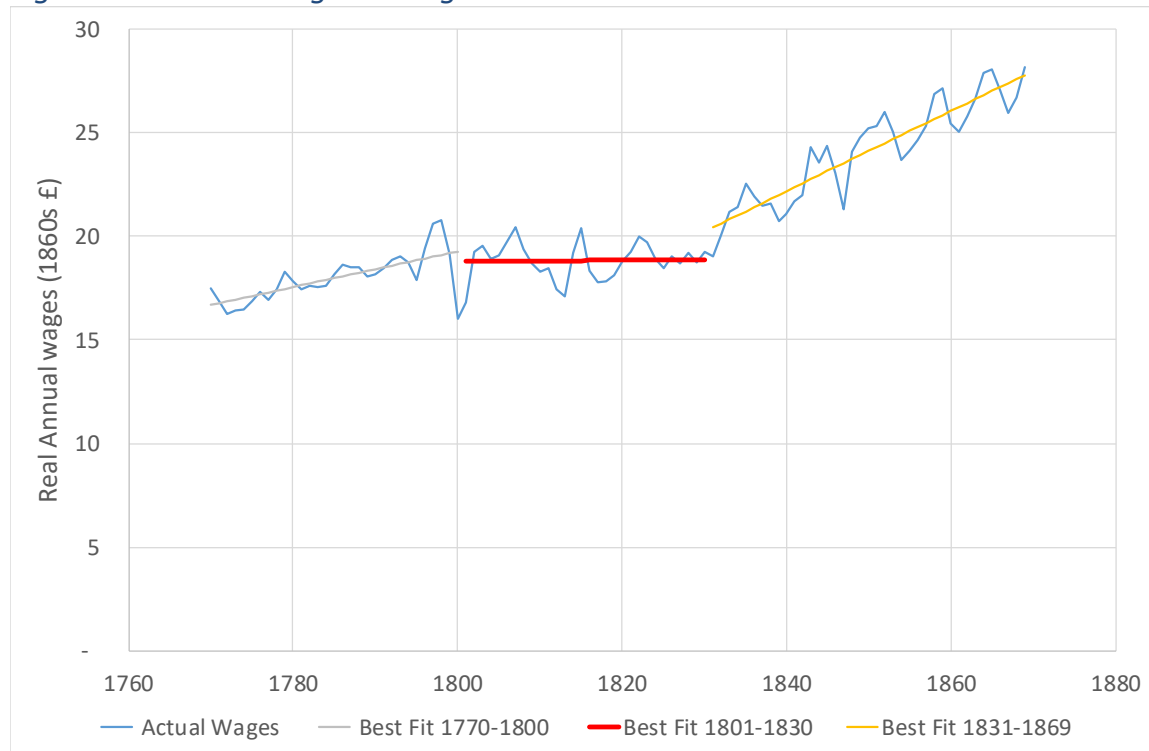
*It was only after 1800 that the revolutionized industries were large enough to affect the national economy. ... and the purchasing power of wages stagnated... Hence, the upward leap in inequality.”*

In a separate paper, he carried out a detailed analysis of wages during the Industrial Revolution, whose results are summarised in the chart below.

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<sup>57</sup> (Allen R. C., CAPITAL ACCUMULATION, TECHNOLOGICAL CHANGE, AND THE DISTRIBUTION OF INCOME DURING THE BRITISH INDUSTRIAL REVOLUTION, 2005)

Figure 35: UK real wages during the Industrial revolution



Source: RC Allen<sup>58</sup>

The chart shows Allen's estimate of the actual wages in each year from 1770 through to 1869 as well as lines of best fit for three periods: the first up to 1800; the second from 1801 to 1830; and the third from 1831 onwards. It is the second of these periods, from 1801 to 1830, that Allen identifies as being the time when industrialisation was having a major impact on the UK's economy.

The chart demonstrates that this period (1801-30, marked in red) interrupted real wage growth in the UK – despite the additional demand for manpower from the military (this was the time of the Napoleonic wars). For more than a generation, during which time the UK was leaping forward in terms of growth and competitiveness, real wages remained essentially flat. Indeed, it was not until 1833 that real wages again reached the level they had attained in 1798, *35 years earlier*.

