

# Marx on technical change, heterogeneous labour and distribution: Some notes

**Andrés Lazzarini** (UFRJ, Brasil; UNGS-CONICET, UNSAM, Argentina)  
[alazzarini@gmail.com](mailto:alazzarini@gmail.com)

**Denis Melnik** (National Research University Higher School of Economics, Moscow, Russia)  
[dmelnik@hse.ru](mailto:dmelnik@hse.ru)

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## Abstract

The paper examines the arguments held by Marx's contribution to the study of technical change, distribution, and heterogeneous labour. In contraposition to some mainstream views on these issues, we show through textual exegesis that the upshot of Marx's analysis is that technological progress would not only mean an eventual rise in unemployment; it is also a means to reduce the likelihood of distributional conflict between profits and wages. Whether in the form of machines, robots, or artificial intelligence (AI), Marx's perspective on technical progress is relevant today, as permanent technological change has the purpose to counterbalance the still-inescapable conflicting factors that could give rise to wage increases.

**Keywords:** Marx; technical change; distributional conflict; heterogeneous labour

## Marx sobre cambio técnico, trabajo heterogéneo y distribución: algunas notas

### Resumen

El presente artículo examina los argumentos de Marx en su estudio del progreso técnico, distribución y trabajo heterogéneo. En contraposición con las opiniones prevalecientes por el mainstream sobre estos temas, mostramos a través de exégesis textual que para Marx el progreso tecnológico no solo significaría un aumento del desempleo; también es un instrumento para reducir la probabilidad de conflicto distributivo entre ganancias y salarios. Ya sea en forma de máquinas, robots o inteligencia artificial, la perspectiva de Marx sobre el progreso técnico continúa siendo relevante, ya que el cambio tecnológico permanente tiene el propósito de contrarrestar los aún inevitables factores de conflicto que podrían dar lugar a elevar los salarios.

**Palabras clave:** Marx; progreso técnico; conflicto distributivo; trabajo heterogéneo

## 1. Introduction

The old question whether technical change and innovations will reduce the labour's toil and sacrifices is, and will continue to be, highly relevant; for as we witness the so-called revolution in IT, the industry 4.0, the introduction of robots, the use of artificial intelligence (AI) and big data in production processes (especially in developed countries) academics and policy makers seem to be worried about the prospect of the future job market. As such it seems to be a question of paramount importance. While the future key features of labour markets are still widely unknown, there seems to be little doubt that a technical transformation is taking its root in many production processes.

One of the unquestionable 'truths' in modern discourse on economic policy says that the industrial system, in a mode it acquired by the last quarter of the 20<sup>th</sup> century, is already dismantled, leaving behind it only several rust scars in place of former industrial clusters over the once-industrialized globe. The argument is further supported by indication to the latest technological advances abovementioned and the pressure of competition within the international division of labor. Consequently, it is said, there is no way to keep up the jobs and incomes the system used to generate. Any measure to support a nation's industrial system, therefore, seems to be a nonsensical attempt to stick to the past.

That there is no way back to the past is undeniable – *Panta rhei*. However, with all the power of persuasion the argument above commands, it is a purely rhetorical device. It renders obsolete an 'old' system of production just by proclaiming it to be old. Without due theoretical substantiation on the nature of changes, it is not altogether clear if the present economic structure is in fact 'new'. Likewise, without such substantiation any indication to future trends turns to be a mere futurological exercise – hardly a solid foundation for policy measures. But in this case, as we will argue, the substantiation is there: it is provided with the substitution principle, one of the key elements in the analytical system of the marginalist approach in economics.

The marginalist approach threw away the uncomfortable problem of exploitation for the ascending Victorian society. Yet, it is hardly possible to introduce a dynamic perspective in that approach. The effects of technical change on distribution are either considered in terms of an external shock causing temporary disequilibrium effects to be absorbed through the price signals (Solow, 1956), or through endogenous growth models which take into account positive externalities of the different types but violate the very marginalist theory due to the absence of decreasing marginal returns in the inputs (Solow, 1992). Dissatisfaction with the still-mainstream, marginalist approach to technical change and its relationships with accumulation and distribution calls for alternative ways of addressing current present issues in a very touch-and-go world. Thus Section 2 will provide with a brief excursion on how the problem of technical change and distribution has been dealt with by the dominant marginalist approach. Then, in Section 3, the

significance of Marx's contribution to the study of technical change is reappraised, at the same time that the irrelevance of the same problem for the mainstream approach may be better comprehended. Our reconsideration of Marx's salient views on technical change ends in Section 4 with some final remarks stressing the relevance of this perspective to broaden the intellectual horizons necessary to reflect on the current situation.

