Labour Coefficients Reduction and Working Time Reduction

di Sebastiano Fadda*

Abstract

The present path and nature of technological innovation is such as to reduce dramatically the labour coefficients in the production processes nearly in every sector and surely in the productive system taken as a whole. This issue, which is linked to the concept of "technological unemployment" evoked by Keynes, is considered both under a theoretical and an empirical perspective, and it leads to explore the most viable way out of the problem of this kind of unemployment, which is the shortening of the working time. The paper explores the complexity, the technical problems and some policy implications of this solution. Finally, some intermediate, less radical, measures in this direction are considered.
JEL Classification: E23, J21, O33.
Keywords: Technological Unemployment, Working Time.

Riduzione dei coefficienti di lavoro e riduzione del tempo di lavoro

Sommario

La natura e il tasso di progresso tecnico attualmente in atto sono tali da ridurre drammaticamente i coefficienti di lavoro pressoché in tutti i processi produttivi e sicuramente nel sistema economico nel suo complesso. Ciò genera un problema del tipo di quello individuato da Keynes come "*Technological Unemployment*". Il paper esplora questo problema sotto un profilo teorico ed empirico e prende in considerazione la soluzione basata sulla riduzione del tempo di lavoro. La complessità, i problemi tecnici e le implicazioni di politica economica relative a tale soluzione vengono esaminate approfonditamente. Infine vengono suggerite alcune misure intermedie e meno radicali in questa direzione.
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Introduction

The explanations of (and the policies against) unemployment are still based on traditional views about the working of the economy and particularly of the labour market. According to this view involuntary unemployment is essentially due either to difficulties in "matching" demand and supply, or to wages higher than the equilibrium level of full employment. The inability of wages to adjust to the equilibrium level is in turn ascribed either to trade unions interfering against the free working of market forces or to dynamics of new-keynesian kind such as efficiency wages or implicit contracts or "insiders –outsiders" models.

This view is nothing but an extension to macroeconomics of the microeconomic principle of equilibrium of the individual firm in a perfect competition world. Ignoring the role of aggregate demand, the demand for labour can simply be assumed as a decreasing function of wage levels due to decreasing marginal productivity of factors. But if aggregate demand is considered, the growth of employment as a consequence of falling wages requires to assume the existence of either the so called "Keynes effect" or the "Pigou effect". The first relies on the increase of investment demand due to the fall of interest rate which follows the increase in real money supply when prices fall as a consequence of declining wages; the second relies on the increase in consumer demand due to the increase in the real value of financial assets, assuming consumption demand to be a function of wealth as well of income.

As is well known, several objections can be raised against the actual working of these effects. Just to mention a few: consider the elasticity of investment to interest rates, or the role of the real rate of interest, or the strategic behavior of consumers in times of falling prices.

The possible co-existence of equilibrium wage level with disequilibrium in the labor market and equilibrium between aggregate demand and supply has been proved by Clower (Clower 1965) in opposition to the Walrasian general equilibrium model. The distinction between "notional" and "effective" aggregate demand allowed then Malinvaud (Malinvaud 1977) to clarify the distinction between "classical" and "Keynesian" unemployment, pointing out two different obstacles to the achievement of full employment: on the one hand the relation between wages and marginal productivity of labour and on the other hand the insufficient effective aggregate demand.

In this frame the economic policies suggested by the European Union and generally implemented by member states with heavier unemployment problems have taken a rather funny shape. On one side a cut in wages has

been advocated and attained, on the other side the awareness of its negative effect on aggregate demand has been handled with the idea that foreign demand would have compensated the fall in domestic demand. But unfortunately the supposed fall in prices due to reduced wages didn't show able to compensate the productivity gap to the extent necessary to gain competitiveness in the world, and particularly the European, market.

Consciousness, although late acquired, of the failure of such approach in dealing with the problem of unemployment has recently pushed our policy makers to reduce the emphasis on the supply side of the labour market (which has been the main limit of the Lisbona strategy and the following updates) and to address the issue of aggregate demand. But with regard to its components of consumer and investment demand the approach has not been appropriate, since it has fundamentally underestimated the role of disposable income distribution as far as the first is concerned and overestimated the role of the interest rate with regard to the second.

Obviously, supply side labour policies are necessary in order to reduce frictional and structural unemployment: the Beveridge curve has to be shifted to the left and the rise of the natural rate of unemployment has to be avoided. But the real issue nowadays is: since the achievement of equilibrium between labour demand and supply is obstructed by the two constraints (one relative to wage-marginal productivity ratio and one relative to insufficient effective demand) is it possible to increase aggregate demand up to totally remove the second constraint? In other words, can demand management policies make aggregate demand and output grow such as to be able to absorb all the labour supply (allowing for structural and frictional unemployment)? If not, the target of full employment should be abandoned and commitment should be turned to take care of those who cannot be involved in productive activity not because of "matching" problems, but because they exceed the labour imput requirements of the economic system. In the following sections we shall explore this question, first by reconsidering the definition of full employment and of "labour demand", then by questioning the compatibility between technical progress and the target of full employment, and finally by considering policies to conciliate increasing technical progress with ensuring full employment.

