



Technology and the Labour Market: Technological Unemployment as a Historical Debate

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11.1 INTRODUCTION

Technological unemployment has been an externality since the early eighteenth century. The modernisation of production methods has generated intensive stages of labour being replaced by capital as a factor of production, and the schools of thought have debated adjustments to the labour market based on the assumptions that form the foundations of each doctrine. Classical capitalist orthodoxy, and its neoclassical heirs, have assumed the hypothesis of price and wage flexibility that tends to balance markets over time, within the framework of *Say's Law*. From the Keynesian perspective, prices and wages are rigid downwards; in this case, if there is an economic recession, economies do not return to the path of growth

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because unemployment becomes persistent and incentives for investment weaken.

In addition, the impact of technological innovation on production opened another debate on its treatment as a variable. For Solow, technological innovation was an exogenous variable that affected the production function, while for Schumpeter it was endogenous to the evolutionary process of industrial capitalism. In both cases, technological progress had repercussions on the capital–labour combination, generating unemployment.

This chapter reflects on the consequences of technological unemployment in twenty-first-century capitalism, in a framework of greater equilibrium in the distribution of income.

11.2 STARTING POINT

11.2.1 *David Ricardo and the Machinery Question*

The classical economists who lived through the Industrial Revolution analysed the changes in the production system and the extension of the markets, using their publications to create the theoretical content of Political Economy. The first reference to technological unemployment appeared in chapter XXXI of the third edition of David Ricardo's *On the Principles of Political Economy and Taxation*, in 1821.

As is well known, groups of artisan workers, among them the Luddites of the nineteenth century in Great Britain, were against the introduction of machinery because of the unemployment it would generate. Their grievances were initially focused on the activities of textile producers, and in the heat of the debate Ricardo wrote: "I am convinced, that the substitution of machinery for human labour, is often very injurious to the interests of the class of labour" (Ricardo, 2003 [1821], p. 314). In his opinion, and in the short term, the decrease in the demand for labour impoverished workers. In Ricardian terminology, the argument was based on the inequality between net income (annual profit of capitalists and landowners) and gross income, which also included circulating capital (to pay the workers). Logically, when machinery replaced labour, the *wage fund* was reduced and workers would be paid less or, alternatively, there would be fewer employed workers who would have been replaced by the machinery, "the demand for labour would diminish, and the commodities necessary

to the support of labour would not be produced in the same abundance” (Ricardo, 2003 [1821], p. 317).

Underlying the explanatory Marxist theory of the *reserve army of labour* was the same Ricardian argument: unemployment was generated during the mechanisation of the production process, as can be seen in *Das Kapital*, volume I, chapter XV, sections 3, 4, 5 and 6 (Schumpeter, 1968, p. 64). Marx distinguished three forms of unemployment: floating, latent and stagnant. The floating form was technological unemployment moving from one industrial job to another, the latent form was agricultural unemployment, which migrated to the cities, and the stagnant form was the misery of the population, a necessary condition for the development of capitalist wealth (Braverman, 1983, pp. 328 and 329).

In the second part of chapter XXXI of Ricardo’s *Principles*, the two offsetting arguments for technological unemployment were introduced. First, the saving in wages reduced the circulating capital and would be transformed into accumulated capital for new investments, which would provide new jobs with the consequent expansion of the demand for labour. Secondly, foreign competition forced the generation of investment in machinery to lower costs by reducing the labour factor in production processes (Ricardo, 2003 [1821], pp. 320–321). In conclusion, technological unemployment was generated in the short term, but in the medium and long terms, it was offset by new jobs in other productive activities and the expansion of foreign trade.

11.2.2 *What Economic Theory Says About Technological Unemployment*

Institutional development paved the way for two drivers of prosperity, namely, technology and education. In the sixteenth century, William Lee, a local priest from Calverton (England), had his stocking knitting machines ready and travelled to London to apply to Queen Elizabeth I for a patent to expand textile production, but he was met with a resounding royal refusal. The Queen considered it ruinous to deprive her subjects of employment and turn them into beggars. The fear of the creative destruction of technological progress had begun. The Queen was concerned that the population displaced from their jobs might threaten her political power and turn against her. It is a historical pattern for innovation to generate resistance, not only from displaced workers but also from economic elites and governments (Acemoglu & Robinson, 2014, pp. 219–221).

