ABSTRACT

This thesis consists primarily of a critical review of recent literature on the subject of the employment effects of technological change. The analysis of this literature is derived from a 1942 article by Hans P. Neisser, directed against the orthodox denials of the possibility that technological progress could cause "permanent" or unreabsorbed displacement of labour. Arguments classified under one of the Say's Law, neoclassical, or wage fund schools are examined using the Neisser framework. As a secondary aspect, some elaboration is undertaken of the process by which uncompensated technological unemployment could arise. The main conclusion made is that, in agreement with Neisser's appraisal of the literature of his time, modern economic analysis is not able to refute the theoretical possibility that technological change can lead to the creation of a persistent pool of unemployed labour as outlined by the Marxian schema.

RESUME

La présente thèse expose et critique certains textes récents sur les effets du progrès technique sur le niveau d'emploi. L'analyse de ces textes s'inspire d'un article de M. Hans P. Neisser publié en 1942. Cet article s'adressait aux penseurs traditionnels qui refusaient l'idée que les changements technologiques puissent entraîner un déplacement "permanent" ou non réabsorbé de travail. On utilise le cadre conceptuel de Neisser afin d'analyser les différents raissonnements, classés par écoles (Loi de Say, néo-classique, fonds de salaire ou "wage fund"). D'autre part, on décrit un processus qui pourrait générer le chômage technologique non compensé. Ainsi, en accord avec l'analyse critique de Neisser sur les textes économiques de son temps, on conclut que l'analyse économique moderne n'est pas en mesure de réfuter l'idée marxienne selon laquelle un nombre assez grand de travailleurs restent inemployés à cause des changements technologiques.

"PERMANENT" TECHNOLOGICAL UNEMPLOYMENT RECONSIDERED

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CHAPTER I

INTRODUCTION

Periods of stagnation and unemployment have occurred in every society which has experienced industrial development under a system of unregulated private enterprise. Such periods, since they could not be blamed on so obvious an event as crop failure as they might be in a pre-industrialised society, tended invariably to cause a flurry of speculation into the theoretical possibility that the lack of employment could be attributed to the machines which very clearly seemed to be taking over tasks which had previously given jobs to workers. Opposing this viewpoint were always those who felt the lack of employment to be merely a temporary discrepancy which would quickly right itself by its own impetus, or once any unwarranted restrictions on the free workings of market forces were removed. These opposing sides of thought have been engaged in a debate almost as long as the period of industrial

development, a debate which has risen in intensity as the problem of unemployment rose in public importance as a serious recognised problem of the economy. Despite the length of the debate, the current wide range of opinion surrounding the question of technological unemployment indicates that the theoretical problem has not been resolved to general satisfaction.

In the preface to Gourvitch's survey of the history of economic thinking on technological unemployment[1], it is noted that there have been recurrent waves of interest in the question as the problem of involuntary unemployment became important in real life. But,

> In each such wave there was a tendency to regard the problem as peculiar to the then current phase of economic development and our own interest today is no exception.[2]

This passage was published in 1940 when the western

[1]Alexander Gourvitch, Survey of Economic Theory on Technological Change and Employment (Philadelphia: Works Project Administration, 1940).

[2]Ibid., p. v.

industrialised world was just beginning to pull out of the Great Depression of the 1930's. Obviously the commissioning of the book by the U.S. government constitutes to some extent the passage's own contradiction, since it indicates that the U.S. government did not think the problems of the 1930's to have been "peculiar" or unique to the degree that one could not benefit from the conclusions past thinkers had reached on the possibility of technological unemployment.

Nevertheless, the above quoted statement is probably valid insofar as a great deal of the literature appearing on the subject in the period tended to redebate the same basic questions of earlier economists, making few original contributions.[3] The same comment could be made about many recent writings on the question of technological unemployment, interest in which was revived by the re-appearance of high levels of unemployment in the North American economy in the late 1950's-early 1960's and even more recently in the late 1960's-early 1970's. Thus, many arguments have appeared

[3]This is not to deny, of course, that a few exceptional works have made great steps forward.

in the past decade with their protagonists appearing to be unaware of the criticisms and doubts which followed the publication of very similar ideas in the past, many of these criticisms and doubts never having been fully answered or refuted.

Hans Neisser, in the 1942 article which is the basic reference work of this paper,[4] set out specifically to refute all of the traditional theories which denied the possibility of technological unemployment and which true to historical form, proliferated in the Depression-period literature. It can probably be safely stated there was no immediate response which was able to demonstrate the invalidity of any of Neisser's basic criticisms. Taking Neisser's arguments as they stand, it is the intent of this paper to determine whether they continue to remain valid, or at least unrefuted, in light of some of the more prominent writings on the question of technological unemployment which have been published in the past decade.

As a secondary aim, it is also intended to

[4]Hans P. Neisser, "'Permanent' Technological Unemployment," American Economic Review, XXXII (March, 1942).

supplement and criticise Neisser's arguments where they might appear to be weak, especially inasmuch as he suggests alternative approaches to the employment effects of technological change. In the cases where his arguments appear unsatisfactory in the face of new developments, it seems warranted to expand on the basic arguments he presented in his article, since his omissions were, we submit, often due to the fact that he did not feel it necessary to elaborate on every facet of the approaches he criticised, particularly those which were no longer popular at the time of his writing. Rather, his criticisms were primarily aimed at specific writings which had recently appeared and been given some attention. Thus we find, for example, Neisser devoting a great deal of space refuting the Say's Law denial of technological unemployment using what might seem to us to be fairly obvious arguments, because a book published a decade earlier had used Say's Law in close to its original form and had been taken quite seriously.[5] But, although the line of his refuta-

[5] P. H. Douglas and A. Director, The Problem of Unemployment (New York: Macmillan, 1931).

tions might appear rather trite today, it will be shown that the type of reasoning against which they were directed has not completely died out.

Neisser was not the only economist of his period to attack the presumptions of the orthodox theorists when real-world evidence demonstrated the inadequacies of theories that predicted the impossibility of persistent involuntary unemployment. Neisser's much better known contemporary, Keynes, also criticised the assumptions underlying the classical and neo-classical arguments, and then presented a model which explained the possibility of the economy settling down to a less-than-full-employment equilibrium due to a lack of aggregate demand. One might wonder why Neisser, writing six years after the publishing of Keynes' General Theory, did not make greater use of Keynes' arguments in attacking the traditional denials of the theoretical possibility of involuntary unemployment.

As is pointed out below, Neisser was certainly aware of Keynes' arguments and briefly referred to them a few times in his article. But for the present, until we discuss this issue further in the final chapter, let us just state that Neisser seemed to be interested

in the effects that technological change could have on the level of employment over long periods in which technological change takes place (what Marshall would refer to as periods of "secular change"),[6] whereas Keynes attempted to explain the phenomenon of unemployment occurring due to a lack of aggregate demand which prevented the economy at a given time from reaching a potential level of full employment. To state this another way, Neisser in his article discussed the type of unemployment which, he felt, could not be any more than temporarily eradicated by policies which worked merely to increase the level of aggregate demand and which might therefore be regarded as "permanent". We shall return to this point in Chapter VII.

Finally, it should be noted that Neisser's article was published during a period of considerable renewed interest in Marxian economics.[7] This undoubtedly stemmed from

[6]Alfred Marshall, Principles of Economics, 8th ed. (London: Macmillan, 1936), p. 379.

[7]The year Neisser's article was published, 1942, was also the publishing date of among others, J. Robinson, Essay in Marxian Economics, J. Schumpeter, Capitalism, Socialism, and Democracy, and P. Sweezy, Theory of Capitalist Development.

the influx of many German-speaking expatriates (of whom Neisser was one) to Anglo-Saxon academia, who brought with them a Marxian interpretation of the Great Depression. In light of the failure of orthodox theory and Keynes' ideas not having yet been totally understood and accepted, the Marxian alternative seemed especially attractive. Thus it seems natural that Neisser, himself having been grounded in the Marxian tradition, should offer the Marxian approach as an alternative interpretation of the phenomenon of technological unemployment. However the primary purpose of his article was not to offer an alternative, which he discusses only briefly, but to point out the weaknesses of the traditional theories which purported to prove the impossibility of technological unemployment.

In his article, Neisser did not, in fact, attempt to arrive at any positive conclusion as to what the consequences of technological change would be for the labour force. Rather, he set out to show and felt that he had proved the following:

> There is no mechanism within the framework of rational economic analysis that, in any situation, would secure the full absorption of displaced

> workers and render "permanent" technological unemployment in any sense impossible.[8]

To arrive at what we might call this negative conclusion, Neisser delineated and discussed the three major schools of thought concerned with the question in the order that they were developed historically:

1. Say's Law of Markets approach.
2. The circulating capital or Wage Fund school.
3. The neo-classical equilibrium approach.