1. The notion of full employment and of demand for labour

In order to proceed it is necessary first to emphasize some aspects of these two notions. Clearly a situation of full employment is not one in

which everybody has got a payed job. People not in working age, people who are not willing to work, people whose qualifications do not match the qualifications required to fulfill the vacancies and people who are delayed in the process of finding out and fulfilling the vacancies are all people without job who do not contradict a situation of full employment. When no other people than these are jobless there is full employment, which amounts to say that labour demand and labour supply are numerically equivalent. But this apparently straightforward definition suffers of ambiguities both on operative and conceptual grounds. On operative ground it's difficult to account for people who are willing to work but do not engage in positive actions of job search and for people who would be willing to work only under particular conditions. On the demand side while it' easy to measure that segment which has given rise to employment it is awkward to take accurate account of demand which has not been matched by supply. On the theoretical level, the above definition is tied to the notion of "clearing of the market" and it corresponds *"to the point of intersection between the supply curve and the demand curve* (Robinson, 1937, p.171) But if the assumption is made that both the demand and the supply functions are sensitive to endogenous variables besides the real wage, the notion of full employment based on the clearing of the aggregate labour market becomes ambiguous. It would be better to adopt another conceptual definition, such as the one given, again, by Joan Robinson: (ib, p.15) that situation in which " no one employer can increase his staff without reducing the staff of some other employer, or "one entrepreneur can increase the amount of labour he employs only by reducing the amount employed by someone else". Still clearer is the notion of full employment adopted by Keynes, which in addition is also connected with the notion of aggregate demand. According to Keynes the condition of full employment is the one in which the size of employment is inelastic with respect to rising effective demand; that is when, for a given technology, output cannot growth because of lack of labour force. "a zero elasticity of supply for output means that an increase of demand in terms of money will lead to no change in output; that is to say , prices will rise in the same proportion as the money demand rises. Inflation will have no effect on output or employment., but only on prices…. Indeed, the condition in which the elasticity of the supply of output as a whole is zero is, I now think, the most convenient criterion for defining full employment" (Keynes, 1973, p.106). In other words, output can grow only if technology and productivity increase and, it has to be noticed, conversely if technology and productivity increase, full employment can be maintained

only if output grows. This ca be considered the basis for the subsequent warning by Keynes about "technological unemployment".

Coming to the conceptual definition of "demand for labour" it has to be refined In one aspect. Whatever the variable on which it is considered dependent, it cannot be meant in terms of "workers", but in terms of "quantity of work", possibly hours of work. The technology of the economy, in fact, defines the input coefficients of labour in terms of quantity of work and not of workers. Converting the quantity of work into quantity of workers requires a passage of institutional nature (as such subject to discretionary changes): precisely, the hours of work per employee. In fact the total output of an economy is given, again *for a given technology*, by productivity per hour multiplied by the number of hours worked per employee multiplied by the number of workers actually employed. As a consequence, for a given productivity per hour, total output may change even when the number of employees does not change provided the hours worked per employee do change, or, *vice versa*, when the hours worked per employee do not change if the level of employment changes. Or, total output may remain constant if both variables change but in opposite and compensating directions. These qualifications are of great importance when dealing with the real question: whether it is possible to achieve the target of full employment through appropriate aggregate demand management in case of technical progress and increasing productivity.

2. Technical progress and technological unemployment

When introducing the role of technical progress with regard to the goal of full employment it must be born in mind that although it can be neutral, or labour saving or capital saving, either in the Hicks or in the Harrod sense, it is always labour saving in absolute terms because it always reduces the labour input coefficients of production. Therefore it always implies a rise of labour productivity. This concept is very tricky, as it is nearly undistinguishable from the productivity of any other factor of production (Fadda 2013), nor the growth accountancy gives satisficing answers to the problem. Still, for our purpose we can use the crude concept of labour productivity as the ratio between total output and total labour input. Therefore we identify technical progress with its effect of increasing labour productivity.

In order to explore the relationship between the goal of full employment and the presence of technical progress the first step has to be devoted to the question of the impact of rising productivity on the level of employment.