For Robert Solow, in *Technical Change and Aggregate Production Function*, technology was an exogenous variable. In his research, he estimated an aggregate production function for the United States, during the period 1909–49, and innovation was the residual factor that explained 87.5% of the increases in productivity over the period (Solow, 1957, p. 320). For Joseph Schumpeter, in the *Theory of Economic Development* from 1911, capitalism was treated as a dynamic evolving process, where technological innovation represented a third factor of production, an endogenous variable in the model, whose variations generated capital gains with an impact on dynamic cyclical growth processes. This mutation was carried out by innovative entrepreneurs who were altering perfect competition, directing it towards monopolistic markets (Schumpeter, 1944, pp. 103 and 217).

In Schumpeter's Theory of creative destruction included in *Capitalism, Socialism and Democracy* from 1942, monopolistic competition can be more efficient than perfect competition in driving the innovative process of the economic cycle, and producing greater job creation than job destruction, with a net positive effect (Boianovsky and Trautwein, 2010, p. 260).

Macroeconomics evolved during the twentieth century from multiple perspectives and over decades characterised by deep crises and world wars. Theoretical developments took shape within the different schools of thought, with a dominant orthodoxy that can be grouped, broadly speaking, into the heirs of classical thought and the heirs of Keynesian thought. The former assumes the argument of flexibility of prices and wages and the latter assumes that they are rigid. As a result, the heirs of classical thought expect that, in the face of crises and recessions, the markets will adjust prices and wages and return to the path of economic growth following Say's Law. The heirs of the main Keynesian streams contemplate historical periods with persistent unemployment, which paralyses a part of the productive sector, because the private sector is not sufficient to restart the drive for aggregate economic growth, so this must be offset with fiscal, monetary and income public policies.

The fact that macroeconomics has developed through successive contributions that are added intermittently to the general compendium of models makes it difficult to understand them, given that the starting assumptions in the behaviour of the variables are not homogenous and depend on who has made the contribution. For example, the classical heirs think in terms of real wages and the Keynesian ones in terms of monetary

wages, and economic growth behaves differently if constant, adaptive or rational expectations are assumed. In addition, it all depends on whether Say's Law works or not, or if the Quantity Theory of Money always explains inflation, or what part of the Animal Spirits each economic doctrine accepts.

In traditional macroeconomics text books, the labour market is linked to the market for goods and services, and everything is so aggregate that it is difficult to understand the individual behaviour of work, or grouped by profession, because they are all intermingled. We also have statistical data, such as total population, active, employed, unemployed, full employment, equilibrium wage, frictional unemployment, structural unemployment, efficiency wage, implicit contracts, internal and external workers, legal regulations, unions and business organisations (McConnell et al., 2007, pp. 511–519). We can talk about trends in the variables in a general way, but it is impossible to make specific predictions and some questions are difficult to answer, for example, does the labour market explain the equilibrium salary of a country well? Is that salary representative? Why is the interprofessional minimum wage treated as if it were an efficiency wage? Should we assume that if wages go up, profits go down in all sectors? What effects can technological unemployment have on economic sectors? What effects does technological unemployment have on the skilled population or on the unskilled?

From economic theory, technological unemployment continues to be explained in the way Ricardo established: a process of change that is reabsorbed over time, either in other production facilities or through reskilling of the workforce. It continues to generate mistrust, as is currently the case with robotics and its possible effects on jobs. And new questions arise: Can technological unemployment be explained without considering its effects on the other social dimensions, such as the possibility of reducing working hours if there are improvements in productivity? Is it possible to propose the payment of a basic wage income because of the robotisation of work?

Let's think about the effects that an increase in the minimum interprofessional wage has on the economy of a country. Orthodoxy says that the increase in wages increases the cost of production and will be passed on to prices, losing external competitiveness and reducing the demand for employment. However, if the effects derived from job stability and security are also included, consumer demand may increase, meaning that aggregate demand can expand, which will drive more production.

Regarding this debate, David Card, a US Labour Economics scholar and Nobel Prize winner in 2021, in his work *Do Minimal Wages Reduce Employment, A Case Study of California 1987–89?* used his data to show that increases in the minimum wage did not reduce employment (Card, 1992, p. 54).