## **2. A brief excursion through the marginalist school on technical change and distribution**

Since the late nineteenth century the marginalist approach has provided the 'micro-foundations' for mainstream economics. According to its core tenets, individual behavior is the result of rational choices made in order to obtain the highest possible degree of satisfaction under some given constraints. Starting with this principle, the marginalist analysis was designed to demonstrate how the market mechanism allows for a decentralized coordination of individual choices through price signals. Marginalist theory holds that the end result of this coordination is equilibrium, which ought to satisfy two major conditions: maximum degree of satisfaction among the individuals involved into the market system; and optimal distribution and maximum use of the available resources, the 'factors of production'. Thus, the market mechanism absorbs the exogenous shocks (shifts either in tastes and preferences, or technical innovations, or availability of resources) to ensure an ever-present equilibrating tendency.

Originally, the marginalist models present the degree of labour-force employment as a result of individual choice made by its owner: after calculations of pains of labour and pleasure of 'future good' as in William Stanley Jevons ([1871] 1888, 169-70); or due to owners' preference of present goods over the future ones, as in Eugene von Boehm-Bawerk (1891, 318): "For the present goods which he receives the wage worker gives, wholly and entirely, the indefinite future product which his labour may create." Only after contributions of Alfred Marshall ([1890] 1920), John Bates Clark ([1899] 1908) and several other authors did it become possible to consider the impact of *real costs* (as opposed to initial 'psychological' ones) within the marginalist framework. This advance in 'realism', however, came at a price. With it, the main driving force behind the decisions on the degree of employment became the calculations of those who were able to compare real costs and profits: employers, rather than employees. Thus, the problem of *relations* between these two groups of 'economic agents' – the social problem rather than the individual choice – entered into the marginalist analysis. As Clark (1899 [1908], 4) wrote, "The indictment that hangs over society is that of 'exploiting labor.' [...] If this charge were proved, every right-minded man should become a socialist". He, however, as well as other marginalist authors, was keen to postulate, that there was a "natural law" behind the chaotic struggle on the labour market (Clark [1899] 1908, 2-3). According to that law, wages were to be defined in the end (that is, under equilibrium) by the marginal productivity of labour as a homogeneous factor of

production, not by the bargaining power of an employer or other institutional arrangement.<sup>1</sup>

Thus, the problem of exploitation was removed from the most widely known presentations of the marginalist approach. The substitution principle further diluted the social dimension of the process of production and distribution in a natural-like vision of economic system. According to it, employers' choice can be described as a measurable comparison between two factors of production, specified in appropriate technical units, capital and labour. The actual proportion of these two 'quantities' of factors employed would be determined by the condition that makes equal the price of each factor and its respective marginal productivity, hence the inverse relations between the functions of demand for each factor of production. Thus, if wages rise there will be a tendency to shift production towards capital-intensive methods of production, that is, to substitute 'machines' for workers.

The substitution principle allowed, in principle, introducing the technical change or technical progress and its effects on distribution into the marginalist framework. Although this theoretical device might provide with some marginalist rationale to classify technical change (capital-augmenting or capital-saving, labour-augmenting or labour-saving, neutral) in order to anticipate their effects on functional distribution of income, the difficulties in distinguishing changes in distribution due to the increase in capital per labour as a result of capital accumulation<sup>2</sup> from technical progress were enormous. As early as 1901 Knut Wicksell stressed those probable difficulties, in what perhaps was the very first attempt by a marginalist author to deal with the issue of technical change for economies with labour, land and capital (although this factor was envisaged as being the result of saved-up original factors land and labour). Thus:

It is, therefore, the common productivity of labour and land which is increased by machinery. How much of the increase is to be ascribed to the action of one or the other factor cannot be ascertained, and is further of no importance in regard of their respective shares of the product. In this connection marginal productivity alone is the determining factor. But an increase in the total product as a result of technical changes in the processes of production *need not by any means lead to an increase in the marginal productivity of both factors of production*. It may be that the marginal product of one of the factors decreases whilst the marginal product of the other increases all the more; either the marginal productivity of labour may increase at the expense of land, and consequently wages at the expense of rent, or conversely rent may increase at the expense of wages. Examples of the former kind

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<sup>1</sup> The same reasoning does apply to any other factor of production, including capital, so that the rate of remuneration or rate of interest (profits) of capital is determined by the marginal productivity of that factor.

<sup>2</sup> The marginalist theory foresees that as capital accumulation proceeds capital per worker will tend to be less scarce and therefore its price (rate of interest) would go down, while the wage rate rises. This is frequently referred to in the literature as the process of *capital deepening*; see, for details, Harcourt (1972) and Lazzarini (2011).

are perhaps to be expected where, owing to some invention, the existing supply of natural energy is, as it were, increased. (Wicksell 1901 [1934], 135, emphasis added).

The unsettled situation in which the marginalist school was left by Wicksell on technical change and distribution would be taken up three decades later by John R. Hicks (1932 [1963]).

Hicks (1932 [1963], 121-27) assumes that, as capital accumulation proceeds, an increase in the supply of capital per worker would lead to an increase (decrease) in the wage share (profit share) since the elasticity of substitution is lower than one (something Hicks assumes throughout). In view of this, Hicks introduced the existence of *induced* labour-saving technical change whenever the real wage increases, which is different in nature to both the direct mechanism of substitution (through the alternative *known* techniques) and the indirect mechanism of substitution (based on consumers' preferences that shape the pattern of demand for consumption goods). Thus, in face of an increase in the real wage the economy should tend to develop more and more 'labour-saving' techniques that use more capital relatively to labour. In this sense, rising real wages would permanently become in a *permanent* incentive to technical change which could save on the more expensive factor. Nevertheless, this claim is inconsistent with the basic premises of the mainstream theory of prices and distribution; indeed, if one factor of production, say, labour, turns out to be more expensive relatively to capital, then this means, within the marginalist approach, that labour is more productive relatively to capital, so why an entrepreneur would *save* on the factor which is more productive? However, this problem remained somewhat behind the shadows in the marginalist thought for three further decades, as Hicks' arguments are reiterated in the second edition of his book, in 1963:

The real reason for the predominance of labour-saving inventions is surely that which was hinted at in our discussion of substitution. A change in the relative prices of the factors of production is itself a spur to invention, and to invention of a particular kind – directed to economising the use of a factor which has become relatively expensive. The general tendency to a more rapid increase of capital than labour which has marked European history during the last few centuries has naturally provided a stimulus to labour-saving invention. (Hicks, 1932 [1963], 124-5)

Generally, however, these theoretical attempts did not alter the core marginalist substitution principle. Rather, they tend to further reinforce the underlying principle of substitution whenever capital accumulation, due to changing values of elasticities of substitution, leads to patterns of income distribution that are in antagonism with empirical regularities. So, even if the possibility of structural unemployment could be admitted, it is still considered as but a temporary distortion, whose persistence can be explained by institutional rigidities, and by a reluctance of the affected workers to 'homogenize' the factor of production they own – their stickiness to previous, obsolete qualifications and unsuitability in acquiring new skills.

A neoliberal economic guru may well complain over the loss of industrial jobs, and still claim that any attempt to protect them, or, generally, to maintain the previous

level of wages in face of technical change and/or international competition, would only increase the tendency to replace them (either with robots or with labour from overseas, or with both). No policy measure can go contrary to the ‘natural’ tendency of competition to substitute the cheaper factor for the more expensive one. However, even within the specific field of studies on technical changes the *application* of this principle is not unproblematic. For example, despite the fact that wage differentials between skilled and unskilled labour has risen, the supply of skilled labour increased relatively to unskilled labour in the USA since the mid-1970s. As Brugger and Gehrke (2017, 22) argue, until the early 1980s, the increase in the relative supply of skilled labour led to the neoclassical effect of the skill premium to decrease. However, at the beginning of the 1980s, the steady increase in the relative supply of skilled labour was accompanied by a steady increase in the relative wages of skilled labour (see, also, Acemoglu, 1998). Not only the trend goes contrary to that suggested by the substitution principle; it indicates that *heterogeneity* of labour should be taken into further consideration.

