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Résumé de l'article

The subject of technological unemployment is used to illustrate how accepted theory leads to wrong answers because the technique used is that of partial equilibrium analysis. On this basis one rules out the investment needed to make the change in production method. In a dynamic context, in which such change continues, the employment effects of this investment should be allowed, and they can be seen to be substantial relative to the loss in employment from the installation of the new capital equipment. The result is that technological change conceived in this broad context is expansionary, and the implications for industrial relations and other policies is very important.

COMMENTAIRES

TECHNOLOGICAL UNEMPLOYMENT A FAILURE IN THEORIZING

Earl F. Beach*

The subject of technological unemployment is used to illustrate how accepted theory leads to wrong answers because the technique used is that of partial equilibrium analysis. On this basis one rules out the investment needed to make the change in production method. In a dynamic context, in which such change continues, the employment effects of this investment should be allowed, and they can be seen to be substantial relative to the loss in employment from the installation of the new capital equipment. The result is that technological change conceived in this broad context is expansionary, and the implications for industrial relations and other policies is very important.

Economists have suffered a dramatic loss of prestige during the last decade. Criticism is heard from within the profession as well a from others. Heller[1] recently listed nine presidential critics.

There is, however, little consensus on the reasons for the inadequate performance. It should be helpful to focus attention on a particular area, a theoretical question that has been disputed for two centuries with little agreement even as to whether or not there is a problem. Yet the theoretical ingredients are at hand, and it remains but to put them together properly.

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[1] W.W., HELLER, «What's Right With Economics?» A.E.R. March 1975.

[2] TECHNOLOGY AND THE AMERICAN ECONOMY, a Report of the National Commission on Technology, Automation, and Economic Progress, Volume 1, February, 1966.

It is, moreover, an area of practical importance. Within the past decade there has been a National Commission[2] specially appointed, a major study at a major university,[3] a special international conference,[4] and untold numbers of research projects touching various phases of the matter. Only a kind of blindness has stood in the way of a resolution of the theoretical question, the answer to which is basic to the proper handling of the practical problems which abound.

The subject of technological unemployment is surely a good testing ground for economic theory. Let us review briefly the significant events in its long and colorful history.

Adam Smith was not worried about these matters, but he was writing during the early years, before machines had appeared in quantity. Say's treatise[5] showed an evolution of his attitude with successive editions, from one of caution about the introduction of machines, to one of denying any interference with their introduction. Ricardo's change in opinion was in the opposite direction, and occurred with dramatic suddenness with the third edition of his *PRINCIPLES*. McCulloch was very disturbed and responded with vigor in a way that has found much sympathy among economics ever since. Gide and Rist suggested[6] that the classical economists were as hard hearted on this matter as the Marxists were in their own sphere. The neoclassical economists proved to be much the same.

Marx built a substantial theoretical structure on the Ricardian basis. One bit of his theory has become widely accepted among economists, and in this acceptance can be seen the weakness of current theorizing on this matter.[7] The Compensation Controversy was con-

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[3] HARVARD UNIVERSITY PROGRAM ON TECHNOLOGY AND SOCIETY, 1964-1972; A FINAL REVIEW; Cambridge, Mass., 1972, E.G. Mesthene, Director.

[4] T. EVANS, and M. STEWART, PATHWAY TO TOMORROW: THE IMPACT OF AUTOMATION ON PEOPLE, A survey of the International Conference on Automation, Full Employment, and a Balanced Economy at Rome in June, 1967. (Pergamon, Oxford)

[5] C. GIDE, and C. RIST, A HISTORY OF EXONOMIC DOCTRINES (D.C. Heath and Co., p. 112)

[6] *Op. cit.*, p. 181

[7] E.F. BEACH, «A Naive Argument» RELATIONS INDUSTRIELLES/INDUSTRIAL RELATIONS August, 1974. In this brief note M. Blaug is seen to repeat the so-called «Naive argument» which stems from DAS KAPITAL that the disemployed cannot be expected to be reabsorbed in the making of the machinery that displaced them because if they were, there would be no saving in unit costs which was the reason why the machinery was introduced. But this is a long run or partial equilibrium form of analysis. To see that it is inappropriate we need merely ask what difference it might make

tinued in the German literature and brought to the English literature by a group of German expatriates during the 'thirties. English economists regarded Marx as a socialist, with little to contribute to theoretical economics.[8] It is to Schumpeter's credit that he helped make the reading of *DAS KAPITAL* a part of an economist's training.