All of these three basic lines of thought, or in some cases only portions of them, have been brought back in various forms by economists whose writings have appeared in the past decade. As shall become evident, some of these arguments have been put forth in essentially the same form in which they existed when Neisser wrote his article, so that we need not, in these cases, elaborate from Neisser's arguments as he originally presented them. In other cases, however, the original theories have been much sophisticated or the conclusions altered, so that some further interpretation of Neisser's basic criticisms may be required

[8]Neisser, op. cit., p. 71.

in order to relate them to more recent works.

The publications to be examined in this paper from the viewpoint of Neisser's criticisms, will be discussed in the order that they seem most appropriately classified under one of the above three schools of thought. Thus Chapter II is devoted to those arguments in which Say's Law appears, Chapters III and IV to the neo-classical equilibrium approach, and Chapter V to wage fund formulations. In Chapter VI we digress from the main part of the paper to discuss the Neisser article in itself, rather than just using it as a frame of reference, to point out some of his omissions and to consider some of the alternative approaches to the question of technological unemployment that he proposes. A brief summary of the paper and a conclusion about Neisser's criticisms, that is, whether they remain unanswered by recent literature, are presented in Chapter VII.

CHAPTER II

VESTIGES OF SAY'S LAW

As mentioned in Chapter I, Neisser devoted a substantial analysis in refuting the implications of appeals to Say's Law because this "oldest argument against technological unemployment" had only a decade before been revived "in a little more sophisticated form"[1] by Douglas and Director.[2] The Say's Law approach depends basically on the assertion that, as Neisser expressed it, "Purchasing power is, by itself, indestructable."[3] However Neisser demonstrated that this assertion and the conclusion which followed out of it, namely that full employment would always be ensured, were valid only under the condition of

[1]Neisser, op. cit., p. 50.

[2]Douglas and Director, op. cit.

[3]Neisser, op. cit., p. 53. For a discussion of the various interpretations of Say's Law see Schumpeter's History of Economic Analysis, pp. 615-25. Our purpose here is to point out the relatively simple versions used.

some highly implausible assumptions. In short (and as we shall elaborate below), he showed that in order for the full employment conclusion to bear out it was necessary for the supply of any product for which demand might increase to be perfectly elastic in the short run, and the labour-to-output ratio had to be exactly equal in every industry whose demand might be affected as a result of technological change.

Keynes can be credited with convincing economic theorists once and for all of the invalidity of Say's Law, by making it appear plausible that creation of a supply of goods and services need not invariably create an equivalent and concurrent amount of demand in the economy. For this reason we are no longer likely to see arguments made by reputable economists which would attempt to make use of Say's Law in its full-fledged formulation in order to prove the impossibility of technological unemployment. However, to say that reputable modern economists would no longer directly assert Say's Law does not mean that elements of Say's Law do not continue to be used implicitly in much the same way that Douglas and Director used it, as will be seen shortly.

First we should point out as Neisser did, that the Say's Law approach and the neo-classical approach to the question of technological unemployment differ only in the extent of adjustment which must be allowed for in order for, as their proponents claim, full employment to obtain. Thus neo-classical theorists specify that technological unemployment is impossible only as a long-run equilibrium situation, meaning that capital equipment must have been fully adjusted as to quantity and "quality."[4] The proponents of Say's Law or the Law of Markets, on the other hand, feel that only short-run obstacles -- such as the transfer of expenditures from one good to another or of workers from one industry to another -- need to be overcome in order for full employment to be maintained. Thus when we say that Say's Law is being asserted in this context, we are referring to a writer's claim that market forces will act to absorb any surplus labour supply without any additional capital equipment having to be built.

[4]By "quality of equipment," Neisser refers to the degree of labour-intensity of the technique embodied in a particular piece of equipment.

As an example of the kind of literature in which implicit appeals to Say's Law continue to crop up, we refer to an article on "Automation and Jobs" by Yale Brozen.[5] The general conclusion of the essay is that most unemployment popularly attributed to technological change is actually due to the overpricing of labour by unions and minimum wage statutes. At one point in the article, Brozen outlines what happens when labour-saving technological change results in workers being displaced from an automated industry despite a fall in the price of output, because demand elasticity is not sufficiently high to maintain the previous level of expenditure on the product (that is, demand elasticity is less than one):

> . . . those buying the product must be spending less of their incomes for it than they formerly did. The leftover income will be used to purchase more of other products. The increase in sales of other products will provide job openings which will absorb people released from the automating

[5] Yale Brozen, "Automation and Jobs," a pamphlet published by the University of Chicago Graduate School of Business (Chicago: 1965).

> industry. These released people may be absorbed with no cut in wage rates or may obtain higher wage rates.[6]

It is to be noted that Brozen makes no mention about periods of adjustment being required in order for sufficient capital stock to be built. Thus we witness what is in effect an assertion of Say's Law as we have defined it, an assertion whose validity depends upon some very unrealistic assumptions about the economy which Neisser outlined and which are summarised below.

As Neisser carefully pointed out, unless there is a completely elastic supply of output of the automated industries (taken as a whole) in a case such as the one which Brozen describes, some of the diverted purchasing power will raise prices rather than output.[7] Even if the "indestructability of purchasing power" is not weakened by the price barrier, a further important assumption must be fulfilled if all of the displaced labour is to be reabsorbed. It must be assumed that, in all industries,

[6] Ibid., p. 9.

[7] Neisser, op. cit., pp. 53-54.

> . . . output and employment are rigidly associated. In other words, an output of, say, $1000 in industry A is supposed to be associated with the same amount of employment as an output of $1000 in any other industry (B, C, etc.) materializing during the same period.[8]

Not only is it implausible that labour-to-output ratios (L/Q) are identical in all industries for which there is changed demand, but the logical consequences of Brozen's statement are even more implausible. Since L/Q must be identical for all industries (or at least those affected by changed demand), technological change must either leave L/Q untouched, or technological change must occur simultaneously in the whole economy such as to keep the ratio identical in all sectors at all times. Brozen evidently intends the former, since he states the following:

> The product of the automating industry sells at a lower price after automation than that for which it would otherwise sell. If sales do not increase markedly and provide more jobs, or at least rise enough to maintain the number of jobs,

[8] Ibid., p. 55.

> those buying the product must be spending less of their incomes for it than they formerly did.[9]

By saying that maintenance of the previous level of expenditure is sufficient to keep all of the work force prior to automation employed in that industry, Brozen implies that L/Q must remain constant or increase. All in all then, Brozen offers us a very implausible model of the economy and of technological change, although he never defines these explicitly.

As a final comment on this particular article, we might note Brozen's implication that the technologically displaced workers can suffer no fall in wages when they are reabsorbed into other industries:

> These released people may be absorbed with no cut in wage rate or may obtain higher wages.[10]

Perhaps Brozen was being deliberately vague in the statement. His non-professional audience (to which the quoted paper was originally delivered) would presumably interpret the sentence to mean that wages for

[9]Brozen, op. cit., p. 9.

[10]Ibid.

reabsorbed workers either remain the same or rise. However when critically examined by economists, his use of the word "may" could be interpreted to leave open a third possibility: that workers "may" have to accept a fall in wages if they wish to be rehired. Unless Brozen is willing to admit to all of the unconvincing assumptions which were set out above, this is a possibility that he would have to leave open.

In fact, Brozen was aware of the possible adverse effects of technological change as an earlier article by him testifies.[11] In an appendix to this earlier article, he describes the following as a possible result of a labour-saving innovation:

> If the demand facing the industry is sufficiently elastic, its total labour requirements will increase. It will use a larger amount of capital in the aggregate. This means that under static assumptions it will absorb capital from other industries. The marginal productivity of labour in other indus-

[11] Yale Brozen, "Automation's Impact on Capital and Labour Markets," in Automation and Society, ed. by H.B. Jacobson and J. S. Roucek (New York: Philosophical Library, 1959).

> tries will drop, which will be reflected back into this industry. Consequently, wage rates will drop or unemployment will occur, despite increased employment in this industry.[12]

The qualification about "static assumptions" is meant to indicate that the process of new capital creation made possible by more productive techniques will be an offsetting force to reabsorb the technologically displaced workers. Brozen's faith in this process leads him to make the observation that:

> If we were to measure the number of jobs created by technological change, as well as the number of workers displaced, we would find that . . . more jobs have been created than have been eliminated.[13]

These passages indicate that, in contrast to the blanket assertions about the benefits of technological change made in the other article cited, Brozen is capable of taking a more calmly reasoned approach that leaves open the theoretical possibility that "wage rates will drop or unemployment will occur."

[12] Ibid., p. 393.

[13] Ibid., p. 282.

Brozen's personal opinion that such undesirable eventualities will not be the general result of technological change does not excuse omitting mention of these because they occur only occasionally. To characterise technological change as inevitably employment-creating and wage-increasing in the short run, as he does in the first article cited here, constitutes making an unstated assumption about the nature of innovations discussed.