To move towards modern capitalism, we can go back to two reflections by John Stuart Mill. The first refers to the support for union demands to recognise their bargaining power to increase subsistence wages, in this case by expanding the Wage Fund. The second, by admitting the coming together of interests between workers and capitalists, where capital gains have a sufficient margin to establish efficiency wages (Gallego, 2009, pp. 61, 62).

11.3 THE TECHNOLOGICAL UNEMPLOYMENT TO COME

The impact of new technologies, especially robotics as machines designed to automatically carry out tasks to replace traditional labour, is a current fact. The unemployment of professionals who will not be needed for productive tasks as they will be replaced by artificial intelligence is looming, for example, in production lines with robotic arms, object recognition machinery, information processors, robots, air and sea navigation assistants and driving motor vehicles, and the management of all kinds of services, such as financial, tourist, security, etc.

There are four ways of thinking about the labour impact of the new technologies:

- Substitution automation (dominant approach, in which machines drive workers into unemployment, technological unemployment is guaranteed)
- Pragmatic approach (digitalisation and robotisation will generate and destroy jobs in a labour framework of different jobs, technological unemployment uncertain)
- Integration automation (digital work through requalification of employees, technological unemployment uncertain)
- Multiple automation (digitalisation and robotisation is a priority for the new working conditions, profound transformation of the labour market with qualified jobs)

Substitution automation is the most pessimistic option and assumes that the destruction of jobs will not be offset by job creation in new occupations. The pragmatic approach is the most optimistic because it assumes that the loss of jobs could be offset by the new professions in demand, the supply of jobs normally expanding with digital advances. Integration automation is the second derivative of the pragmatic approach and opts to strengthen the digitalisation and robotics process. Here a debate opens up about the consequences for the demand for employment of different groups of workers: the highly qualified, the semi-qualified and the unqualified. Multiple automation comes from research in computer science with real experiences in artificial intelligence, for example, from platforms like Google or Amazon, which manage markets for digital goods and services with the processed information from the customers themselves, but which still hide great dependence on low-skilled and poorly paid human labour (Lahera, 2020, pp. 3–10).

Robotisation has spent decades advancing in multiple areas, with examples such as Tesla, Nintendo, Microsoft and PrimeSense. Some companies and sectors are ready for the imminent development of the industry. Compared to the past, where historically textile production was one of the most automated in countries like the United States, labour has already been replaced by machinery and there is a low labour/capital ratio. It must be remembered that this process is not only due to the substitution of labour for capital, but also to the fact that textile manufacturing has been moving towards countries with very low wages, such as China, India and Mexico, and this opens another reflection derived from the previous one: What will robotisation mean for the countries that have developed their international competition on the basis of low wages? How will a robotisation process affect China?

Robotisation is normally focused on the manufacturing industry, but it has many other ramifications in areas such as services and agriculture. In the West, the services sector accounts for a large proportion of active workers, as in the case of Spain with the financial and tourism sectors. For example, in the United States, there are already fast-food establishments that have automated the production of hamburgers, which, if it became widespread, could mean a sharp drop in employment for low skilled workers. And the same is happening in the retail sector, given the increase in internet sales which has already altered the physical presence of sellers to one involving other professions for the storage and distribution of products, with an army of poorly paid workers, on many occasions appearing

falsely to be self-employed to lower the labour costs of large companies. Similarly, self-service machines are replacing jobs in shopping centres, as is access to financial services through ATMs or Internet banking.

This widespread process of automation leads us to robotics in the cloud, where a centralised computing system provides and updates the intelligence of mobile robots, through a process similar to updating mobile phones. Since 2010, Google has been running a system called *Googles*, for robots with cameras, which through photographs can recognise the objects they come across, generating a centralised database that is continuously updated so that the devices can record the objects found.

In the case of agriculture, the use of machinery to harvest fruit and vegetables is already common. In Spain, machines have been used for years to harvest grapes and olives, and this can be extended to nurseries and greenhouses to replace the staff responsible for looking after the plants. In Japan, there is a robot that can pick strawberries based on changes in their colouration. In Australia, the University of Sydney's Robotics Institute has developed devices that take samples of the land surrounding each plant to then inject the specific quantities of fertilisers and water they need at all times, with the consequent reduction in costs and chemical fertilisers, which will benefit aquifers (Ford, 2016, pp. 19–38).