This problem can be (and it has been) considered under an empirical perspective and under a theoretical approach. The empirical perspective generally leads to conclude that historically no positive relationship has emerged between productivity growth and unemployment. The classical standard reference is to the fact that since when the worries of the luddism started to pervade the world of workers, the predictions of massive unemployment due to technological change have always proven false. More detailed empirical investigations reach more refined conclusions, sometimes revealing that although in the short run there may be a positive relationship it disappears or turns negative in the long run. Two empirical studies, though, are particularly worth mentioning. The first (Benigno 2010), based mainly on US data, finds out a positive relationship between productivity growth and employment in the long run, but a negative one between a rise in the variance of productivity growth and employment. The explanations could be grounded on the slow process of adjustment of wages to productivity growth (Ball & Mankiw 2002, Pissarides 2009), which would let production costs decline, profits increase, and consequently the demand for labour be pushed up by more investment and economic growth. On the other hand, in case of downwards shift of the pace of productivity growth the increase in wages according to expectations would make profits shrink causing a reduction in the demand for labour in order to protect profits.

The second lot of empirical considerations that I think worth mentioning comes from J. Mason (2015). The data that he reports show that "Ten-year periods with high growth of productivity invariably also have low unemployment rates; periods of high average unemployment are invariably also periods of slow productivity growth". This is as far as the Us are concerned, plus Japan and some other countries, while many other countries show inverse relationships. Relative to these data It can be observed in the first place that the causal direction of the relationship is not established. It may well be that technical progress and productivity growth are able to speed up the growth of the economy so that the demand for labour rises, but it may also be the other way round: when unemployment falls and labour becomes scarce employers are stimulated to speed up the process of innovation, also increasing the level of ouput due to high aggregate demand. In addition, changes in output and employment could be strongly influenced by monetary and fiscal policy, something which obviously would discredit any straight relationship between productivity and employment.

A second observation concerns the different shapes that the above correlation shows in different countries. This really poses a problem: there must be other aspects (which are to be detected) able to affect this relationship. It

may be differences in the kind of innovation, it may be differences in labour market institutions and regulations, it may be differences in the world trade position, it may be differences in content and timing of economic policy. When dealing with the problems of maintaining the target of full employment in the long run in presence of technical progress these aspects will prove of fundamental importance.

A final but essential consideration about the empirics of the evolution of this relationship is that the historical trend cannot be assumed to continue as such in the future. There is no reason to believe that the new inventions of the future will have the same effect on the labour market as in the past. There is no reason to say that the growth of output will have in the future the same pace of the past. Perhaps in the past all kinds of polluting activities did not have significant effects on climate change, but they do in the present, and probably will do to a larger extent in the future. Similarly, the fact that all the past predictions have proven wrong says nothing about how the variables involved are going to behave in the future. It is not correct to infer from the past the evolution of the future. So, being unable to rely on past experience, particularly in times of deep and fast changes, we are forced to look for light in the theory.

Economic theory on this topic is mainly derived from neoclassical approaches. Among the classical economists, Ricardo (Ricardo 1817) in his well-known chapter 31 on machinery saw a conflict between mechanization and employment, while Marx saw in the growth of the "organic composition of capital" on the one hand a way of forcing wages to subsistence level but on the other hand a root from which an underconsumption crisis of the system would develop (Marx,1993).

Neoclassical models generally deny a negative effect of productivity increase on employment in the long run although they admit it could temporarily show in the short run. "Many structural shocks that initially create a positive trade-off between productivity and unemployment set in motion a dynamic path of adjustment involving capital accumulation or decumulation that in principle can eliminate the trade off"(Gordon 1995 p.4). In Solow's model of growth, full employment is unaffected by technical progress, since an increase in investment will accompany the shift of the production function as well as the increase in the capital/labour ratio. Even according to Layard's approach the equilibrium unemployment rate is not affected by changes in technology: "Unemployment in the long run is independent of capital accumulation and technical progress" (Layard, p.107). Rowthorn, on the other hand has objected that these conclusions are valid only on the assumption of a unit elasticity production function (Rowthorn

1999). The theoretical literature on this theme is vast, but definitely not conclusive, and it looks right to agree with Blanchard, Solow and Wilson when they state that "theoretical arguments are unlikely to settle the issue, precisely because it turns so decisively on the reaction of aggregate output to (favorable or unfavorable) productivity shock. The problem is located at the intersection of the demand side and the supply side, the least developed and most controversial area of economic theory". (Blanchard, p.5).

The complexity of the issue and the various interconnections and possible lines of causation among the involved variables can be summarized as following.

Consider first the relationship between growth and productivity. A first line of causation goes from productivity to growth and implies a positive effect of the first to the latter. This effect is attributed to reduction of unit costs, which will allow the aggregate supply curve to shift down. If the aggregate demand curve remains unchanged the result will be an increase in aggregate output. But the aggregate demand curve may shift left or right according to whether no new investment and no consumer demand increase will take place or more investment in view of higher profits and more consumption demand will follow. If the aggregate demand curve shifts right, output will increase still more. But the direction of causality between productivity and growth can be reversed. Growth may be the cause of increasing productivity by virtue of the pro-cyclical conduct implied by Okun's law or by technical progress embodied in the new investments required to enlarge productive capacity or also by the pressure towards labour saving innovations coming from tighter labour market conditions.