Brozen's vagueness and silence about specific underlying assumptions is certainly not uncommon, particularly in publications which are not directly intended to present economic reasoning for critical analysis by academic economists. One example of such a publication is the report of the United States National Commission on Technology, Automation, and Economic Progress,[14] a commission which had been established in 1964 in response to the public concern that the high rates of unemployment in the late 1950's and early 1960's were caused by rapid technological change. Al-

[14]National Commission on Technology, Automation, and Economic Progress, Technology and the American Economy (Washington: U.S. Government Printing Office, 1966).

though the Commission was given the general mandate "To identify and assess the past effects and the current and prospective role and pace of technological change,"[15] the contents of their report indicates that the commissioners were largely preoccupied with the specific effects of technological change on the demand for labour.

The National Commission's concentration on employment effects is also attested to by the fact that it chose to define technological change, on the aggregate level, solely in the context of increases in labour productivity. The way to offset displacement of workers is stated as being the elementary mathematical problem of maintaining a rate of growth of national output equivalent to the sum of the rates of growth of the labour force and total labour productivity. All this can be accomplished, so it is maintained, by the simple expedient of "positive fiscal, monetary, and manpower policies."[16] To the Commission the solution, then, is one of providing the labour force with sufficient skills

[15] Ibid., p. xiv.

[16] Ibid., p. 16.

and maintaining sufficient aggregate demand to allow output to grow as fast as the sum of labour force and worker productivity increase.

The National Commission's interpretation of the phenomenon of technological change as it affects labour is some improvement from the most naive applications of Say's Law, since it is not assumed that "the indestructability of purchasing power" should absorb any displaced workers somewhere else in the economy. There is a recognition that aggregate demand may well be lacking in the future, wherefore comes the need for "positive" monetary and fiscal policies. Indeed, the tone of urgency with which the report views the counteracting forces on the level of employment -- growth of productivity and growth of output -- conjures up the image of a "race" in the Marxian sense.

However the Commission's failure to analyse the determinants of its narrow characterisation of technological change, at least in the main text of their report, makes the problem of reabsorbing displaced labour appear much simpler than it is in real fact. In the report, labour productivity growth is discussed as if it can be regarded as a fairly constant or, at the least, as an

exogenously determined rate. Adding to this the growth rate of the labour force (which almost everyone but the Malthusians would agree to be an exogenous variable), output has only to grow as fast as this independently determined rate to prevent unemployment from rising. It is thus stated that an increase in output will lead to a proportionate increase in employment, i.e., that "demand for commodities is demand for labour," as Neisser expressed Say's Law.[17]

In actual fact, statistics for any industrialised country will show that when real GNP begins to grow at a faster rate, even well before potential full employment is reached the rate of growth of labour productivity will also increase. Thus it is evident that there is a direct relationship between the rate of growth of output and the rate of growth of productivity, the possible explanations for which will not be dealt with here. What should be noted, though, is that there is a complex two-way relationship between the rates of growth of output and productivity, so that it is unrealistic

[17]Neisser, op. cit., p. 53.

to imagine that the former can be manipulated at government will to increase employment without this increase being at least partially offset by concurrent changes in the latter.

Because of the Commission's implicit appeals to principles of economics which are dependent on the same assumptions as a crude assertion of Say's Law, the reabsorption of technologically displaced workers is pictured as being within the practical reach of a government that is aggressive enough to use "positive" aggregate demand policies. But as Neisser explained and as we have recounted above, an increase in output cannot be assumed to be necessarily associated with a proportionately equivalent increase in employment, which is in effect what is done by assuming the rate of productivity increase to be completely exogenous. The problem of reabsorbing displaced labour may therefore be considerably more complicated than the National Commission implies it to be.

CHAPTER III

THE SIMPLE NEO-CLASSICAL EQUILIBRIUM MODEL

In comparison to the Say's Law and wage fund schools, Neisser felt that the neo-classical equilibrium approach to the question of technological unemployment "has a greater theoretical validity than the two older appraoches."[1] We will discuss Neisser's reasons for dismissing the wage fund theory in Chapter V and, as for Say's Law, we have described in the previous chapter Neisser's demonstration of the highly implausible assumptions on which the viability of this "law" depends. It was also noted in the previous chapter that the neo-classical interpretation of the problem essentially differs from the latter only insofar as it allows for a wider range of adjustment of economic variables to the impact of technological change. Unlike the Say's Law theorists, the neo-classicists of Neisser's day admitted

[1]Neisser, op. cit., p. 62.

that full employment of labour could be guaranteed only if wages were fully flexible, and when sufficient capital stock of the appropriate optimal technique had been built up. Thus the neo-classical proponents asserted that the economy would necessarily settle at a full employment level but only as a long-run equilibrium situation.

By defining a less rigorous condition of full employment, it might seem that the neo-classical analysis overcomes many of the weaknesses of the Say's Law approach to the question of technological unemployment. One might, in fact, judge that the eventual results of technological change on the demand for labour, as postulated by the neo-classical equilibrium approach, are theoretically plausible. However even if this is granted, we will try to demonstrate that the neo-classicists' tendency to concentrate solely on hypothetical long-run equilibrium situations leads them to give a distorted impression of the real-world phenomenon and effects of technological change. In the present chapter, then, we refer to a presentation of what we might call the simple or traditional neo-classical model, as put forth in a book by Herbert A. Simon.[2]

Since what is today called neo-classical analysis has been the reigning orthodoxy of economics since before the turn of the century, it should not be surprising that the theoretical tools of neo-classical economics have been greatly sophisticated in their interpretation of technological progress. Thus, much as the simple neo-classical model appears to overcome the most unrealistic rigidities of the Say's Law assumptions, the more advanced neo-classical models are a great improvement over the simple model. In the following chapter (Chapter IV) we will discuss the Salter model of technological change[3] and the empirical work carried out in this tradition by Murray Brown,[4] in comparison with the approaches suggested by the simple neo-classical model. But although these two "sophisticated neo-classical" works show great improvement over their pre-

[2]Herbert A. Simon, The Shape of Automation for Men and Management (New York: Harper and Row, 1965).

[3]W. E. G. Salter, Productivity and Technical Change (London: Cambridge University Press, 1969).

[4]Murray Brown, On the Theory and Measurement of Technological Change (London: Cambridge University Press, 1966).

decessors (as characterised by the Simon model), we will try to show that Neisser's basic criticisms against the neo-classical approach continue to hold.

As was mentioned above, Neisser believed the neo-classical argument against technological unemployment to be of greater theoretical validity than the other two approaches he examined:

> . . . the neo-classical one stands on much firmer ground, on account of its lesser scope. However, even the neo-classical approach is far from giving the unambiguous answers its adherents ascribe to it.[5]

By the "lesser scope," Neisser refers to the fact that the neo-classicists allow for the possibility of technological unemployment occurring because of the short-run immobility of capital and the rigidity of wages. However the latter is often only a technical requirement since most neo-classicists, such as Simon, claim that the inevitable result of technological change is to raise wages. On the former point, we note that Simon is indeed careful to emphasise that the postulated re-

[5]Neisser, op. cit., p. 52.

sults of his model economy apply only in the case of full long-run equilibrium.[6] He does nevertheless speculate empirically about what he judges to be the usual short-run effects of technological change, and we will discuss these speculations later in the chapter.

In short, Simon attempts to prove, through abstract analysis and historical example, that technological change can have only beneficial results for labour, in that any type of technological advancement, whether or not it is labour-saving, will in the long run be able to maintain full employment while increasing wage rates. Simon deals with a very simplified model economy, where "beanbricks" are the sole consumption and capital good. He then considers the long-run effects of a single technological change on his hypothetical economy. He finds, by way of numerical example, that in the new long-run equilibrium all workers are employed at higher wage rates, while the rate of return on capital (beanbricks) remains constant. However Simon admits that the results of his model depend on some crucial assumptions:

[6]Simon, op. cit., p. 19.

> The most important assumption is that the total amount of capital responds quickly and elastically to the price paid for capital, while the total amount of labour supplied responds only a little to the real wage.[7]

The conclusion derived from his theoretical model is thus inevitable:

> . . . any technological improvement, regardless of whether it conserves capital or labour, will increase real wages.[8]

If we accept Simon's assumptions then we would have to grant that, after a new long-run equilibrium has established itself following a technological change, the workers will have become the almost total beneficiaries of the change in technique. However we need not agree with Simon's total lack of mention of the labour displacement and deferred consumption which would have to take place during the adjustment period. He seems to treat lightly the fact that, for the happy results to bear out of his numerical examples, capital stock

[7] Ibid., p. 20.

[8] Ibid., p. 17.

would have to be multiplied several times.