Even in the third period, after 1830, when the process of industrialisation was largely complete, and wages began to rise again, the rate at which they did so was still lacklustre compared with the overall growth in the economy. Real

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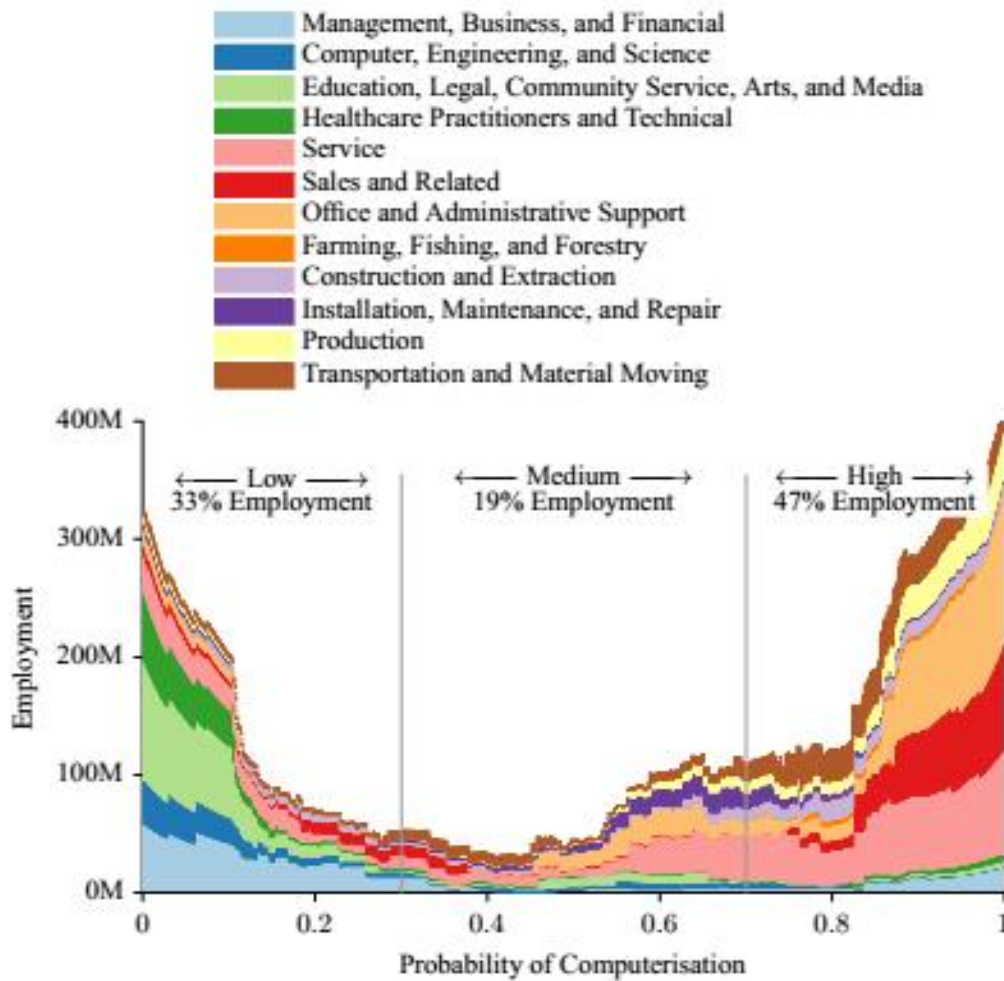
58 (Allen R. C., *Pessimism Preserved: Real wages in the British Industrial Revolution*, 2007)

wage growth from 1830 to 1869 averaged around 1% per annum; in that same period, real GDP grew at over 2% per annum – more than twice as quickly.

The Industrial Revolution, then, was a revolution for the economy as a whole but, especially for the first 30 years or so, all the benefits went to the rich. Although the new technology *did* create new jobs, these were often less skilled and less well-paid than the jobs they destroyed; it was not until the process of industrialisation was essentially complete, and the ‘creative destruction’ was finished that wages could resume their upward progress.

Another team at Oxford has been taking a close look at the possibilities for automation in the US. Carl Frey and Michael Osborne examined over 700 occupational categories, and for each one assessed the probability that jobs in that sector would be automated within the next 20 years. Their conclusion, summarised in the chart below, was that 47% of US jobs are in high-risk categories with more than 75% chance of being computerised in the next two decades. Only 33% of jobs have less than 25% chance of being computerised by 2033 – and by 2050, of course, the process will have advanced much further.