Turning to consider the relationship between productivity and employment, a two ways causation can also be detected. On the one hand productivity growth is bound to affect the level of employment either positively if the consequent growth is strong enough or negatively if growth is not enough to compensate for labour substitution. In addition, structural effects may take place regarding polarization, wages and long term unemployment owning to skill biased technical change. On the other hand a reverse positive causation may go from employment to productivity as a consequence of increasing scarcity and wages, while increasing unemployment and declining wages would lead to a slowdown of productivity. The positive impact of employment on productivity would also mitigate the price rise, lessening in this way the constraints of the Phillips curve.

A similar view about these relationships, which will also help to answer the question whether full employment in the long run is compatible with continuous technical progress, can be found in Pasinetti's approach (Pasi-

netti 1993). Technical progress will reduce labour coefficients of production at different paces in different sectors. Some sectors will be stronger affected than others. Taking account of these different reductions, plus the different output dynamics of each sector, plus the weight of each sector in the aggregate output, plus the creation of new productive sectors it is possible to establish the net balance in aggregate terms between the destruction and the creation of new jobs which follow the introduction of technical progress. As Pasinetti says, in different historical periods it could well be that this balance is positive, and that only problems of adjustment of the labour force, mobility, education and training need to be solved. In that case appropriate active labour policies would be sufficient to put things right. But it may also be that this balance is negative, and it will be so when the rate of output growth in aggregate terms is not sufficient to compensate for the destruction of jobs operated by technological innovation. In this case no active labour policies would be able to find employment for the loss of jobs that cannot be replaced. This is the problem that Keynes forecasted when he said: "We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come--namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour" (Keynes,1930).

3. Should we give up the goal of full employment?

The problem is how to cope with the possibility foreseen by Keynes, or, in other words, how to avoid that full employment be held back by technical progress. It is clear that what is true at the industry level is also true for the economy as a whole: aggregate labour demand is bound to increase with productivity growth if aggregate output is sufficiently elastic, and will decline if aggregate output is not adequately elastic. Therefore the final and also long run impact on employment depends on the elasticity of both consumer and investment demand. Both price and income elasticities have to be considered. Obviously, since the labour coefficient reduction affects also additional output, its rate of growth has to be higher than the rate of reduction of labour inputs per unit of production in order to compensate for technical progress job destruction. A particular interpretation of the production function makes the problem still worse. Considering, as Summer does (Summer 2013), a production function of the kind: $Y = F(\beta K, L +$

$\lambda(1-\beta)K$), where one unit of capital is equivalent to λ units of labour, allows to make a distinction between two uses of the stock of capital: one part for the customary use and the other part to substitute for labour. As more capital will be reallocated to substitute for labour, output will increase but, being larger the stock of effective labour and smaller the stock of conventional capital, the wage level will decline. In view of this last effect it is not sure that output will grow, and then: "rapid productivity growth associated with inelastic demand leads to fewer and fewer people being engaged in the activity" (Summers, 2013, p.4). It is important at this point to notice that this could be a further and more general explanation of the different impact of increasing productivity on employment in different countries as mentioned on page 6: it is not the absolute intensity of technical progress that matters, but the ratio between this and the rate of economic growth. Obviously behind the different growth rates there are different factors in different countries.

In this frame the question becomes: in times of increasingly rapid technical progress will consumer and investment demand be able to growth at a higher speed so as to achieve the goal of full employment? And if not, are there any means that could be adopted to achieve full employment or should we abandon the goal of full employment altogether?

The question can be split in two parts. The first part is: are we in times of such "dangerously" rapid technical change that full employment may be rendered impossible? And the second is: what ca be done if we are there or nearly there?

The literature on the topic of present rapid increase of technical change is burgeoning and it sounds like we are witnessing something completely different from the past. It is not like substituting looms for workers or trains for horses. It is far beyond ICT revolution, it looks like progressively transferring to robotics most of the tasks up to now performed by human workers. Jeremy Rifkin (Rifkin 1995) began many years ago to foresee mass unemployment as the fundamental problem of 21st century. Martin Ford (Ford 2009) expects the workers expelled by technological innovation from productive activity not to be able to find employment in other sectors in the next few decades. The race against machines (Brynjolfsson and McAfee, 2011) is such as to bring Frey and Osborne (2013) to predict that 47% of jobs currently existing in the US will vanish in the next two decades, while Jeremy Bowles (2014) foresees a net loss of 50% of today jobs in Europe in the next decades. In several occasions Ulrich Beck (Beck 2009) has drawn the attention on the prospect that in the next decade the

employment of only 50% of the working age population would be enough to produce all the goods and services demanded in advanced countries.