For instance, in one of his numerical examples,[9] Simon discusses a postulated labour-saving innovation which would, at the new long-run equilibrium situation, have multiplied real wages 7.2 times. This new technique requires a capital stock of 60 beanbricks per man, which is 12 times the capital intensity of the former technique of 5 beanbricks per man. Then Simon states:

> If labour supply were constant, the stock of capital would have to multiply 12 times in the process of reaching the new equilibrium. However the capital supplied, as a fraction of total output, would only need to increase by 20 per cent. Such an increase could easily come about through a modest rise in the rate of interest.[10]

By implication, any technological change which does not entail an increase in the capital-output ratio would, according to Simon, not require any increase in the rate of interest to call forth additional capital, no matter how many times the capital stock would have to

[9] Ibid., p. 18.

[10] Ibid.

multiply before the new equilibrium is reached.

Simon is incorrect in implying that, in the course of adjustment to technological change, capital equipment will never be in inelastic supply in the transition from the original equilibrium to the new one. However his mistake comes easily from a method of analysis which compares two hypothetical equilibrium situations without giving any methodical consideration to the process of adjustment between these equilibria. It is evident that Simon is so taken up by the mechanics of comparative static analysis that he not only ignores the periods of wage decrease or unemployment which may take place before sufficient capital stock is accumulated, but he also fails to see that capital cannot be magically created out of potential future output. Note that, through the process of comparative statics, Simon simply supposes that new capital stock is created out of the much higher level of output at the new equilibrium, not realising that the capital stock must have been put in place <u>before</u> the new output can be produced. It is thus very possible that, before the new equilibrium is reached, great capital shortages and, consequently, increased interest rates may have ensued.

Simon overcomes the necessity of having to deal with the possibility of unemployment in the long run by simply defining a situation of long-run equilibrium as one in which all available workers are employed. Thus Simon does not even consider the question of technological unemployment, except to mention that unemployment is theoretically possible only in the short run. Instead, he assumes full employment as a matter of course and concentrates on the level of real wages. Citing historical experience he states:

> Industrialisation and increased mechanisation have consistently and persistently been accompanied by rising real wages. The opposite relation appears only occasionally over short intervals of time and is submerged in the long-run trend.[11]

Unless Simon were willing to dismiss stages of as much as 60 years as "short intervals of time," he must recognise the existence of a considerable amount of historical evidence which shows that there may in fact have been long periods of industrialisation which were characterised by constant or falling wages and involuntary

[11] Ibid., p. 27.

unemployment. For instance, there were available at the time he wrote his book several well-established pieces of literature which favoured the opinion that the general level of wages in Britain, the pioneer of industrialisation, had remained constant or perhaps even fallen between 1780 and 1840.[12]

We shall not here dwell on the validity of or reasons for this particular historical phenomenon, although it will be considered from a different viewpoint in Chapter V when we discuss the wage fund analysis. We might just observe at this point that Simon felt he could dismiss from consideration such periods of economic history when it is not at all clear that technological change was beneficial to the working population, because they were periods when the full benefits of long-run equilibrium had not yet been achieved. Simon obviously feels it to be an undisputable fact, looking back from the viewpoint of a twentieth-century industria-

[12] E.g., see W. H. B. Court, A Concise Economic History of Britain (London: Cambridge University Press, 1954), pp. 129-132. References are made to earlier works in Phyllis Deane, The First Industrial Revolution (London: Cambridge University Press, 1965), pp. 243-251.

lised society, that technological progress has bestowed great material benefits on the populations of industrialised societies, including its workers. This being the case, one can understand how his historical perceptions tend to reflect the weaknesses of the method of neo-classical equilibrium analysis; that is, they both tend to ignore any period of adjustment between equilibria during which the detrimental effects of technological change may have been felt.

It is partially for the neo-classicists's failure to deal explicitly with periods of adjustment, that Neisser believed a much more useful mode of analysis to be one which puts emphasis on the process of capital accumulation. Neisser did so because he felt that the important determinant of the level of employment at any particular time is the existence of equipment requiring a specific labour input. We will discuss this alternative approach in Chapter VI, but it should be noted here that we have not been accusing the neo-classical method of committing errors in its logic (other than Simon's statement about the interest rate). It is only suggested that the abstractions of neo-classical theory (i.e., perfect equilibrium situations) are not very useful for

examining the problem at hand, that is, the effects of technological change on the level of employment.

But even if one could accept Simon's historical observation that technological change is almost always associated with full employment and rising wages (which, he asserts, it invariably is in the long run), Neisser advises that we not dismiss the possibility of technological unemployment on the basis of "unanalysed historical facts."[13] What we might infer from this statement is that historical experience might, just as Simon's model, be based on certain crucial factors such as the relative abundance of capital and the relative scarcity of labour, factors which may be at least partially independent of the process of technological change itself. It is easy to see that if these assumptions about relative factor supplies are dropped from Simon's model (for instance, suppose that both capital and labour are in inelastic supply), full employment might be obtained after labour-saving technological change only if wage rates are decreased. This would be so if capital were scarce enough that the increased returns to capital

[13]Neisser, op. cit., pp. 52-53.

would more than offset the increased output obtainable from the new techniques. And if wage rates are inflexible downward, then "permanent" technological unemployment would arise. If such a reversal of relative factor supplies were to occur in the real world, this is the situation that would be predicted by the logic of Simon's model.

We mentioned above that the neo-classical model of the Simon type does not seem to be a particularly satisfactory one for interpreting the phenomenon of technological change, since it virtually ignores the path of adjustment between the hypothetical situations of long-run equilibrium. The weaknesses of the model are even more evident when it is realised that technological change, as it has typically occurred in history, usually consists of a cumulative and persistent process, rather than one of isolated and independent changes from time to time. Thus, even if we accept the notion of firms or industries moving from one long-run equilibrium to another, at any one time most of the economy may be in an out-of-equilibrium situation.

In the next chapter we relate arguments which challenge the legitimacy of interpreting the economy

in terms of movements towards long-run equilibria, even on the level of the firm. These arguments should make particularly more apparent the prevalence of non-equilibrium situations in a world in which technological progress is occuring. But even when the tendency towards a long-run equilibrium is accepted as properly characterising the effects of individual changes of technique in individual firms, the real world economy need not bear out the predictions of the simple neo-classical model. The cumulative effect of technological changes may cause the economy on the whole to behave far differently from what is postulated by examining a single change in equilibrium in a hypothetical one-commodity economy.

CHAPTER IV

A MORE SOPHISTICATED NEO-CLASSICAL APPROACH

Post-war economists who wished to examine seriously by empirical methods the effects of technological change on the level of emloyment, found themselves extremely limited by the artificialities of the simple neo-classical approach to technological change. Many of these researchers realised that technological progress should properly be regarded as a dynamic and continuing process, but they nevertheless remained devoted to the reigning orthodoxy of neo-classical analysis. A more sophisticated version of the neo-classical model was therefore developed to deal with the particular phenomenon of technological change. As already outlined in Chapter III, we deal here with the works of two major contributors to this approach. The first of these, W. E. G. Salter, introduced an original approach to interpret the effects of technological change on individual industries.[1] Murray Brown, the second writer

whom we discuss, tried to make use of Salter's analysis in measuring the aggregate effects of technological change on the total labour force,[2] and thus approached the issue in which Neisser was interested.

Salter's book, Productivity and Technical Change, has been regarded as constituting a major advance in the neo-classical treatment of technological change and its impact on the economy. We will concentrate here mainly on synthesising the theoretical approach which was laid out, although a large part of the book was devoted to the empirical testing of this approach.

In the theoretical section, Salter postulates and examines situations of "momentary equilibrium" after the introduction of technological change in an industry. Such momentary equilibria are compatible with the continued operation of plants embodying techniques which are no longer of optimal efficiency given current factor prices, and are therefore no longer used in new plants being built. This is possible because any fixed capital

[1]Salter, op. cit.

[2]Brown, op. cit.

equipment, Salter felt, can usually be thought of as having no value in itself (other than possible scrap value), so that any net returns (i.e., receipts minus operating costs) accruing from the continued operation of these plants could properly be regarded as rents, or more properly, "quasi-rents" as they were defined by Marshall.[3] According to Salter's model, then, plants employing older techniques are replaced only when current operating costs (total variable costs in the neo-classical language) exceed the total costs (i.e., fixed plus variable costs) of the current "best-practice" technique.[4]

The amount of labour employed in an industry at any one time depends, in Salter's model, on the units of labour required per unit of output for the different techniques embodied in the plants being operated, and the levels of output produced by each particular "vintage" of plant. Salter makes the usual assumptions of perfect competition, so that plants of a particular vintage will

[3] Marshall, op. cit., p. 352.