There are some curious episodes in this development. Of five German economists who came to the United States during the 'thirties, Schumpeter alone felt that there was no serious problem. In contrast, Lederer, Gourvitch, Neisser and Lowe all expressed their worries in print. Schumpeter, in his *HISTORY*,[9] declared the Compensation Controversy «dead and buried», disposed of by a superior theoretical technique. He specifically refers to Hicks's *THEORY OF WAGES* as illustrating this new technique. Hicks, on the other hand, was not satisfied with his findings, and recently he has returned to this specific question.[10] In the second edition of the *THEORY OF WAGES* he discusses Schumpeter's infatuation with the technique, of which he was somewhat sceptical. His continuing struggle to improve it over four decades has been remarkable. It is also notable that he has confused rather than illuminated the question at hand.[10a]

In the United States in recent years, the controversy has taken the form of an argument between the structuralists and the generalists. In this form, however, it is not likely that the fundamental question will be posed, not to say answered. On the fringe of this long debate there is even more vehemence and less light.[11]

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if the process of mechanisation were speeded up. Surely there would be some point at which they would all be reabsorbed, and indeed there could be a shortage of labor, if the process of mechanisation were rapid enough.

[8] See the Bibliographical Appendices of the Ashley edition of Mill's principles where Marx is mentioned only in the short section on Socialism.

[9] J.A. SCHUMPETER, HISTORY OF ECONOMIC ANALYSIS (Oxford, 1954) p. 684. Schumpeter's discussion of this subject is very one-sided, making no mention of the writings by Lederer, Gourvitch and Neisser that were then still current. It is interesting to speculate on whether he might have changed it if he had lived to complete the writing of the book.

[10] E.F. BEACH, «Hicks on Ricardo on Machinery» The ECONOMIC JOURNAL, December, 1971

[10a] In his CAPITAL AND TIME he maintains his «capital shortage» model. See esp. Chapter X

[11] It is not enough to label these arguments as «fatuous» as does R. Solow on p. of THE REPORT OF THE PRESIDENT'S COMMISSION ON AUTOMATION — A CRITIQUE, Public Affairs Conference Report, No. 4 (National Industrial Conference Board, 1966). Solid counter argument is needed.

THE FUNDAMENTAL QUESTION

It is easy to pose the basic question: What is the net employment effect of technological change? It is important, that it be understood.

Consider first, the meaning of the term «technological change». Economic theorists define this to mean a shift of a production function,[12] so that for the same inputs, more output can be produced. In much the same way, mechanisation is a movement along an isoquant, indicating a change in the proportion of the inputs, with no change in output. The points of comparison are all points of equilibrium, with adjustments finished. There is no indication of how the move is made from one point to another.

This is a narrow definition, and quite often the debates are confused because the general public does not realize that economists choose to answer a question that is much more circumscribed than the one which is in their minds. On behalf of the economic theorists, it is claimed that they wish to explore the effects of one change at a time, and they regard the investment needed to bring about the change as another causal factor. In principle, it is said, these production changes can take place without any additional investment, and hence each factor should be investigated separately.

Such a defense is more difficult, however, in the case of pure mechanisation, because in this case there most be some addition to the capital available. Even here, the economist points out that he is considering long run equilibrium positions, before and after, when, in each case, the economy has come to rest and the temporary investment effects have disappeared. Such an analysis should not be applied directly, however, to an economy which continues to mechanise, because the investment effects continue, at a pace related to the speed of the shift.

In the case of pure technological change, much new investment is usually associated, whether it is recognized or not,[13] and hence to base

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[12] Our discussion is confined to the discussion of a change in the production method of a given commodity. The essence of the argument applies equally well to a change in commodity, though some theorists emphasize the difference. Indeed, many changes in method come about by the creation of new commodities, such as the automobile and the electric motor.

[13] Much real investment is hidden in the accounts of firms which consider active change as an essential element of survival. The purchase of a product may include some payment toward the research and introduction of a new product, the cost

one's anslysis on the rare exception is to misguide. Thus, as Marshall pointed out long ago, analysis based on comparative statics is but a first step to a complete analysis of a dynamic economy. Some synthesis should be made of the various partial analyses.