It seems therefore that we are close to the point in which the speed of job destruction caused by such rapid and deep technological progress will hardly be compensated by job creation due to consumer and investment demand. The production of all the goods and services to match aggregate demand would require the employment of only a fraction of the available labour; or, reciprocally, if full employment were attained this would lead to overproduction which would revert the economy to permanent persistent unemployment. It seems that we have reached at aggregate level that paradoxical situation depicted by Bertrand Russel with reference to a single industry. "Suppose that, at a given moment, a certain number of people are engaged in the manufacture of pins. They make as many pins as the world needs, working (say) eight hours a day. Someone makes an invention by which the same number of men can make twice as many pins: pins are already so cheap that hardly any more will be bought at a lower price. In a sensible world, everybody concerned in the manufacturing of pins would take to working four hours instead of eight, and everything else would go on as before. But in the actual world this would be thought demoralizing. The men still work eight hours, there are too many pins, some employers go bankrupt, and half the men previously concerned in making pins are thrown out of work. There is, in the end, just as much leisure as on the other plan, but half the men are totally idle while half are still overworked. In this way, it is insured that the unavoidable leisure shall cause misery all round instead of being a universal source of happiness. Can anything more insane be imagined?" (Russel 1935, p.16)

Obviously Russel didn't imagine that either rising wages in the pin sector or falling prices of pins could have increased the demand for other goods in such a way as to employ all the workers dismissed in the pin industry. This is what is accounted for in multisectoral models, where cross elasticities of demand play a fundamental role in ascertaining the impact of technical progress on employment. But if the reduction of labour input coefficients is extended to all the economy, if the substitution of human work with machines or robots pervades all sectors, then the preservation of same levels of aggregate employment is conditional on adequate increase of aggregate production. The problem, therefore, is whether it is possible for aggregate demand to grow up to such a required level. The problem may also be exacerbated by the fact that the initial fall in unemployment will work towards a reduction in consumer demand. Unless the pace of aggregate output growth is higher than that of aggregate productivity increase (me-

asured as a weighted average of all sectors) it will impossible to avoid a fall in employment as a consequence of technological change, and therefore it will impossible to maintain the goal of full employment.

Since it is out of question the possibility and also the opportunity of slowing down the path of innovation (it wouldn't make sense to delay the reduction of the human effort required per unit of production), it is on the other side of the ratio, i.e. the speed of output growth, that possible actions are to be considered if the goal of full employment is to be maintained.

Of course, monetary and fiscal policies must come to play in this regard, as well as real policies such as industrial policies, agricultural policies, research policies, and so on. But since consumer demand is the key variable, both in itself and in its role relative to the investment function, it is towards its growth that action should be directed. To this end, a most effective and structural measure would be to attain a less unequal income distribution. As Keynes said, "measures for the redistribution of incomes in a way likely to raise the propensity to consume may prove positively favourable to the growth of capital" (Keynes, 1967, p.373).

Although empirical evidence and theoretical debates are less than conclusive about the impact of unequal distribution on the rate of growth, the prevailing hypothesis is that of a negative relationship between the two (Fadda, 2015). The available measures towards a reduction of income inequality range from those directed to affect the market distribution (before tax and transfers) to those directed to change the disposable income distribution. Although the first ones should be preferred, also the second ones could be effective if well designed. Careful design is required to avoid distortive effects that could turn to be worse than the inequality they are meant to correct (Fadda, 2015). Transfers, both in money and in kind, could be particularly effective in rising aggregate demand beyond the level reached with the original market distribution.

Social expenditure could be a second and powerful tool to control the ratio between productivity increase and output growth. The provision of public goods and social services financed out of taxation of top incomes or through public debt would help to support aggregate demand.

A third way of providing a stimulus to labour demand when jobs are lost because of technological change is that of stimulating, actually with specific policies aimed at exploiting the possibilities open by same technological progress, the production of new goods and of new services to which a growing paying demand would be addressed. This additional demand could come from either the wage increase due to productivity growth or from the

price fall, and would be a reflection of the evolution of needs and tastes as the standard of living rises.

All these measures are right, but they do not solve the problem. In case of excessively wide gap between labour demand and supply and in case of accelerating and deep technical change, relying only on these measure could lead to an obsessive search for a continuous increase of the rate of growth. GDP growth would be pursued, in this case, not for the sake of generating social welfare and responding to social needs, but only for the sake of creating new jobs, in an endless spiral escalation. Furthermore, in the long run such a rate of growth could easily turn to be unsustainable under several points of view. Both because neither natural resources nor human needs are unlimited, this process is bound to crash in the long run against a destructive consumistic exasperation or/and against an insuperable limit of overproduction. The measures above are useful and also necessary as countercyclical and stabilization policies, but their ability to reach and maintain full employment in a world of continuous deep and accelerating technical progress of the kind we are starting to witness is doubtful, not to say hopeless . Actually the economy may be trapped between an *unsustainable rate of growth and an unsustainable rate of unemployment.* The need to escape this trap requires that other options be considered.