[4] Salter, op. cit., pp. 52-58.

all embody the technique that was best-practice at the time the decision was made to build the plant. Presuming, as Salter does, that the price of capital goods relative to wages falls over time, the best-practice technique becomes more and more mechanised.[5]

If we were to add Salter's concept of a momentary equilibrium of co-existing techniques to the simple neo-classical model, we would be able to gain some insight into the type of situation in existence between the long-run equilibria which are shifted by the occurrence of technological change. Salter's model, then, allows us to say something about the nature of the adjustment path, which neo-classical theorists such as Simon are forced to ignore as a temporary out-of-equilibrium situation. But Salter's model is more realistic than to imagine that technological change consists of occasional isolated shifts in production coefficients such that the industry will eventually work towards a situation where one optimal technique is used by all firms. Rather, technological change is perceived as a continuing process, with the result that production is

[5] Ibid., pp. 66-73.

always carried out by a variety of co-existing techniques embodied in plants of different vintages.

Since Salter developed his approach to examine the effects of technological progress on individual industries, his analysis is of only limited usefulness if one's intention is to determine the overall effects of technological change on employment, that is, the expected impact of technological change on the entire labour force rather than just that employed in specific industries. Salter's own empirical work showed a significant positive correlation between output per head and employment in individual British industries from 1924 to 1950;[6] however, United States data and later British data did not show such a correlation.[7] But even if consistent relationships between employment and productivity changes in individual industries were found, it would not be legitimate to reach a conclusion about the total employment effects of technological change. This is because no account has been taken of any spill-over effects,

[6] Ibid., pp. 123-124.

[7] Ibid., pp. 169 & 211. Empirical work carried out by W. B. Reddaway.

that is, of the changes in employment which might occur in one industry as a result of a technological advancement in another.

However Salter's model gives some conceptual idea of the limitations to achieving a true level of full employment in an economy characterised by changing technology and factor prices. Salter's notion was that current employment in industry is little affected by actual current factor prices but is primarily determined by the techniques embodied in plants currently operating, techniques which were chosen on the basis of what relative factor prices were expected to be at the present time. Thus, unless past expectations about present wage rates (and other operating costs) are fully realised, there is no reason to expect that there might be an equivalence between current supply and demand for labour. Salter's model thus seems to put in analytical terms Keynes' appraisal of the important determinants of the level of employment at any given time:

> . . . past expectations . . . are embodied in the to-day's capital equipment with reference to which the entrepreneur has to make to-day's decisions . . . It follows, therefore, that . . . to-day's

> employment can be correctly described as being governed by to-day's expectations taken in conjunction with to-day's capital equipment.[8]

Of course, the type of unemployment based on miscalculations of future trends gives us no reason to expect that this should lead to a systematic increase in the level of unemployment as the rate of technological change increases. Indeed, such mismatchings of labour supply and demand might be expected to continue even in a state where no further technological advancements are made, so long as there occur any changes in factor prices which are not perfectly foreseen. It was left to others to make use of Salter's valuable insights in order to approach the question that Neisser, among others, was interested in. That is, the question of whether technological change leads to "permanent" or non-reabsorbed unemployment.

Murray Brown wrote a book, preceded by a number of articles, which undertook the specific empirical task of determining the macroeconomic effects of techno-

[8]J. M. Keynes, The General Theory of Employment, Interest, and Money (London: Macmillan, 1967) p. 50.

logical progress in the context of the United States economy.[9] He did not limit himself to examining the employment effects of technological change, but emphasised these as one of the most important repercussions. By attempting to describe and measure the effects of technological change on the whole economy (not just individual industries), Brown felt that he was approaching the problem that Neisser exposed. Referring directly to Neisser's article and seemingly accepting Neisser's conclusion that "permanent" technological unemployment is not impossible, Brown intended "to present a set of measures which are designed to quantify the various forces affecting employment."[10] He felt his analysis could separate the effects on employment of technological progress from the other forces, thus offering a precise measurement of the amount of labour displacement due to technological progress.

Brown carried out his study using the established framework of neo-classical analysis, but he overcomes some of the artificialities of the earlier "simple"

[9] Brown, op. cit.

[10] Ibid., p. 165.

equilibrium model by incorporating refinements along the lines of those first introduced by Salter. However, by taking on the problem of determining the effect of technological change on the total labour force, Brown is forced to make use of some artificialities of his own which are intendant upon the process of aggregation.

The most conspicuous weaknesses of Brown's analysis are those made evident by objections against the basic concept of aggregate production functions. For example, Joan Robinson has for many years pointed out the impossibility of arriving at a measure of the value of capital which is not dependent on the rate of profit.[11] Thus we have reason to suspect whether one of the basic variables in Brown's aggregate production functions is really indicative of that which it is supposed to measure, that is, the amount of physical capital in the economy.

More recently, Franklin M. Fisher has attempted to demonstrate that the empirical success of the Cobb-

[11] E.g., Joan Robinson, "The Production Function and the Theory of Capital," Review of Economic Studies, XXI, No. 55 (1953), pp. 81-85.

Douglas and C.E.S. production functions -- which are those employed by Brown in his analysis -- is due not to the actual existence of the technical relationships posited by those functions, but to the existence of certain empirical phenomena.[12] In the case of the Cobb-Douglas function, this phenomenon is the occurrence of a relatively constant labour share of total production. Thus, with respect to the Cobb-Douglas, Fisher concludes:

> . . . labour's share is not roughly constant because the diverse technical relationships of modern economies are truly representable by an aggregate Cobb-Douglas but rather that such relationships appear to be representable by an aggregate Cobb-Douglas because labour's share happens to be roughly constant.[13]

We will not here attempt to describe the objections of Robinson and Fisher as they would apply to Brown's ana-

[12]Franklin M. Fisher, "The Existence of Aggregate Production Functions," Econometrica, XXXVII (October, 1969) and idem, "Aggregate Production Functions and the Explanation of Wages: A Simulation Experiment," Review of Economics and Statistics, LIII, (November, 1971).

[13]Fisher, "Production Functions and Wages," p. 325.

lysis. But, noting their significance, we will try to show that it is possible to discern serious weaknesses in Brown's model with the reasoning that has been followed so far.

Brown incorporates the Salter model by describing a short-run expansion path function in which the current capital-labour ratio depends on a distributed lag of historical price ratios.[14] However, in order to be able to measure the nature of the technological change which is taking place, Brown reduces the number of factors in his equation by assuming the presence of a long-run expansion path in which "steady state conditions will prevail," such that the capital-labour ratio stays unchanged. Algebraically this is expressed by

$$U_o = K'^{-\sigma} P_o^{\sigma/(1-\lambda)} ;$$

where U_o is the current capital-labour ratio; K' the "long-run capital intensity coefficient;" σ the short-run elasticity of substitution; P_o the current capital price-labour wage ratio; and λ the "rigidity parameter," which is derived from the distributed lag price equation.[15]

[14] Brown, op. cit., pp. 69-70.

According to Brown, "the λ coefficient is interpreted as the degree of rigidity of substitution of the installed equipment in response to a change in the current factor-price ratio." Thus the exponent $(\sigma/(1-\lambda)$ he defines as "the long-run elasticity of substitution."[16]

By making recourse to a long-run expansion path function, Brown assumes that the economy is always tending towards a defined stable long-run equilibrium in which there is a constant ratio of factors. True, Brown takes account of the fact that there will be a lag in achieving the optimal long-run position because of the continuing use of out-dated techniques in fixed capital equipment. The λ-coefficient is supposed to quantify this lag. But the assumption is that the ultimate tendency is towards a secular period or "epoch" during which non-neutral technological change does not occur.[17]

With reference to the quotation from Keynes' General Theory made above (pages 44-45), we noted that

[15] Ibid., p. 71.

[16] Ibid., pp. 70-71.

[17] Ibid., pp. 72-75.

Salter's analysis seemed to overcome or at least avoid one of Keynes' major criticisms of neo-classical, analysis, since it does not depend on an assumption that the economy is approaching some point of long-run equilibrium. Brown, however, by attempting to interpret technological changes in the aggregate economy using a neo-classical framework, is forced to revert to assumptions about long-run equilibrium tendencies. Salter himself made the following observation:

> . . . it is obviously impossible to employ the long-period schema for the analysis of technical change and productivity. . . . Moreover, once we admit the existence of continuous disturbance and slow adjustment, the long-run framework is unsuitable for analysis of the cost and price movements accompanying technical change; for its basic tools, such as long-period supply functions, are incapable of application in such circumstances.[18]

Undaunted by Salter's warnings, Brown proceeded to employ a long-run production function, while attempting to account for Salter's developments by including a lag variable. It can be seen, then, that Brown is oper-

[18]Salter, op. cit., p. 7.

ating under the same long-run model that Simon put forth on a much simpler level. While Brown does not choose to simply ignore problems of short-run adjustment as Simon does, he feels that the economy is at all times close enough to long-run equilibrium that any non-neutral changes in production parameters from one epoch to another can properly be characterised and measured as shifts in long-run expansion paths. These shifts, then, are supposed to measure the bias (labour-saving or capital-saving) and degree of technological change, and consequently the amount of labour displacement which is attributable to technological change.