Figure 36: Probability of computerisation vs employment category



Source: Frey & Osborne<sup>59</sup>

High-risk categories of jobs include sales and related areas, many service jobs, and much office and administrative support work as well as construction and extraction, production and – as mentioned above – transportation and material moving. In the high-risk categories alone, some 67 million jobs (out of a total of 142 million) stand to be lost. These are the people that Ira Sohn referred to in his metaphor with the horses.

## **Abundance in the face of Automation**

By 2050, it is at least a strong possibility that technology will have advanced to such a stage that the great majority of jobs can be done by machine better or more cheaply than the cost of keeping a human alive.

In a free market, humans would be competed-out. No political party has a policy to deal with this issue.

This poses two questions:

1. How will people live without jobs?
2. What will they do with their lives?

This Appendix explores the possibility of creating a dual economy in which essential products and services are built as efficiently as possible, by machines. Luxury products and services – handmade – are supported by means of a dual currency: some money can be spent on basic (machine-made) and products and services; some can *only* be spent on hand-made products and services. Call the first currency “M dollars” and the second currency “H dollars.”

The owners of the factories in which the machines build products and services, would be required to translate some of their income into H dollars. They would then spend this money in the workshops where humans create hand-made products and services.

### ***Structure of the economic model***

The model consists of four entities which interact with each other:

1. **capital and land owners**, consisting of the richest 20% of the population (this roughly corresponds to the situation in the US, where the richest 20% own about 90% of the wealth);
2. **citizens** with negligible capital, consisting of the remaining 80% of the population;
3. **factories** owned by capital and landowners in which machines produce standard products and services;
4. **workshops** in which citizens can be employed providing handmade products and services.

### ***Assumptions***

For modelling purposes, I have made the assumptions below. Of course, they may not be optimal and better results may be possible: the objective here is merely to show that automation need not lead to dystopia – if we handle it well.

The basic level of consumption per person needed to sustain life is \$10,000. By hypothesis, the greatest volume of basic products and services per dollar can be obtained by spending the money in the factory, and therefore individuals will first meet their basic needs in the factory and then may consider other spending on luxury goods. For example, a good suit might be made by a factory for \$200; a handmade suit might cost \$4,000. The best handmade products will be positional goods i.e. they act as a marker of social position and wealth.

Both capital owners and ordinary citizens are limited in the amount that they can spend in the factory (to prevent the factory out-competing the workshop). Surplus income must therefore be spent as H dollars in the workshop. For the model, we have assumed that capital owners are allowed to spend \$40,000 per person in the factory whereas ordinary citizens are only allowed to spend \$10,000 per person.

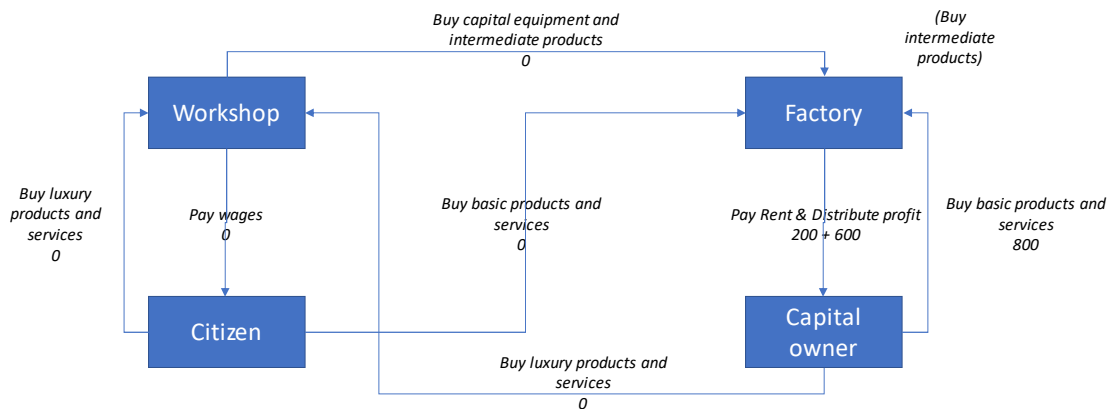
Both the workshop and the factory require capital, and capital turns (a measure of capital productivity) are assumed to be 1.00. Depreciation is assumed to be over five years – i.e. 20% per year. Both workshop and the factory buy their capital equipment from a factory.