4. The reduction of working time

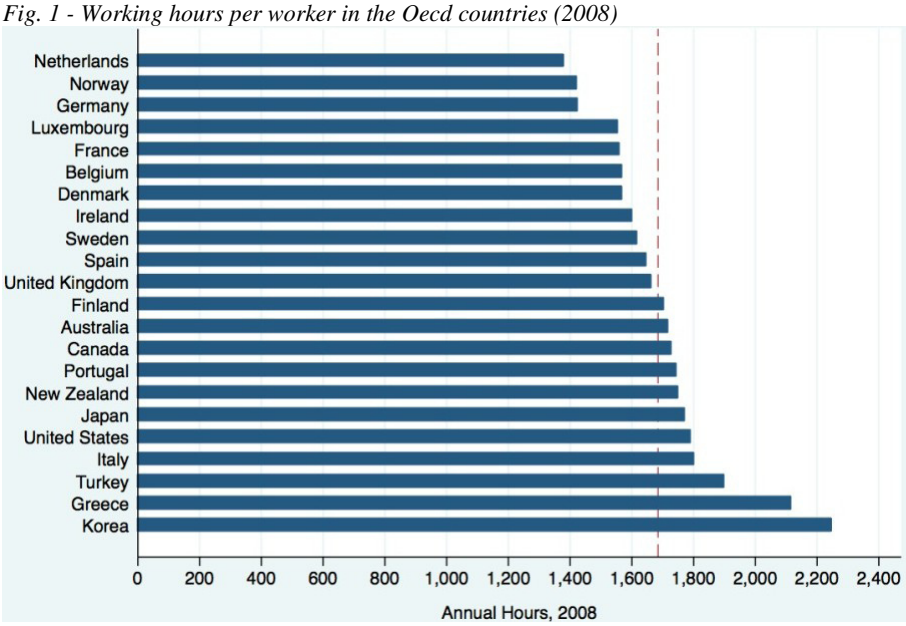
An alternative way to conciliate increasing technical progress and full employment comes from the distinction made above between reduction of labour input coefficients and reduction of "workers" coefficients. Taking account of this, the problem could be reduced to an elementary arithmetical sequence. If the total amount of working hours required for an output that equals aggregate demand falls and this total amount is divided by the number of workers, the result is the number of work hours per worker which is needed to keep constant the level of employment. If the starting point is one of full employment, implementing this calculation would neutralize the job destruction effect of technical progress, and the advantage of productivity increase would be entirely translated on the variable of working time per worker.

Undoubtedly the historical evolution shows a path of working hours reduction, although this has been caused more by workers' demands for better quality of life than by deliberate labour policy choices. From the original working time with no limits of regulatory or contractual kind of the first

industrial revolution, a first step forwards has been the English Factory Act of 1833, which imposed a limit of eight hours a day for workers aged between 9 and 13 and of 12 hours for workers aged between 14 and 18. Later, in 1850, a limit of 10 working hours a day was imposed for everyone. In France the revolutionary government imposed in 1848 a general limit of 10 hours a day in Paris and 11 in the province. In Italy, in 1860 the daily working hours were about 15, while in 1923 it was established by law a length of 8 hours per day and 48 per week. Collective agreements in the seventies reduced it to 40 hours in five days. More recently, tentative measures of further reductions have appeared in France and in Germany.

A description of the comparative situation at present time is given in the following graph

Fig. 1 - Working hours per worker in the Oecd countries (2008)



Source: Oecd Statistics.

It is worth noticing that countries which have an average working time per worker comparatively higher than others (such as Greece and Italy) have also a lower productivity per worker, and vice versa.

The above simple arithmetical sequence could be refined in the following way. Suppose an economy is at full employment and an accelerated and deep technical progress takes place. Then, full employment could be maintained by adjusting the productivity per worker trough a reduction of

working hours in proportion with the rate of growth of productivity per hour minus the rate of growth of aggregate demand. Of course this kind of rule implies that productivity per hour is intended in the "crude" sense mentioned above, and that the average changes be weighted for the different sectors or industries of the economy.

Even so, the implementation of this rule, its conversion into measures of economic policy is far some simple. Three main problems arise. The first is concerned with the organization of production processes, the second with the behavior of wages, the third with differences in sectoral productivity changes.

With regard to the first, let's imagine that technological innovations bring in the firm an increase of the ratio between output and labour input, that is an increase of labour productivity in the above sense. It will awkward for the firm to reduce proportionally the working time of employees such as to leave the number of employed unchanged. This would be technically difficult for more than one reasons.