The distinction between pure technological change, a shift of the function, and pure mechanisation, a movement along an isoquant, is impossible to maintain in practice. Such changes as do take place are a combination of the two, and what is needed is a theoretical technique which can handle the general question, with enough flexibility to be varied as one or other of these influences is the stronger. Automation is not a new phenomenon in this respect. Thus, in the statement of the «fundamental question» above, the term «technological change» is to be taken in broad terms of an actual change, which is likely to be a combination of the two aspects, and requiring some new investment to bring it about.

This leads to the next group of questions, which is a matter of distinguishing among the different kinds of effects on employment. There are, on the one hand, the direct effects of disemployment usually experienced by the operating laborers at the time the new machinery is installed. They may not suffer actual unemployment if they are working for a large company which can give them alternative jobs. They are unlikely, however, to continue working on the same production activity, because that would imply a reduction in price of the product and an elasticity of demand that would be unusual. It may be expected that there will be some unemployment of operating labor, and the length of that unemployment is likely to be not very different from the average length found to characterise unemployed workers in general.[14]

The indirect effects are of several kinds, and more difficult to trace out. There is a growth in indirect employment that has been recognized in government statistics, which shows the shifting of employment from the operating floor to the maintenance and repair of

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of which is written off as part of current expenses. Expenditures on research labs may be reported, but costs of planning, training, and adjustment are only imperfectly measured.

[14] Arguments can be found to suggest that the average that is applicable to those who are technologically unemployed should be longer, and also that it should be shorter. Since it is virtually impossible to distinguish these unemployed from others, such arguments are of little use. It has also been argued that the concept of length of unemployment is inappropriate in this context. Such an argument, however, is clearly one of comparative statics, and emphasizes the need to shift to the dynamic context of the real world.

machinery, from floor supervisors to accountants and engineers, etc. Over the years, this shift if substantial, but in a particular case of technological change it is but a small part of the total change taking place.

The indirect employment effects which result from the improvement in productivity are very generally recognized in the literature, and can be assumed to be strongly positive, on balance. There can certainly be some disemployment effects as adjustments take place throughout the economy, but these will be swamped by the increase in real spending and productive activity.

These productivity effects are usually thought of as «long run» in contrast to the «short run» disemployment effects. It can take a very long time for all of the effects to appear, but some of them begin to appear quite soon. Many observers are pleased to note how quickly they seem to develop, a matter to which we shall return presently.

These productivity effects develop through a lowering of the price of the product and an expansion of output, or through increased profits which can be invested in further expansion of production facilities for this product or others. It is easy to see why economists have found it difficult to trace all possible paths; they have tended to fall back on historical statistics to support their conviction of adequate positive effects. Their faith in the neoclassical assumptions of continuity and fluidity are said to be justified.

One kind of effect that is generally excluded from consideration is the investment needed to bring about the technological change. The only investment allowed is that which occurs later, and as a consequence of the improvement in productivity, for example to increase the supply of raw materials for the commodity in question.

We have chosen to discuss the matter of technological change as a complex whole in a dynamic context, and the investment entailed is an important part of it — how important will be seen presently. It is, of course, possible to bring about some change without additional investment, simply by re-investing the depreciation allowances in newer types of machinery. There is much improved productivity from the workers learning as they work. Even here, however, we must be careful to account for any hidden investment.

The disturbances which cause the greatest outcries, however, are the sudden great changes such as the construction of huge automated

factories, which require large amounts of new investment. Let us consider an example of this kind of change.

A large cement company[15] recently built a new plant at Bath, in Ontario, to replace an old one not far away, at Belleville. The new plant has a capacity that is somewhat larger than the old one, but is to be operated with about half the work force. The company has made available the details on the numbers of workers at the old plant who took early retirement, those who were laid off, and those transferred, mostly to the new plant. The company assisted in seeking alternative jobs for those laid off and has some knowledge of their length of unemployment.

Calculations have been made of the amount of wage and employment loss, with no allowance for the termination benefits given by the company, or unemployment benefits paid by the government. These totals were compared with the extra employment that occurred at the construction site of the new plant, without taking into account the employment effects of the materials and equipment that was brought to the site from elsewhere. There is little doubt that the extra new employment on site was many times that lost through the closing of the old plant. The multiple was of the order of ten. This is not to deny, of course, that there are real costs of such change; it is merely to cast light on the economic question of net employment effects of such change.