Even if one were to conclude that the level of technological unemployment could be realistically determined in the context of a long-run production function, it is evident that Brown's analysis has not been able to fully measure the effects of technological change on employment. In the chapter entitled "Technological Progress and Employment," Brown states:

> Our purpose here is to present a set of measures which are designed to quantify the various forces affecting employment. Since technology is only one of the several relevant forces, the measures must isolate separate effects on employment of the

change in output, the substitution of capital for labour and technological progress.[19]

He then proceeds, in the empirical section, to obtain measures of the amount to which changes in each of the following factors is responsible for changes in employment: total output, relative factor prices, neutral technology, and non-neutral technology.[20] However his analysis does not allow him to determine to what extent the changes in output and in relative factor prices are themselves attributable to technological change, unless the level of employment is taken as an exogenous factor.

At best, that is, agreeing with the validity of the long-run equilibrium model, we could say only that Brown has denoted the direction of the long-run expansion path. He has not taken it upon himself to determine whether there is any validity to the time-honoured "compensation principle" of the neo-classical model, that is, the principle whereby the increased productivity of new techniques will create enough employment opportunities to reabsorb any workers displaced

[19] Ibid., pp. 165-166.

[20] Ibid., pp. 172-179.

by their implementation. And if one does not agree with the assumptions of the long-run equilibrium model, then it cannot be ascertained whether or not Brown has accurately measured the degree to which technological change has been labour-saving.

Leaving aside the debate about the use of the long-run equilibrium model, it may be useful to delve into Neisser's evaluation of the neo-classical compensation principle. Neisser commences his analysis by granting the assumption of a hypothetical economy in which wages are fully flexible and capitalists are able to fully adjust to a change in the level of wages by reallocating capital between industries and by changing the methods of production (i.e., a stable long-run equilibrium is achievable).[21] Neisser then supposes that mechanisation occurs in one industry, throwing a great number of workers into the labour market (it is assumed that demand for the mechanised industry's output is not sufficiently elastic to reabsorb the displaced labour in that industry) so that wage rates are forced down. Assuming that aggregate demand can be maintained despite

[21]Neisser, op. cit., pp. 62-67.

the fall in the wage level, the reabsorption of labour takes place, according to the neo-classical method, through two processes to which we have already alluded.

Firstly, a fall in wages would tend to sharply lower the price of goods in relatively labour-intensive industries, thus increasing the quantities demanded of these goods and encouraging the expansion of capital stock in these industries. There are, however, theoretical and practical limits to the extent to which this mechanism can operate, limits which Neisser rather graphically illustrates by means of a Walrasian system of equations. With specifically given data as to supplies of factors and coefficients of production, he shows that the prices of some goods and productive services may have to be negative in order for all factors to be fully utilised.[22] Since a negative wage rate could not exist, it thus appears to be theoretically possible that all labour could not be employed.

The negative results of the Walrasian model depend, of course, on the assumption of fixed coefficients of production. In fact, it is through the adjust-

[22] Ibid., pp. 64-65.

ment of these coefficients that the second mechanism of labour absorption is supposed to take effect according to the neo-classical theory. That is, capitalists are encouraged, by the fall in wage rates, to switch to more labour-intensive techniques of production. Neisser feels that this supposition has limited validity, but here he is forced to attack it by appealing more to empirical than theoretical logic.

In the neo-classical method of analysis, the marginal productivity mechanism ensures the absorption of all available supplies of factors of production, by the ability of entrepreneurs to move along the (long-run) marginal productivity curve through changing techniques. The capitalist chooses that technique at which the value of the marginal product of the factor equals its price. However Neisser speculates that in modern industrial enterprises, the marginal productivity of factors "is very inelastic over the range beyond the combination of capital and labour" which existed in his day.[23] Though some minor changes in the nature of equipment might be made which would permit employing more

[23] Ibid., p. 65.

labour, Neisser feels that even if a large fall in wage rates were to occur, entrepreneurs would not likely revert to older processes of production which require much less capital per worker. This is because the older techniques were likely more costly in other factors of production, as well as in manhours of labour.[24] Since the newer and more efficient techniques were developed over an era of rising wage rates, it is not likely that a range of equally efficient techniques has been worked out to be able to take advantage of cheaper labour.

Neisser's suggestion is, then, that coefficients of production are for practical purposes relatively inflexible, even if complete replacement of all existing capital equipment is allowed for. This may be interpreted as an assertion of the following kind: If a technique of production were developed today which made use of labour priced at the wage of, say, 50 years ago, it would, because of the higher level of knowledge available today, be a much more efficient and profitable technique than the one which was actually in use 50 years ago. However,

[24]Neisser cites the example of the steel industry. See ibid., p. 66.

modern production techniques having been developed during an era in which labour became progressively more expensive, it is reasonable to suppose that there is not within immediate knowledge a range of techniques which could make use of much cheaper priced labour such as to match the efficiency of techniques presently embodied in existing equipment. Rather, it would take time to develop such techniques, through an adjustment period that some neo-classical writers have termed "the very long run."[25]

The neo-classical retort to Neisser's criticisms might in fact be that, although the neo-classical mechanism cannot for all possible combinations of capital and labour ensure full employment in the long run, it can do so in the very long run. In response to this we refer again to the quoted passages made above from Keynes and Salter (pages 44-45 and page 51, respectively). These passages make it evident that many modern writers find the concept of long-run equilibrium of doubtful usefulness in examining the impact of various forces on

[25]E.g., R. G. Lipsey, An Introduction to Positive Economics (London: Weidenfeld & Nicolson, 1966), pp. 287-294.

the level of employment, for the reason that in the real world basic parameters never remain constant for a period of time sufficiently long for the capital equipment to fully adjust. One should therefore be even more sceptical about the possibility that the relative wage level could stay constant long enough to allow for an even longer period of adjustment, that is, the adjustment period towards equilibrium in the very long run.

Neisser makes one final theoretical argument against the neo-classical school's assertion that the marginal productivity mechanism (through the variation of production methods) can solve the unemployment problem in the long run for any possible combination of capital and labour. Returning to the theoretics of the Walrasian system of equations, if it is now granted that production coefficients are variable, one would suppose that an equilibrium solution could now be found at which all supplies of factors will be utilised at a positive remuneration. In fact, however, an equilibrium solution can be guaranteed for any combination of factors only if the production functions are homogeneous of the first degree.[26] In practical terms, this means that

theoretical equilibrium can be achieved for any combination of factors only if economies of scale are completely absent. Equilibrium would still be possible if economies of large-scale production were in fact present, but only for specific combinations of labour and capital.

This point was recently brought out by Nicholas Kaldor who, referring to a 1928 article by Allyn Young, notes Young's argument:

> . . . that the extent to which capital is used in relation to labour is predominantly a matter of scale operations -- the capital/labour ratio in production is a function of the extent of the market rather than of relative factor prices.[27]

Kaldor stresses the importance of this notion, since he feels it has the potential of upsetting the entire validity of equilibrium economics as an allocative mechanism in societies where economies of scale proliferate. He points out the immunity of theoretical economists to well-known facts in this regard:

[26]Neisser, op. cit., p. 66.

[27]Nicholas Kaldor, "The Irrelevance of Equilibrium Economics," Economic Journal, LXXXII (December, 1972), p. 1242.

> . . . the general equilibrium school has always fully recognised the absence of increasing returns as one of the basic "axioms" of the system. . . . Yet on an empirical level, nobody doubts that in any economic activity which involves the processing or transformation of basic materials -- in other words, in industry -- increasing returns dominate the picture for the very reasons that are fundamental to the nature of technological processes and not to any particular technology.[28]

Kaldor's suspicions appear to make a strong point out of the objection Neisser made to the inviolability of the theoretical long-run full-employment equilibrium. We can thus stress its importance more than did Neisser, who notes it as an objection of a purely theoretical nature to be added to those which were based more on speculative empirical reasoning against the realistic possibility of the economy reaching a point of "very-long-run" equilibrium.

[28] Ibid., pp. 1241-1242.

CHAPTER V

A REVIVAL OF THE WAGE FUND THEORY

When Neisser wrote his article in 1942, he took the implicit viewpoint that technological change might well pose a threat to the level of employment, a threat which economists ought to recognise. Since the conventional economic analysis of his period generally rejected such an eventuality, he felt compelled to point out the unrealistic assumptions and the flaws in logic which led to such conclusions and thus make clear the need for some alternative method of analysis. At his time, of the three schools of thought which Neisser discussed the wage fund approach to technological unemployment seemed evidently to be in a state of relative disfavour as a method of analysis. Nevertheless, he felt it necessary to discuss the wage fund theory because of "the central position into which classical economists have placed it in discussing technological unemployment."[1]

Briefly, the wage fund approach sees the volume

of circulating capital or the "wage fund" in existence at any point of time as being the determinant of the level of employment and the wage rate (not individually, but essentially the product of these two)[2] at that time. Technological progress, it was felt, might result in a conversion of circulating to fixed capital, thus reducing the volume of the wage fund. Ricardo in fact felt that this tendency might be so general as to be able to conclude:

> That the opinion entertained by the labouring class, that the employment of machinery is frequently detrimental to their interests, is not founded on prejudice and error, but is conformable to the correct principles of political economy.[3]

Most successors of Ricardo who used the same approach came up with the much more optimistic conclusion that, "at least in the vast majority of cases, the

[1]Neisser, op. cit., p. 59.