In the first place, the technology of each production process does not offer an elasticity of substitution between factors such as to permit movements along a "continuum" in a kind of "fine tuning" by matching increases in productivity with corresponding splitting of the specific task of one worker into different complementary workers. There are discontinuities (of different extent according to specific tasks and stages of the production process) that, if disregarded by hasty redistributions of the working time, would create a disruption in the process which would neutralize all the gain of productivity increases.

In the second place, the reduction in total unit costs due to technological change would affect differently variable and fixed costs. Possibly, changes in fixed costs (such as cleaning, maintenance, administration, recruitment and so on) would be unaffected by changes in the process of production, therefore the reduction in total unit costs would be less than proportional to the increase in productivity so that a general cut in the working time proportional to the average increase in productivity would rise fixed unit costs making impossible for the firm to maintain the same level of competitiveness in the market.

In fact the conversion of productivity increases into shorter working time should be carefully designed in a thorough restructuring of production operations and of firm organization. The option between fewer working hours per day or fewer working days per week is also available. In any case an absolute proportionality between productivity growth and working time reduction could be hardly managed.

The second problem is relative to wage levels. Ignoring the first problem and assuming that in a manufacturing process the increase in productivity per worker were accompanied by a strictly proportional reduction in the hours worked per worker, the labour cost per unit of production would be constant if the worker's wage was kept constant. In this case the level of wages would not benefit from the increase in productivity. If, on the contrary, workers wanted to transfer to wages some of the productivity benefit, the proportion between productivity growth and working time reduction should change accordingly. In other words, workers are faced with a trade-off between change in wages and change in working time, and this would consequently affect the level of employment. With regard to this an important point ha to be made. In case of a working time reduction being generally imposed as a measure of economic policy, workers can still keep the choice about this trade-off using the possibility either to engage in other short time paid jobs or making themselves available for overtime work (unless these were effectively discouraged or prohibited). In this case any positive impact of shorter working time on employment would vanish. The probabilities of this happening are of course linked to the individual preference function; a greater utility attributed to income rather than to free or leisure time would act in this direction; something which is non unlikely to happen given the growing tendency to engage in a kind of social competition in terms of consumption and status symbols exhibition.

The third problem would arise if a general reduction of working time were extended to all the economy while different sectors have different rates of productivity increase. Obviously this would cause either an exit from the market of the firms in the sector with lower (or nihil) productivity growth, or a change (which could be very substantial) in relative prices. If the society thinks such change inappropriate the Government could act through taxes, transfers and subsidies to restore the previous equilibrium. An intervention of this kind has been experienced in Sweden in the mid of the nineties with a fundamental cooperation with trade unions collective bargaining (Erixon, 2008).

We can conclude that great care has to be taken in designing this kind of policies, but that with a careful combination of growth policy and working time management it is possible to maintain the goal of full employment even in times of heavy job destructive technical progress.

Now a similar but quite different question has to be asked: can a shortening of the working time be used as a measure to curb the rate of unemployment even when the economy is far below full employment and unemployment is not caused by technical progress? What can be done when there is

not enough technical progress to be converted into reduction of working time to fill the wide gap between demand and supply of labour? In this case the limit to the increase of employment (apart from frictional and structural unemployment for which effective active labour policies are appropriate) would be set either by wages above the equilibrium level or by insufficient aggregate demand. When the latter is the case the question is whether, while aggregate demand stimuli are taking time or are unable to achieve its growth, it could be of some help to act to convert the total labour input of the economy into a larger number of job places through a reduction of the working time. It has to be said that this possibility is prejudicially opposed by those who think that the labour force unable to find jobs in the production of goods and services for the market should be employed in jobs to satisfy social needs (such as so called "third sector" activities, no-profit, and so on). This would have a double advantage: it would lessen the drive towards consumerism (because "absolute" needs and not "relative" needs would be involved) and it would rise real wages because private expenditure for basic needs would decline (Valli, 1996). It is clear that this perspective may be thought as complementary and not in contrast with the above said perspective of "redistribution" of jobs, because of political feasibility and its risk of state paternalism and also because its public financing would in any case require a sufficient level of market production.

Another radical opposition to the perspective of shortening the working time in order to increase employment comes from the argument that the supposed increase would be swept away by entrepreneurs's readiness to pay higher wages for more productive workers working longer: since shorter working time and lower unemployment would "worsen the quality of a worker's effort; then a maximizing firm has an incentive to substitute a higher wage for fewer workers. A decrease in standard working hours thus may not result in a lower unemployment rate" (Chun, p.367). This argument, though, is based on the unproven assumption, of Shapiro efficiency wage flavour, that "an increase in unemployment rate motivates the worker to furnish much more effort" (ibidem) and vice-versa.