It can be argued that, in general, such employment effects will be substantial.[16] If there is an annual saving in labor costs of x dollars, there will be an investment of a multiple of x. The investment takes place earlier than the displacement, and there will be multiplier effects, so that the total wage creation should be much larger than x; and yet x would be the actual wage loss only if the displaced workers remained out of work for a year on average. Official statistics show that the average length of unemployment is closer to a third or a quarter of a year.

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[15] These data have been supplied by the Company, but similar data can be found in ROCK PRODUCTS, « For the Cement Industry; a Time of Crisis » by R.S. HARWELL, April and May, 1968. It is very relevant that the concern of this author is the availability of capital for the new investment that is seen to be necessary for the conversion of the industry.

[16] E.F. BEACH, « Hicks on Ricardo on Machinery », E.J. Dec. 1971, and E.F. BEACH, « Automation in Perspective », APPLIED ECONOMICS 1971, 3, 147-152.

There is much concern over the pace of technological change. It is presumed that the more rapid the change, the greater the adjustments to be faced, and hence a speed-up is to be feared. Yet if this pace is increased, investment must be increased pari passu, and if the employment effects of the investment are as substantial as they seem to be, the early increase in spending should help the displaced workers to find alternative jobs.

Clearly it results in a distortion of the analysis to rule out the investment effects in a dynamic context. Those who look at the past record are lulled into thinking that there is no serious over-all problem. They are too easily convinced that the economy adjusts adequately. Yet it is the income effects from this investment spending that facilitates the adjustment. One is reminded of Taussig's sharpness when he noted that international balances seemed to have adjusted faster than he had reason to believe from the traditional gold flow analysis. Subsequent discussion brought to light the great importance of the income effects in speeding up the adjustment process.

This bias in attitude affects the economists' approach to fiscal policy. The government is said to bear the burden of maintaining a proper climate, which generally implies providing enough aggregate demand, so that the displace workers can be absorbed with a minimum of disturbance. The recognition of the function of investment in the process of technological change shows that the government is not the stoker of the furnace, the sole provider of fuel, but should play the part of the governor, sometimes dampening the fire. It would have been helpful to have been aware of this during the last ten years.

Attitudes on industrial disputes are affected. Real costs of change are recognized, and the tendency is to place burdens on the companies attempting to make such changes, which must tend to slow up the process. Yet, if it can be seen that society as a whole benefits from such change, and a slowing up brings less benefits; that moreover, the increase in incomes allows the government income out of which to facilitate such change, the whole burden should not be placed on the companies. Of course, governments do help through unemployment benefits, training programs, etc; but such programs should not be seen simply as socially necessary programs, but programs that are economically supported by the results, and a cost benefit analysis might suggest that they be increased.

AN ANSWER TO THE FUNDAMENTAL QUESTION

We may now return to the fundamental question: What are the net employment effects of technological change? We are asking a question in terms of economic theory, not in terms of social or real costs. Is it possible to estimate the employment effects in such a way as to draw up a balance? The answer seems to be yes. Not all of the effects can be measured, and not all cases need be explored.

We can make a rough estimate of the disemployment effects of the installation of new equipment, as against the positive employment effects of the investment needed to bring about that change. These are both short run effects, occurring in much the same time period of change, and hence very relevant to the assessment of total effects in a dynamically changing economy. The result is a positive net employment effect, which is then reenforced by the «long run» effects that result from the improvement in productivity. Thus a clear conclusion is reached, without the necessity of tracing through the multiplicity of such effects. The conclusion differs markedly from much current opinion.

These changes tend to take place in typically Schumpeterian cycles, but the fundamental question is to be answered in terms of smooth growth, from which variations can be allowed. In this context it is difficult to escape the conclusion that technological change is expansionary. We should be more concerned about its regularity than its pace.

THE NATIONAL COMMISSION

The perversity of modern attitudes can be seen in some of the recent reports. The Harvard Program[17] used 17 economists out of a total of over a hundred scientists, yet the fundamental question does not seem to have been raised in any form. The Report of the National Commission on Technology, Automation, and Economic Progress[18] is even more revealing.

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[17] See footnote #3, and also E.G. MESTHENE, TECHNOLOGICAL CHANGE; ITS IMPACT ON MAN AND SOCIETY (A Mentor Book 1970)

[18] See footnote #2, and also H.R. BOWEN and G.L. MANGUM, eds., AUTOMATION AND ECONOMIC PROGRESS (Prentice-Hall, 1966) from which many quotes could be taken to support the following analysis.