[2]Neisser notes the confusion between different classical economists about this basic notion, ibid., pp. 59-60.

[3]David Ricardo, Principles of Political Economy and Taxation (Middlesex, England: Penguin Books, 1971), p. 384.

wage fund would not be reduced by technological progress."[4] For the present, the original arguments of the wage fund theorists and Neisser's criticisms of them are worth re-examining, since the wage fund approach to technological unemployment has recently been restated in a book by J. R. Hicks.[5] To examine Hicks' evolvement to this position would be an interesting study in itself, since it obviously reflects a judgment by this eminent long-time proponent of neo-classical analysis, that the neo-classical tools are inadequate for dealing with the particular problem. However we shall limit ourselves here to an examination of his arguments made in support of the wage fund concept.

If Douglas and Director's espousal of Say's Law, which was published about a decade before Neisser's article, can properly be called a restatement of "the oldest argument against technological unemployment,"[6] then perhaps we can call Hicks' revival of the wage fund

[4]Neisser, op. cit., p. 59.

[5]John Hicks, A Theory of Economic History (Oxford: Clarendon Press, 1969).

[6]Neisser, op. cit., p. 50.

theory a restatement of the oldest argument for technological unemployment. It is mentioned above that Neisser attacked the wage fund approach as another attempted but (so he tried to prove) incorrect dismissal of the possibility of technological unemployment. However Hicks brought back the wage fund theory in its original form as it was put forth by Ricardo, to explain the possibility that technological unemployment might actually arise. Hicks in fact makes use of the Ricardian wage fund in attempting to understand that very same historical case that Ricardo was trying to interpret as a contemporary -- England of the late eighteenth and early nineteenth century. Hicks undertook the problem that we mentioned earlier in Chapter III in discussing this historical period, of trying to explain why, in a rapidly industrialising economy, there should be only "a small rise, or an actual fall in the general level of real wages."[7] He sees the cause of this lag in wages as being a general surplus of displaced labour, and thus a manifestation of the type of technological unemployment that Ricardo delineated.

[7]Hicks, op. cit., p. 148.

Ricardo's and Hicks' conception of technological unemployment arising from depletion of the volume of circulating capital (wage fund) is not really "permanent" in the sense that there is no inherent mechanism ensuring an eventual restoration of full employment. This is so because their arguments ensure that, after a period of adjustment during which investment is taking place in machinery embodying the technological change, the wage fund and therefore the level of employment will have been restored to their former levels (and keep increasing). In a numerical example which Hicks presents, this period of adjustment is shown, given the assumed circumstances, to take 11 years.[8] However, he obviously is of the opinion that in the real world the cumulative effect of the process can last for a much longer period. Thus he submits that in England during the Industrial Revolution, a period of rapid technological change and investment in fixed capital, the volume of circulating capital had been sufficiently restricted for labour to have felt the deleterious effects for a period of sixty years.

[8] Ibid., pp. 168-171.

The basic principle underlying Hicks' suggestion seems plausible enough if we consider the analogous situation of administrators in presently less-developed countries who sometimes make the conscious decision to sacrifice some part of present consumption (this is not to say that absolute per capita consumption must decrease if the economy is at all growing) in order to be able to invest in capital equipment and raise the future ouput of consumption goods. However we must ask ourselves whether the wage-fund mechanism adequately conceptualises this basic principle and, even if we agree that it does, whether Hicks' example is applicable to the historical period he wished to understand.

To examine the second point first, one might decide that Hicks' example, of a capitalist who produces at a lower level of output for ten years after the introduction of technological change, draws up a somewhat unrealistic situation.[9] Professor Beach has shown that the temporary decline in employment in Hicks' example is drastically reduced if, altering Hicks' specifications slightly, it is assumed that capitalists invest

[9] Ibid.

a small amount of their surplus upon expectation of higher profits, or that the new machines have a slightly higher level of output than the old ones.[10] Thus one might find the conclusions of J. S. Mill (and most other later classical economists) more acceptable: that the increased productivity of new machines would, in most cases, sufficiently offset the potential reduction of the wage fund caused by mechanisation.[11]

As to the more fundamental question of whether the changing volume of working capital is the actual determinant of the level of employment after technological change takes place, Neisser feels that the classical economists' obsession with the size of the wage fund was unwarranted:

> The classical theory had recognised that production is conditioned by the co-operation of fixed capital, circulating capital and labour, the ratio of capital to labour being governed by what was later called

[10]Earl F. Beach, "Hicks on Ricardo on Machinery," Economic Journal, LXXXI (December, 1971).

[11]J. S. Mill, Principles of Political Economy, Vol. I (New York: Colonial Press, 1899), pp. 96-98.

> "the nature of industry," i.e., the state of the arts; if so, how could the mere preservation of circulating capital ensure re-employment.[12]

The classical economists' total concentration on the size of the wage fund, then, says Neisser, does not seem to follow logically out of their own recognition of the role of fixed capital. This fact appears evident from the following passage quoted from J. S. Mill:

> . . . every increase of capital gives, or is capable of giving, additional employment to industry; and this without assignable limit. I do not mean to deny that capital, or part of it, may be so employed as not to support labourers, being fixed in machinery, buildings, improvement of land, and like. In any large increase of capital a considerable portion will generally be thus employed, and will only co-operate with labourers, not maintain them. What I do intend to assert is, that the portion which is destined to their maintenance, may (supposing no alteration in anything else) be indefinitely increased, without creating an impossibility of finding them employment . . .[13]

[12]Neisser, op. cit., p. 61.

[13]Mill, op. cit., p. 66.

With regard to Mill's statement above, Schumpeter wonders "why he should have thus maimed a theorem that was certainly not beyond his range of vision."[14] Schumpeter gives the following reading of the suppositions behind Mill's line of reasoning:

> . . . while of course he was not unaware of the fact that the relation between technological [fixed] and wage capital is variable, he was inclined on principle . . . to take it for granted, perhaps as technologically fixed, and to neglect the substitutability between the two . . .
>
> . . . he took the relation between technological and wage capital as a datum, so that in the final result saving would increase both of them in the same proportion.[15]

While Schumpeter's interpretation may reinforce Neisser's arguments against the later classical economists, it would not appear that they hold against Ricardo, at

[14] J. A. Schumpeter, History of Economic Analysis (New York: Oxford University Press, 1968), p. 641.

[15] Ibid., pp. 641-642. It is to be noted that Schumpeter does not attempt to reconcile this interpretation (i.e., of fixed factor relations) with Mill's assertion that the increase of the wage fund by itself can create employment without limit.

least in his chapter, "On Machinery," where he emphasises the conversion of circulating into fixed capital. Likewise it might appear that Hicks has avoided the criticisms against the wage fund made by Schumpeter. However the basic issue which Neisser outlines remains, in that Ricardo and Hicks both perceive the volume of circulating capital as being the sole determinant of the level of employment.

In the context of Hicks' assertion of the wage fund theory, it might be appropriate to rephrase Neisser's question, "How could the mere preservation of circulating capital ensure re-employment?" to ask instead: How could the mere contraction of circulating capital ensure unemployment? In response to this point, Hicks finds himself admitting that it could not if wages are fully flexible downwards.[16] This follows from Hicks' model of the Ricardian wage fund, where all labour, if it is provided with the exogenously defined level of means of subsistence, can immediatly be put to work in the construction of machines without the aid of any other factors of

[16]J. R. Hicks, "A Reply to Professor Beach," Economic Journal, LXXXI (December, 1971), pp. 922-923.

production. If, however, we were to add to the model the constraint that machinery can be built only with labour in conjunction with one other factor which is not in completely inelastic supply, then the full employment of all labour is not necessarily ensured.

One might be tempted to argue (as Mill in fact did)[17] that the addition of such a constraint to Hicks' model should not prevent the employability of labour as long as the means of subsistence (circulating capital) is not exhausted. However this, in effect, would constitute an assertion analogous to the purest form of Say's Law -- "Demand for commodities is demand for labour." The implications of such an assertion have been covered in Chapter II of this paper. The specifications of Hicks's model make it clear that an automatic availability of fixed capital (sufficient to maintain a constant ratio of fixed to circulating capital) has not been assumed, as Schumpeter seems to insist that Mill had done. The only alternative to explain Hicks' assertion that there will always be full employment if wages are fully flexible must be an assumption of infinitely substitu-

[17]Mill, op. cit., p. 66.

table factors of production. Several arguments against such a notion were outlined in Chapter IV and need not be repeated here.