The main problem of this perspective rests in the relationship with wages. In fact, should the shortening of working time remain within the limits of the increase in productivity, as long as the necessary organization adjustments are made, no rise in labour cost per unit of production would occur. But if this measure exceeds the increase in productivity, the only choice is between cutting wages and/or rising production costs. The first choice could be dealt with in the frame of the trade-off between income and leisure time, the second could be tackled with cutback of non labour costs and

with infra-industry and international harmonization to avoid loss in competitiveness. Both could be eased with State intervention. Since what matters to workers is disposable income and to entrepreneurs gross labour costs, a reduction of tax and social security contribution would help protecting both net wages and labour costs for unit of production. The most effective use of worktime reduction for work sharing with state subsidies has been made in Germany during last recession: "Short-time work was the "German answer" to the economic crisis. The number of short-time workers strongly increased in the recession and peaked at more than 1.5 million. Without the extensive use of short-time work, unemployment would have risen by approximately twice as much as it actually did (Brenke and others, 2011), although state intervention seems to have led to abuses after the end of the crisis. If a general change of functional distribution were also allowed, the possibility of altering the share of profits would add some degree of freedom in dealing with the problem.

If a general reduction of working hours imposed by law encounters several problems of the kind just recalled, an easier path is to create space for flexible and gradual reductions based on personal choices or collective agreements. On this line would be the possibility of agreeing voluntary marginal reductions of working time joined with wage reductions, such as, for instance longer periods of unpaid vacations, or longer temporary leaves, unpaid and for various purposes, or even the possibility of sabbaticals. Another option could be to free the part-time work from its features of forced, precarious, peripheral and unskilled job and to extend it to voluntary opportunities for central well-structured tasks requiring high responsibilities and high skills.

Still more, retirement regulations could allow for flexible retiring ages, with gradual reduction of working time linked to progressive inclusion of young workers in the firm. In this way the concept of working time per worker that we have been referring to becomes closer to that of working time per person. The ratio between total hours worked and total population is bound to decline if the number of pensioners and their life expectancy rise and the entry into the labour force of youngsters is delayed. But this process doesn't mean a decline of working hours per worker; on the contrary it could call for its growth, turning the process against the work sharing perspective.

Finally, agreements and regulations which make overtime work less costly than standard work should be avoided. All these operative lines must be carefully designed and organically conceived as part of a coherent strategy. This composite strategy of shortening working time requires three pre

conditions in order to be effective and not disruptive of the economy: first, an efficient labour market working according to the principle of "flexicurity"; second, an improved work organization within the firm following the lines of the "lean production"; third a good degree of international coordination among national regulatory systems and among workers and entrepreneurs representatives.

Conclusion

A short conclusion can be drawn as following.

In order to lessen unemployment of "classical" nature, measures concerning wage moderation and active labour market policies are needed; but these are not sufficient in order to achieve full employment.

When unemployment of "Keynesian" nature (as Malinvaud calls it) pervades the economy, the implementation of policies aimed at expanding effective demand are also needed. But even these are not sufficient when "technological unemployment" arises.

When the path and the depth of technical change are such as to make it impossible for the rate of growth to keep up with it, then a shortening of the working time per worker seems to be also necessary in order to keep the goal of full employment.

This measure, though, has to be carefully designed in order to avoid distortions and negative effects on the economy when applied to specific productive sectors. Careful calibration and overall reorganization of operational tasks of the productive process of the firms are also needed. In addition, it should also be framed in a context of international coordination and harmonization.

In the meantime, a set of gradual reforms to help an initial redistribution of the work for which effective demand exists, could be adopted, such as a reorganization of "part time" work, a lengthening of vacations and temporary leaves, a better regulation of overtime work and a flexibility in retirement age. All this should allow a better distribution of the benefits of technical progress, instead of technology improvements being used to slacken the labour market by maintaining constant the working time and making more workers compete for fewer jobs and declining wages.

On these lines one should carefully think about the following Keynes plea. Considering the deep practical knowledge of the economy possessed by Keynes no one could think of him as just a visionary utopian.

"I would predict that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is to-day…. For many ages to come the old Adam will be so strong in us that everybody will need to do some work if he is to be contented. We shall do more things for ourselves than is usual with the rich to-day, only too glad to have small duties and tasks and routines. But beyond this, we shall endeavour to spread the bread thin on the butter – *to make what work there is still to be done to be as widely shared as possible.* Three-hour shifts or a fifteen-hour week may put off the problem for a great while. For three hours a day is quite enough to satisfy the old Adam in most of us!... But beware! *The time for all this is not yet.* For at least another hundred years we must pretend to ourselves and to every one that fair is foul and foul is fair; for foul is useful and fair is not". (Keynes, 1930, p.370 – 373)

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