The factory may require intermediate products, which it also buys from a factory, and basic inputs which it buys from landowners. The workshop also buys intermediate products, which it gets from the factory.

### *Impact of these assumptions*

By varying the amount of income which must be translated into H dollars, we can create different scenarios for the year 2050. If the amount which must be translated is zero, the factories will supply the wants of capital and landowners only, and the rest of the population must starve. If this amount is low, we arrive at the scenario of the Modest Proposal or of Accepting Impoverishment. If this amount is higher, we arrive at the scenario of Solidarity and Abundance.

Figure 37: Starvation scenario with zero income for citizens



Note: Figures in \$000

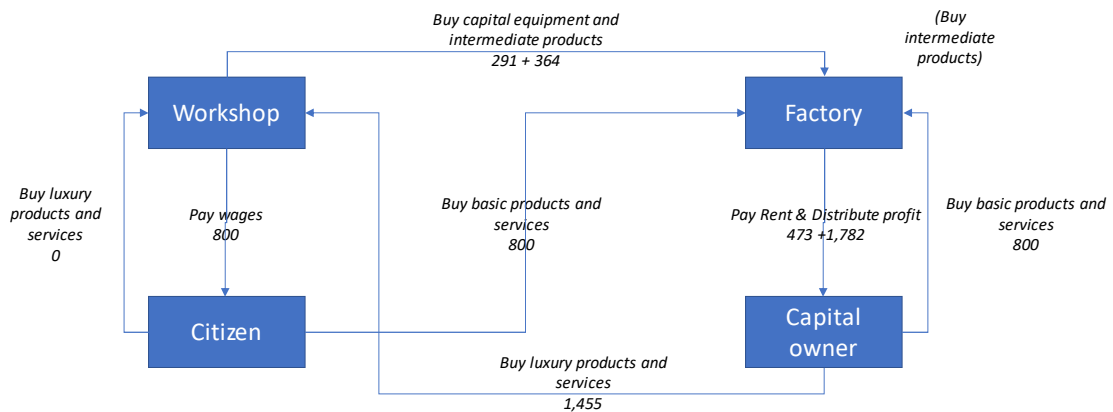
In this first scenario, there is simply no role for ordinary citizens or for the workshop. Society consists entirely of capital owners whose factories produce products and services for their own consumption.

The next scenario introduces a citizen income (via compulsory spending in the workshop) of \$10,000 – survival level. To generate this income, ordinary citizens must work in the workshop to sell handmade products and services sufficient to pay both for capital investment in the workshop and intermediate products, such as woven cloth to make a suit, as well as the basic products and services they need to survive. To do this, they must make and sell \$1,455,000 worth of handmade products and services.

Clearly, ordinary citizens benefit in this scenario from having a basic income which means they need not starve. Capital owners also benefit in two ways:

1. demand in their factories is far higher, both because of the additional basic products and services they supply to ordinary citizens and because of the demand for capital equipment and intermediate products for the workshop;
2. as well as receiving the same level of basic products and services that they received in the first scenario, they now receive luxury products and services with a value of \$1,455,000.

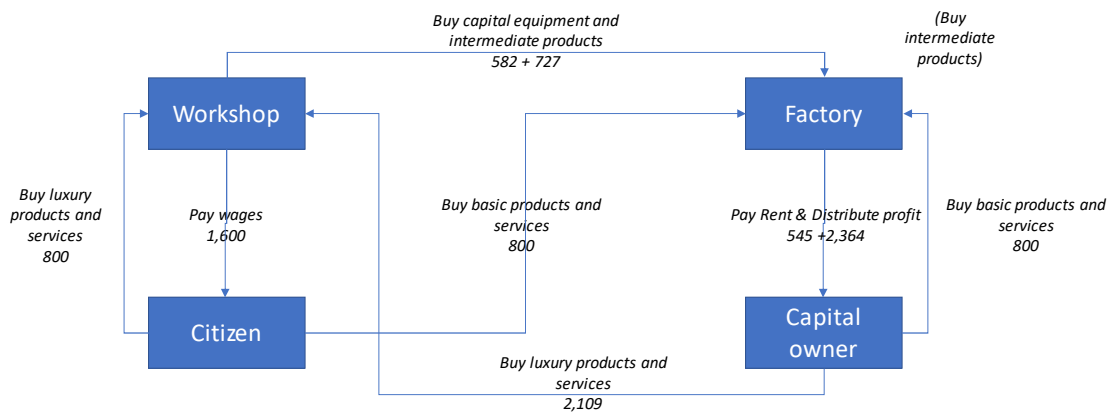
Figure 38: Mass Impoverishment scenario with basic citizen income