These empirical findings have fueled dissatisfaction with the marginalist approach to technical change. Moreover, it is hardly possible to introduce a dynamic perspective into the marginalist analysis, which has remained essentially static. The effects of technical change on distribution are still considered in terms of an external shock causing temporary disequilibrium effects to be absorbed through the price signals. These shortcomings calls for alternative analyses to substantiate the relations between technical change and distribution.

In fact, the problem of a technologically-induced unemployment already attracted the attention in economic literature during the first big wave of technical innovations in Britain and elsewhere during the first third of the nineteenth century, especially during the depression that followed the end of the Napoleonic Wars. Perhaps the most-known response to that was formulated by David Ricardo (1821 [1951]), who admitted the possibility of a negative effect on employment due to introduction of machinery. Thus, Ricardo (1821 [1951], 395) wrote:

Machinery and labour are in constant competition, and the former can frequently not be employed until labour rises. In America and many other countries, where the food of man is easily provided, there is not nearly such great temptation to employ machinery as in England, where food is high, and costs much labour for its production. With every increase of capital and population, food will generally rise, on account of its being more difficult to produce. The same cause that raises labour, does not raise the value of machines, and, therefore, with every augmentation of capital, a greater proportion of it is employed on machinery. The demand for labour will continue to increase with an increase of capital, *but not in proportion to its increase*; the ratio will necessarily be a diminishing ratio.

Another author of that period, Charles Babbage (1791–1871) conceived it as a two-stage process. As Alessandro Roncaglia (2005, 232) shows:

In the first stage, the division of labour (namely, gradual breakdown, over time, of the work process into more and more specific work operations) favours the substitution of qualified with non-qualified workers; in this stage we have a tendency to proletarianisation, much like the process later described by Marx. In the second stage, however, a gradual substitution takes place of non-qualified workers with machinery, and hence a gradual reduction of the share of non-qualified workers over the total active population.

Babbage himself believed that the end result of the process should, overall, be beneficial throughout. What is important for us here, however, is that he considered the diffusion of technical changes as a *dynamic process*, with qualitatively distinct (and possibly intertwined) waves of changes, rather than a monotonous substitution of factors. And he also indicated to heterogeneity of labour as an essential characteristic of such process.

These arguments to substantiate the relations between technical change and distribution by Ricardo and Babbage touching on unemployment and heterogeneous labour were on the whole part of the successive analysis carried out by Marx in *Capital* and other works. As we will see in what follows, Marx's contribution to the study of technical change, distribution and heterogeneous labour puts at the centre of his analysis the conflicting relationship between capital and labour, that is, between private profits and wages.

### **3. Marx on technical change, distribution, labour and conflict**

Karl Marx (1818-1883) was a conspicuous examiner of the tremendous technical change during the mid-19<sup>th</sup> century English industrial revolution, especially of the mechanisation process that took root in the textile sectors. The shift in the sources of energy has chiefly drawn Marx's attention and in fact he analysed some of its consequences. Marx in chapter 15 of book 1 of *Capital* (Marx, 1867 [1887; 1995/97]) studies at length the transition from the period of production dominated by hand tools (Manufacture) to a new period characterised by production, use and diffusion of machines (The System of Machinery), and which to the eyes of Marx marked the beginning of the English industrial revolution. (Marx, 1867 [1887; 1995/97], 257-8)