The Commission was asked to examine the employment effects. President Kennedy is reported[19] as saying: « The major domestic challenge of the Sixties is to maintain full employment at a time when automation is replacing men. It is a fact that we have to find over a ten-year period 25,000 new jobs every week to take care of those displaced by machines and those who are coming into the labor market. »

Of course, good reports are seldom written by a group of people with conflicting interests, but there were two outstanding economists on the Commission, and a substantial number of research reports. The paucity of the analysis contrasts with the recommendations. We need merely note some interesting points.

The first chapter discusses the pace of technological change, and expresses the concern. It merely attempts to assess whether the pace is quickening or not, measured in abstract productivity terms. There is no discussion of the relevant investment.

The second chapter contains such economic analysis as is to be found in it. The approach is summarized at the bottom of page 9:

> « Changes in the volume of unemployment are governed by three fundamental forces: the growth of the labor force, the increase in output per man-hour, and the growth of total demand for goods and service. »

These three factors are treated as virtually independent. The government is responsible for the total demand, and the other two are apparently to be taken as exogenous forces. There is no attempt to establish a relationship between the improvement in productivity per man-hour and the changes in total demand, as indicated by our previous analysis. Let us use some of their figures on p. 17 to establish the orders of magnitude.

Consider an employed work force of 80 million and an annual improvement rate of 2 per cent, a figure taken from the previous chapter. Then, if output were to remain unchanged, 1.6 million persons could be dispensed within the course of a year. If they were without work for a full year, and the average wage were $10,000, this would represent a wage loss of 16 billion dollars.

But such improvement in labor productivity does not happen by chance. A substantial investment is needed to bring it about. In order

[19] This quotation is the introductory statement used by Dunlop to begin his Introduction to AUTOMATION AND TECHNOLOGICAL CHANGE ed. J.T. DUNLOP (The American Assembly, Prentice-Hall, 1962). The Report of the Commission leaves no doubt on this point.

to produce an annual saving in labor costs of 16 billion dollars, an investment of the order of four or five times this amount would be needed, say 70 billion dollars per year. Such an investment would create wages payments much greater than 16 billion,[20] and with such investment going on, the displaced workers would be unlikely to remain unemployed for the full year.

These calculations are very rough, of course, and meant only to obtain some ideas on magnitudes, and show the tremendous difference between considering the narrow definition of technological change used by the economists, and the broad context of technological change in real life.

L'IDÉOLOGIE INITIALE DE LA CTCC UNE RÉPONSE À LOUIS-MARIE TREMBLAY

Alfred Charpentier*

Ces commentaires sur l'ouvrage de Louis-Marie Tremblay[1], se borneront aux préliminaires du chapitre premier (pp. 23-33) dans lesquelles l'auteur analyse l'idéologie du début de la Confédération des travailleurs catholiques du Canada et prétend démontrer que cette idéologie n'a pratiquement commencé à évoluer qu'en 1949, à partir du drame de la grève de l'amiante à Asbestos. Or selon mon expérience vécue dans ce mouvement l'idéologie de la C.T.C.C. a commencé d'évoluer avec la grève du textile en 1937. L'auteur fait quatre observations inexactes, à savoir que l'idéologie initiale de la C.T.C.C. était pro-corporatiste, qu'elle s'apparentait à celle des Chevaliers du Travail «et qu'un nombre imposant des leaders des premiers syndicats nationaux avaient milité auparavant au sein des Chevaliers du Travail» (p. 24). La dernière affirmation est exagérée. «Les leaders des premiers syndicats nationaux qui avaient milité auparavant parmi les Chevaliers du Travail» n'étaient pas un «nombre imposant».

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[20] A multiplier could be applied to this investment if any substantial part of it were the result of monetary creation, especially since the investment takes place before the installation and disemployment; but such a multiplier is not needed to see that the wage creation out of an investment of 70 billion would be at least 35 billion.

* Alfred Charpentier âgé aujourd'hui de 83 ans est un des fondateurs de la C.T.C.C. (CSN). Il a été président de cette centrale de 1935-1946.

[1] *Le syndicalisme québécois. Idéologies de la CSN et de la FTQ 1940-1970,* Montréal, Les Presses de l'Université de Montréal, 1972, 288 pages.