Note: Figures in \$000

If the citizen's income is set comfortably above the poverty line – e.g. at \$20,000 – then, in addition to affording their basic needs, citizens can afford an equal value of luxury, handmade products. To afford all of this, and to pay for the capital equipment and intermediate products required to make the luxury products, in total they must produce \$2,909,000 worth of luxury products and services, of which \$2,109,000 worth will be consumed by the capital owners.

Figure 39: Decent living scenario with citizen income comfortably above poverty line (\$20,000)

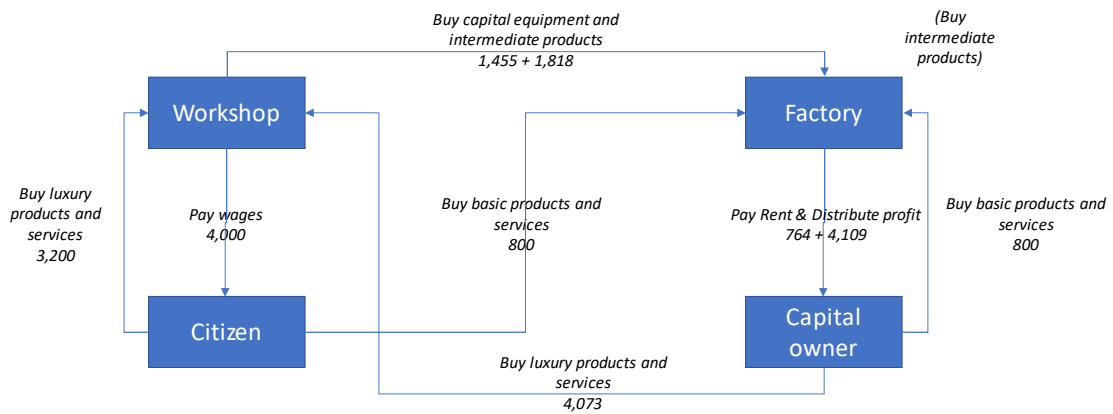


Note: Figures in \$000

Finally, if the citizens are to have an abundant wage (say \$50,000), as well as meeting their basic needs, they will be able to purchase \$3,200,000 worth of luxury products and services. To afford all of this (and the capital equipment and intermediate products it will require) they must produce a total value of \$7,273,000 of which \$4,073,000 worth will be consumed by the capital owners.



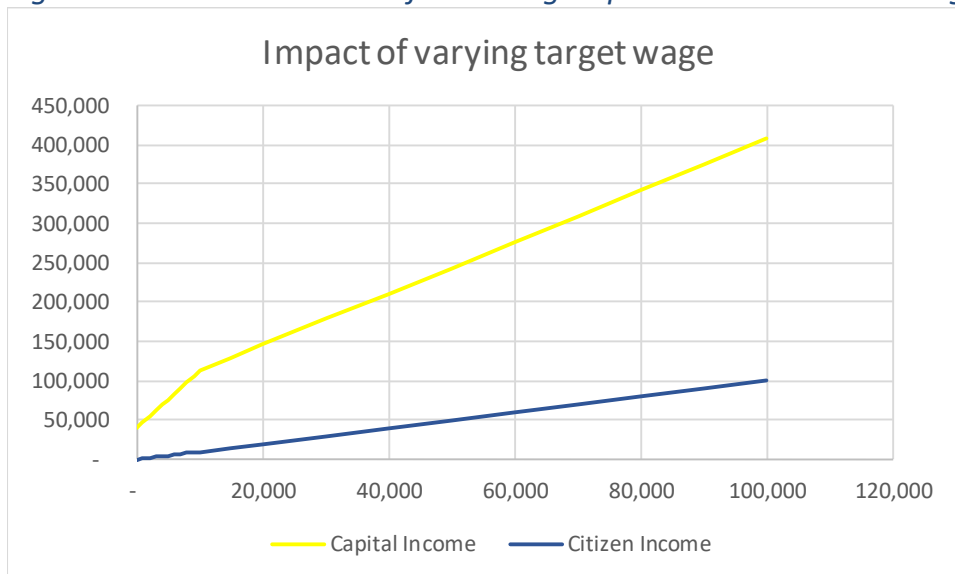
Figure 40: Solidarity and Abundance with citizen income at \$50,000