The compelling question at a time of extraordinary technical revolution, whether mechanical inventions have lightened the day's toil of human beings, was not new to Marx. In fact, Marx (1867 [1887; 1995/97], 257) credits John Stuart Mill (Mill, 1848 [1909]) to first formulate it. But for Marx "like every other increase in the productiveness of labour, machinery is intended to cheapen commodities". At its turn, to cheapen commodities means reducing the quantity of labour embodied in their production, which basically can be carried on because unit labour costs decrease as labour productivity rises. Indeed, Marx holds that in the capitalist system the purpose of the introduction of modern techniques (mechanisation) is to increase labour productivity, raising at the same time the redundant labour. The immediate outcome seems to be quite straightforward: production will be carried out through the new technique employing less labour, thus making the unit cost

cheaper than with the old technique. The redundant labour resulting from that process will not only increase the mass of unemployed but also, in the long run, will set a pressure against further wage increases. As usual, this process entails a complicated process encompassing counterbalancing factors and, as such, they also were part of Marx's meticulous enquiry aiming at disentangling the tendencies of the incorporation of machinery into the production system.

Firstly, it is important to bear in mind that the transition from the period of Manufacture to the System of Machinery certainly affected the division of labour, its composition and eventually the wages of labour. For Marx, during the Manufacture period labour organisation was based on the "subjective principle of the division of labour"; thus

it is the workmen who, with their manual implements, must carry on each particular detail process. If, on the one hand, the workman becomes adapted to the process, on the other, the process was previously made suitable to the workman (Marx, 1867, 261).

On the contrary, that subjective principle does not exist in the System of Machinery:

the process as a whole is examined *objectively*, ... , that is to say, *without regard to the question of its execution by human hands*, it is analysed into its constituent phases; and the problem, how to execute each detail process, and bind them all into a whole, is solved by the aid of machines, chemistry, etc. (Marx, 1867, 261, emphasis added).

Thus, the transition from manufacture to the system of machines entailed a radical change in the role of labour and in the ways the latter co-operated.

The second feature is that the system of machines replaces *the skilled labour*, that during the Manufacturing period produced not only commodities but also machines. Marx writes:

The inventions of Vaucanson, Arkwright, Watt, and others were practicable only because those inventors found, ready to hand, *a considerable number of skilled mechanical workmen*, placed at their disposal by the manufacturing period. Some of these workmen were independent handicraftsman of various trades, others were grouped together in manufactures in which division of labour was strictly carried out. (Marx, 1867, 262, emphasis added)

Marx clarifies that inventions have to grow because an "increased demand for the newly discovered machines grew larger" so the machine industry started to split up in more numerous branches and specialisations, and therefore the division of labour within the machine-making sector developed further and further, simplifying the tasks in the production process. However, not only was the expansion in the machine industry conditional to the availability of such specialised and dexterous men, but the production of commodities in general:



the expansion of fresh branches of production, were dependent on the growth of a class of workmen, who, owing to the almost artistic nature of their employment, could increase their numbers only gradually, and not by leaps and bounds. (Marx, 1867, 262).

Of course such a backdrop indicated that “modern industry [was] technologically incompatible with the basis furnished for it by handicraft and Manufacture”, so, eventually, labour becomes just an appendix to the whole system of machines, which now incorporated the application of science. Marx explains:

In Manufacture, the organisation of the social labour-process is purely subjective; it is a combination of detail labourers; in its machinery system, modern industry has a productive organism that is purely objective, in which *the labourer becomes a mere appendage* to an already existing material condition of production. (Marx, 1867, 264, emphasis added)

In his analysis Marx holds that when the most revolutionary technological transformation in nineteenth century (the steam-engine) allowed “the most essential condition to the production of *machines by machines...yet under perfect control*” (263, emphasis added) it was also necessary to provide the *detail parts* of the machine. The discovery of the slide rest by Henry Maudsley allowed produce the individual part of machinery by replacing the hand itself “with a degree of ease, accuracy, and speed, that no accumulated experience of the hand of the most skilled workman could give” (*The Industry of Nations*, London, 1855, quoted by Marx, 1867, 263).