11.4 SOME PROPOSALS FOR DEALING WITH IT

Making economic predictions is complicated, even more so for the case at hand, as it means interpreting the impact of new technologies on the demand for and supply of employment. Economic orthodoxy accepts the pragmatic approach with some unpredictable changes in what will happen, more so if one considers the extent of globalisation and the differences between developed and emerging countries. This is hard to predict. The question is whether the consequences of technological unemployment can influence the capitalist ethics of the twenty-first century and determine active policies, public and private, to offset it. For example, it is already possible to imagine, due to this being introduced by some companies, a reduction in working hours to four working days per week, with no pay reduction.

Facing a near future characterised by continuous technological changes, with direct repercussions on production and employment, we can reflect on the dynamics of some reforms and ask questions such as: How can we deal with the wave of automation? What will be the impact on developed

economies? How could it affect China and the emerging countries? The answers will differ depending on whether they come from a public or private perspective, and depending on the country that introduces the new technologies.

Technological unemployment is reabsorbed over time, but the main question is: How long is that time? Growing technological unemployment implies social punishment that could be mitigated with macroeconomic labour strategies. Continuous training is required to reskill in the area of digital work, appropriate for the times ahead, and it may be necessary to establish policies to maintain some jobs. For example, in the year 2022, a pool of older clients inexperienced in digital banking management appeared in Spain, which required the extension of personalised services hours.

From another perspective, in relation to consumer rights, it is interesting to recall the reflections of Shoshana Zuboff in her book *The Age of Surveillance Capitalism*, in the final chapter of which she talks about the loss of reciprocity of information that economic agents have when they interact in markets. Zuboff reminds us that Smith spoke of an atomistic market and Hayek of a mercantile democracy, which assumed information was distributed equally among all economic agents. These assumptions have disappeared with the new technologies of Internet purchases, which allow large companies such as Google, Amazon, Apple and Meta to collect data and consumer purchase histories to manage the information. Then, the transparency of the market disappears, and the suppliers become oligopolies with the consequences that have for controlling prices and increasing the profits of companies, to the detriment of consumers. Another derivative is the comparison between good and bad information on social networks, indistinguishable for new technologies and that confuses people's decisions. The objective of information transparency should be prioritised in modern societies (Zuboff, 2018, pp. 657–693).

The possibility of earning a universal basic income, as Piketty proposes in *Le Capital au XXI Siècle*, is justified by the inequality of capitalist economic systems, and could be offset with political decisions on progressive tax reforms for global capital, with national compensatory incomes and investment in education, within the framework of a participatory and circular economy where private property and the profits of capitalism must be balanced with the rights of workers and consumers (Piketty, 2013, pp. 15–16, 835–839).

Hayek's economic pragmatism led him to develop arguments in favour of a universal basic income, to provide a safety net for the public and preserve individual freedom of action, thus avoiding the interprofessional minimum wage and other social assistance, while reducing spending on the welfare state because a basic income is expected to entail lower administrative management costs (Hayek, 1977, pp. 54–55).

There are two main problems for a state planning a basic wage: incentives to work and funding the wages. Economic orthodoxy considers that universal income coverage creates a disincentive to work and thus slows down the drive for productivity. In this case, it would be necessary to perform research for each population to compensate for this, for example, linking those earnings with an obligation to take part in continuous job training, especially focused on sectors with the greatest demand for work; and stimulate entrepreneurship, since having a guaranteed income can encourage people to complement it with small businesses. The funding of a basic income must reflect the budget of each country, linked to the tax structure on its income and the coverage of public spending it has. Transparency in the management and operation of each country is crucial to avoid having high margins from underground economies, and that depends on the ethical levels of each society. Avoiding political and social corruption and having a good legal system that quickly and fairly manages any disputes that arise is crucial in moving towards richer and more egalitarian societies (Ford, 2016, pp. 240–255).