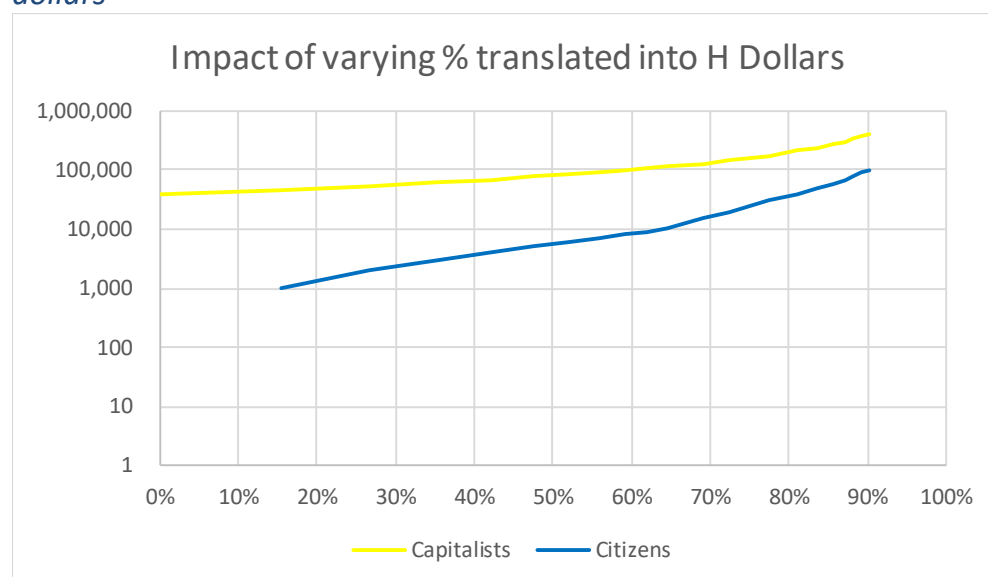
Note: Figures in \$000

Interestingly, there is no trade-off between the income of the capital-owning group and that of ordinary citizens: both groups get richer as the amount of money which must be translated into H dollars rises.

Figure 41: How the income of the two groups varies with citizen wage



*Figure 42: Percentage of capital owners' income which must be translated into H dollars*



In order to reach the survival level of income for ordinary citizens (\$10,000), the percentage of capital owners' income which must be spent as H dollars would have to be 65%; to give them a comfortable living, with an income of \$20,000, would require 73% to be spent as H dollars; a society of abundance for all in which ordinary citizens would have per capita income of \$50,000 would require 84% to be spent as H dollars.

### *Limitations of this approach*

One limitation is evident in Figure 42, above. Although they are enriched by being compelled to spend in the workshop, nevertheless it is likely that the capital and landowners would resent the lack of choice inherent in this approach. Allowing them to spend less than 20% of their money in the factory might be politically infeasible.

A slightly less obvious limitation is capacity to produce: whereas the factory can easily add capacity – it simply acquires an additional robot – the workshop cannot. A tailor can make only so many suits; a luthier can make only so many violins; a sportsman can compete only so many times; and a poet can write only so many poems. If the amount of money spent in the workshop increases once capacity has been reached, the result will be simply inflation. In fact, this effect is already visible in our current system: there is inflation in the prices of fine art and fine wines as well as in the wages of the best footballers.

This creates a third issue: the danger of extreme inequality within the group of citizens. Within the workshop, there may need to be a further mechanism to redistribute income to ensure a decent life for all citizens.

### ***Conclusion***

Despite these limitations, this policy both increases the total wealth of society – because it increases the total value of goods and services which are produced, quite dramatically – and ensures a distribution of that wealth which gives every citizen a possibility of a decent life.

This may not be the best policy solution – but it does demonstrate that the problem is not insoluble. Those who do not like this policy must propose a better one: maintaining the *status quo* would be far worse.