For Marx this technological transformation was not merely concerned with the objective elements of the process of production; it also transformed the skilled labour into redundant labour. Here we find an element so much stressed by Marx in his analysis of technical change, in that an objective feature of the modern capitalist system ruled by the system of machinery engenders the lack of relevance of skilled labour in the social productive process, leading gradually their relative strength in the wage negotiations to wane. If, therefore, the technological transformation entailed the development of an objective structure – the system of machinery –, in which (skilled) labour would eventually lose its strength and probably their share of the social product, then Marx’s analysis of technical change not only could be classified as ‘deskilling-augmenting’ (or skill-labour-saving) but in particular as a weapon on the part of the capitalist class to check wage bargains and labour improvements. We may even argue that Marx (Marx, 1867, 268) actually considers the possibility that diffusion of the use of machinery would simultaneously allow, if not to lower wages at least to check any increase through the creation of a redundant population as well as the employment of women and children (“workers with low muscular mass”) at lower wages, thus establishing *persistent* forces that would eventually push wages down for future wage contracts.

Third, there certainly are counterbalancing factors in the development of the process of technical change that make Marx’s reconstruction of its effects complicated enough to derive a single, univocally directed outcome. As we saw, the social transformation entailed a radical change in *the place of labour* within the

new configuration determined by the system of machinery, which Marx examined in detail by studying the factory laws and the reports by the English commission on children employment in the most dynamic industries of his time (Marx, 1867, 306).

Marx points out that the competition amongst capitalists to cheapen production had been historically carried on by employing labour power at lowered values through night shifts, child and women workers, and prolonged working hours, leading to real wages below the subsistence level, even for long periods. However, this specific feature of the process of competition cannot be extended to infinite, because there are *objective obstacles* to unlimited extensions determined by the human biology. Approaching such natural limits (“it takes many years”), increases in productivity could be only attained by *new techniques*, that is, by introducing machinery:

So soon as this point [*i.e.*, the biological limit] is at last reached the hour has struck for the *introduction of machinery*, and for the thenceforth rapid conversion of the scattered domestic industries and manufactures into factory industries. (Marx, 1867, 306, emphasis added).

So introduction of machinery originates when the old mechanisms that maintained the wages below subsistence are no longer economically effective due to the biologically determined limits of labour. It would thus seem that, only after introducing machinery (and the corresponding increase in productivity) do wages increase, leaving the displaced workers redundant.<sup>3</sup> So this is a counterbalancing factor (rising wages) beneficial to those workers who are employed *within the production process under the new technical methods*. As we have seen above, because of the simplification of processes these tasks under the new techniques need not be carried out by dexterous handicraftsmen.

It is also important to note that Marx (1867, 267) clarified that the use of machinery will make the product cheaper if the amount of labour embodied in the production of the machine is *lower* than the amount of labour displaced by incorporating the former (for example, if the amount of labour embodied in the machine is nine man-hours per unit of final product and the labour displaced ten man-hours). Nonetheless, cheapening the product does not necessarily imply a minimization of costs from the point of view of the capitalist, as this depends on the amount of total capital invested.

Discussion of further counterbalancing factors is found in another work of Marx’s, *Value, Price and Profit* (1865 [1898]). In that work Marx wrote:

Take, for example, the rise in England of agricultural wages from 1849 to 1859. What was its consequence? The farmers could not, as our friend

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<sup>3</sup> “[M]achinery, when employed in some branches of industry, creates such a redundancy of labour in other branches that in these latter the fall of wages below the value of labour-power impedes the use of machinery, and, from the standpoint of the capitalist, whose profit comes from a diminution of the labour paid for, renders that use superfluous and often impossible.” (Marx, 1867, 267).

Weston would have advised them, raise the value of wheat, nor even its market prices. They had, on the contrary, to submit to their fall. But during these eleven years they introduced machinery of all sorts, adopted more scientific methods, converted part of arable land into pasture, increased the size of farms, and with this the scale of production, and by these and other processes diminishing the demand for labour by increasing its productive power, made the agricultural population again relatively redundant. (Marx, 1865, 28).<sup>4</sup>

Again Marx says that once labour productivity increases in those sectors using machinery (in this case agriculture), workers will receive a higher wage. In the long run, the fall in the rate of profits resulting from the wage increase can only be *counterbalanced* by the force exerted by the redundant population that can set a pressure favouring a decline in the value of the labour power, as we discussed above. For Marx:

[T]he appliance of machinery is *but one of the many methods for increasing the productive powers of labour*. (...) The same law obtains in another form. With the development of the productive powers of labour *the accumulation of capital will be accelerated, even despite a relatively high rate of wages*. (...) Simultaneously there takes place a progressive change in the composition of capital. That part of the aggregate capital which consists of fixed capital, machinery, raw materials, means of production ... progressively increases as compared with the other part of capital, which is laid out in wages. (Marx 1865, 28-9, emphasis added)

An increase in labour productivity accelerates capital accumulation and this brings about a rise in the proportion of means of production on the total costs over direct labour. Nonetheless, if an increase in productivity (which of course is not brought about *exclusively* by the use of machinery)<sup>5</sup> boosts capital accumulation, it is then plausible to assume that the latter could be promoted precisely by increases in demand, which in turn could become in an engine for the development of technical innovations. As Marx points out in the above citation, the accumulation process can be accelerated even with higher real wages.

Of course, higher wages diminish the rate of profits; but it is precisely because after wages attain at a certain value that the introduction of machinery turns profitable for producers. In this strict connection, Marx argued in the footsteps already laid out by Ricardo, as Marx admits:

This is the general method in which a reaction of capital against a rise of wages takes place. Ricardo has justly remarked that machinery is in constant competition with labour, and *can often be only introduced* when the price of labour has reached a certain height (Marx, 1865, 28).

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<sup>4</sup> We must highlight that the aim to increase productivity, with its ensuing outcome of lowering the level of employment, is a permanent feature of the system; see, Marx (1867, 264-65).

<sup>5</sup> *E.g.* Discovery of new energy sources, improvement in education, improvement in the nutritional levels of the workers, among others. For the period Marx is discussing (1865), see Hunt (1967, 283-4).

Marx examines the economic reaction of capital in face of an increase of wages with the aim at diminishing total costs, which would lead to a lower level of the value of the commodities. In this *transition*, only those capitalists that happen to be the first ones to adopt the new methods will be able to offset the fall in profitability, in such a way that they can sell, for a limited period of time, each unit of product at a higher price which had been previously prevailing, as long as that unit of product is being produced at lower unit costs. Once again Marx does not reach at a purely balanced result between rising wages and increase in unemployment; rather his analysis is pointing to the fact that in order to counterbalance the increase in wages capitalists will continue to profit by using new methods and the resulting lower rate of profits will, in its turn, be counterbalanced as the increase of unemployed on the labour market pushing down wages in contracts, thereby lessening their strength in wage negotiations.

#### **4. Concluding remarks**

In this paper we have traced from Marx's analysis that one of the most salient consequences of the technical change was the switch in the composition of the labour force, in that the skilled workers lost terrain while unskilled labour (normally associated with women and children) increased. This of course had to do with the specificities of that phase of the industrial revolution he analysed; but also Marx examined the relationship between labour and capital, or between profits and wages. So in this particular sense, the capitalist system is as much the same now as it used to be in that period. What changed were the instruments, contracts, and conditions, in context characterised by the interplay of conflicting relationships between the two parties. To substitute machines or robots for people has nothing to do with rising wages as some great marginalist thinkers believed (Hicks, 1932). Also, considering the recent period in which new forms of organising labour and companies (such as UBER) could give the impression of having reached the end of paid work, seems to us to miss the point, as the economic system continues to be framed in the search for private profits and, as such, the underlying backdrop against which the analysis should be conducted is that of the conflictual relationship between labour and capital. In this sense, we believe that machines replace human beings because dispensing of workers actually is a means to reduce the *likelihood of distributional conflict and class struggle* for higher wages (lower profits). This could be seen as a bourgeoisie weapon against wage rises today no less than the old mechanical inventions were so in the past. Therefore, generalising the substitution of robots, AI and big data for human labour would primarily reflect that labour would stand in a weaker position to negotiate for wages. Marx's analysis illuminates this perspective as technological progress would not only mean an eventual rise in unemployment; the permanent technological change has the purpose to permanent counterbalance the conflicting factors that could eventually rise wages.

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