Another outstanding issue in this debate of ideas is to say what the macroeconomic growth objectives of countries are or should be, these normally being associated with increased employment and national wealth. How do you measure the progress of a society? To deliberate on this question, we can return to John Stuart Mill and his idea of the stationary state. In chapter VI of the fourth book of the *Principles of Economics*, titled *Of the Stationary State*, in which he discusses progress in society, the main question is what we mean by progress and why we assume there will be a confrontation between capital and labour. As Mill says, one cannot look at the stationary state of capital and wealth with the disgust that the *old school* did. "I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels, which form the existing type of social life, are the most desirable lot of human kind, or anything but the disagreeable symptoms of one of the phases of industrial progress. ... But the best state for human nature is that

in which, while no one is poor, no one desires to be richer, nor has any reason to fear being thrust back, by the efforts of others to push themselves forward.” In the words of Mill, “industrial improvements would produce their legitimate effect, that of abridging labour” (Mill, 1871, pp. 641–643).

In short, Western economies with high average income levels and strong administrative organisation and institutional development can face and resolve the challenges of twenty-first-century capitalism in a more egalitarian way.

11.5 CONCLUSIONS

This chapter reviews the historical question of technological unemployment as a problem. The orthodox solution of time solving everything with market adjustments and incentives through price and wage flexibility does not seem to be the best, due to the enormous social cost of hardship that entails for workers. Likewise, it cannot be solved by increasing public spending on traditional social protection policies offering partial coverage. These are not questioned in this work, because they help to improve the standard of living of the most disadvantaged people, but they do not solve the unemployment issue.

Debates on technological unemployment are focussed on the new challenges for western societies in the twenty-first century. The capitalist system in its evolution must limit a growing process of inequality that favours nobody. The following reflections are proposed for discussion:

- a. Technological unemployment is a reality that must be tackled.
- b. Measures can be taken in both the private sector and the public sector.
- c. Measures taken by the private sector can help to reduce current working hours, with the consequent greater availability of leisure time.
- d. Policies can be implemented to maintain jobs to offer greater personal service to certain segments of the population.
- e. It is necessary to complement macroeconomic growth targets with other objectives for a greater balance in the distribution of income, to broaden the purchasing power of the most precarious labour sectors, which could increase aggregate demand and with this, corporate profits.

- f. On-the-job training aimed at digital training is necessary and must be permanent.
- g. There is the possibility of proposing a universal basic income as a macroeconomic objective.

REFERENCES

- Acemoglu, D., & Robinson, J. A. (2014). *Por qué fracasan los países*. Deusto.
- Boianovsky, M., & Trautwein, H. M. (2010). Schumpeter on Unemployment. *Journal of Evolutionary Economics*, 20(April), 233–266.
- Braverman, H. (1983). La estructura de la clase trabajadora y sus ejércitos de reserva. In L. Toharia (Ed.), *Mercado de trabajo: teorías y aplicaciones*. Alianza Universidad.
- Card, D. (1992). Do Minimum Wages Reduce Employment? A Case Study of California, 1987–89. *Industrial and Labor Relations Review*, 46(1), 38–54.
- Ford, M. (2016). *El auge de los robots*. Paidós.
- Gallego Abaroa, E. (2009). *Historia breve del mercado de trabajo*. Ecobook.
- Hayek, F. (1977). *Law, Legislation and Liberty, Vol. 3. The Political Order of a Free People* (pp. 54–55). University of Chicago Press.
- Lahera Sánchez, A. (2020). El debate sobre la digitalización y la robotización del trabajo humano del futuro: automatización, pragmatismo, integración y heteromatización. *Revista Española de Sociología*, 30(3), 3–10.
- McConnell, C. R., Brue, S. L., & Macpherson, D. A. (2007). *Economía Laboral*. McGraw Hill.
- Mill, J. S. (1996) [1871], *Principios de Economía Política*. Fondo de Cultura Económica.
- Piketty, T. (2013). *Le capital au XXI siècle*, Madrid. SEUIL.
- Ricardo, D. (2003 [1821]). *Principios de economía política y tributación*, Madrid Pirámide.
- Schumpeter, J. (1944 [1911]). *Teoría del desenvolvimiento económico*. Fondo de Cultura Económica.
- Schumpeter, J. (1968 [1942]). *Capitalismo, Socialismo y Democracia*. Madrid Aguilar.
- Solow, R. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*, 39(3), 312–320.
- Zuboff, S. (2018). *La era del capitalismo de la vigilancia*. Paidós.