Rather than the wage fund, therefore, Neisser asserts that the final determinant of the level of employment at any given time is the quantity and "quality" (embodied technique) of capital equipment in existence at that moment in time:

> The most logical conclusion (which was, indeed, drawn by Marx) would be to have current employment governed by the quantity of fixed capital available and the nature of the respective industry; then, technological progress that raises the amount of fixed capital necessary per worker would bring about displacement, to be compensated solely by further accumulation and investment of capital.[18]

By this statement, it may appear that Neisser is as guilty of short-sighted reasoning as he accused the classical economists of being, by merely switching his total concentration from one type of capital to another as the sole determinant of the level of employment. Obviously, when he sees the quantity and nature

[18]Neisser, op. cit., p. 61.

of fixed capital as determining the level of employment, he is implicitly asserting that there will be sufficient ciculating capital available to utilise all of the fixed capital so that the volume and nature of fixed capital do in fact become the final constraint. In doing this he would in fact have been agreeing with Marx, who had no dispute with what he took to be the general rule of the later classical economists (Mill et al.):

> It is an undoubted fact that machinery . . . cheapens and increases production in that branch which it seizes on, and at first makes no change in the mass of the means of subsistence produced in other branches. Hence, after its introduction, the society possesses as much, if not more, of the necessaries of life than before . . . [19]

But unlike the wage fund proponents, of course, the maintenance of the supply of "the necessaries of life" would not, according to Marx, ensure re-employment of displaced workers. Rather, "this takes place only by the intermediary of new and additional capital that is seeking investment."[20]

[19]Karl Marx, Capital, Vol. I, (New York: International Publishers, 1970), p. 441.

What may be more likely is that Neisser, contrary to both Marx and the classicists, did consider it possible that a technological change might result in a depletion of the so-called wage fund. However, we suggest that he did not discuss in his article the alternative case where circulating capital is fully used up before all fixed capital can be utilised, for the sake of making his primary point against the wage fund formulation. Recall that his attack was directed against the wage fund as it stood in his day, which was the assertion by the later classical economists that "the mere fact that the 'wage fund' was maintained, sufficed to secure also re-employment of the displaced workers."[21] He thus went along with the assumption that the wage fund would be maintained, in order to attempt to demonstrate that this alone would not ensure re-employment of displaced workers.

Neisser was in fact criticised by E. Hagen for his failure to consider the alternative case where there is not sufficient circulating capital to utilise

[20] Ibid., p. 440.

[21] Neisser, op. cit., p. 51.

all available fixed capital.[22] In reply, Neisser admits that in his original article he assumed:

> . . . in accordance with most of the former writers on the subject of technological unemployment and for the sake of argument, that "Say's Law" was in force, i.e., that an appropriate money flow was maintained. Since Mr. Hagen admits that this is possible, my analysis seems to cover wider grounds than his.[23]

If one thinks in aggregative terms, the assumption that the flow of purchasing power and therefore the "wage fund" can be maintained is, after all, simply assuming that demand for final output does not decline. When Neisser assumes that sufficient demand is maintained, he is really doing no more than present-day writers on microeconomic issues and not just "the former writers on the subject of technological unemployment," who conventionally assume that all the macroeconomic problems of

[22]Everett Hagen, "Saving, Investment, and Technological Unemployment," American Economic Review, XXXII (September, 1942), p. 553.

[23]Hans Neisser, "The Concept of Technological Unemployment: A Reply to Hagen's Criticism," American Economic Review, XXXII (September, 1942), p. 555.

equalising aggregate supply and demand have been solved.

If this interpretation is correct, it would seem that Hicks' model of the Ricardian wage fund resolves to a decline in demand that results from laying off workers. But, as Hagen suggests to Neisser, the Keynesian tools of macroeconomic analysis are more appropriate for examining changes in the level of aggregate demand than are models based on the experience of a single firm.[24] This recommendation would seem equally applicable to Hicks' historical tract, since he wished to generalise on the basis of the individual firm to discuss the experience of the British economy during the Industrial Revolution. Indeed, Professor Beach suggests that the lag in the rise of wages during this period might better be understood in attributing it to a lag in aggregate demand.[25]

If unemployment of the kind Hicks discussed can indeed be attributed to an insufficiency of aggregate demand, this does not of course mean that it should be regarded as unimportant or ignored. However, as we mentioned in Chapter I and will touch upon again in Chapter

[24]Hagen, op. cit., p. 553.

[25]Beach, op. cit., pp. 918-919.

VII, Neisser seemed to be intent on isolating that type of unemployment arising from technological change which could not be any more than temporarily eradicated through policies aimed solely at increasing the level of aggregate demand. Unemployment of this kind, he felt, presents a less simple problem for (theoretical) policy solution and can therefore to some greater sense be regarded as "permanent" technological unemployment. In the following chapter we will speculate on the nature of circumstances that Neisser may have envisaged could cause this "permanent" technological unemployment to arise.

CHAPTER VI

NEISSER'S ALTERNATIVE

As a general principle, one might judge that criticisms of any system of analysis should be valued only as much as the superiority of alternative analyses which are available (the alternative may be to offer no theoretical analysis at all). From this point of view it would seem important to give some attention to the kind of theoretical approach that Neisser submits as a superior approach to the ones he criticised, and which we have reviewed in the four preceding chapters.

It was noted in Chapter I that the article which forms the basic reference work of this paper had set itself a wholly negative goal; i.e., to demonstrate that "rational economic analysis" had not been able to prove the impossibility of the occurrence of "permanent" technological unemployment. However Neisser did touch on his preferred alternative approach in various places in his article (some of which we have noted) and devoted a few

paragraphs in discussing the merits of this approach at the end of the article. Reference can also be made to earlier publications in which Neisser set out his positive views on the subject of technological unemployment.

As was noted in the preceding chapter, Neisser stressed the quantity and nature of fixed capital in place at any moment in time as the determinant of the level of employment, and in this sense felt himself to be agreeing with Marx. Like Marx also, he felt that labour displaced through technological change would only be reabsorbed through the instalment of additional fixed capital:

> It never has been doubted by any theorist of rank that accumulation of capital in the form of fixed equipment raises the demand for labour; Marx especially . . . depicts the capitalistic process as a race between displacement of labour through technological progress and reabsorption of labour through accumulation. . . . displacement and accumulation are two largely independent factors, and it is impossible to predict the outcome of the race between the two on purely theoretical grounds.[1]

Neisser's emphasis on the role of fixed capital is more thoroughly expounded elsewhere, as in an article

which was published in 1932 in German,[2] and which Gourvitch in his Survey of Economic Theory on Technological Change and Employment summarises as follows:

> The dependence of employment of labour upon the existence of specific equipment has been formulated most forcefully by Neisser. He demonstrated that the mere availability of labour supply, no matter at how low a price, is insufficient to bring about its absorption in employment, unless there is also simultaneously available a fixed capital -- in the concrete physical shape of plant and equipment -- for the employment of the available workers in accordance with prevailing technical methods and with the demands of the market. The existence of such fixed capital can only be the result of a process; it is conditioned by previous capital accumulation and investment.[3]

Neisser's apparent preoccupation with the amount and nature of fixed capital in place may well lead one to suspect that he has underestimated the employment-creating

[1]Neisser, "'Permanent' Technological Unemployment," p. 70.

[2]Hans Neisser, "Lohnhöhe und Beschäftigungsgrad im Marktgleichgewicht," Weltwirtschaftliches Archiv, XXXVI (October, 1932).

[3]Gourvitch, op. cit., pp. 113-114.

mechanisms inherent to the process of technological change. These employment-creating mechanisms can be seen to operate in the following ways. Firstly, the construction of the labour-saving machinery itself would entail some amount of job creation. Secondly the increased productivity of the new techniques, so one would expect, should make available additional unconsumed surpluses for re-investment in new fixed capital which would employ labour. We will discuss these two mechanisms, and the way in which Neisser deals with each of them, in turn.

Neisser felt that "the naive question whether the displaced labourers would not be reabsorbed in the production of the labour-saving device itself," could be rather easily dismissed:

> As a matter of principle, no increase in the physical volume of capital is necessarily involved in the technological progress; the improved device may not cost more than the unimproved one, and might be financed from depreciation funds; and even if, in a given case the capital embodied in the new device would exceed that embodied in the old one, reabsorption of all displaced labourers is impossible, since otherwise the unit costs of output would not be smaller than before, and no incentive

to introduce the new device would exist.[4]

It seems valid that the reabsorption of all technologically displaced labour in building the labour-saving machinery would constitute a negation of the cost-reducing motive which led capitalists to introduce technological change. But while this may be true of individual occurrences of technological change and new technology may in some cases be introduced by simply replacing old machines, as they wear out, by more modern ones, it would seem that technological progress is usually associated with vast investments in new machines long before the old ones wear out. Surely, it can be argued, the historical process of technological change has shown a steady expansion of employment in the capital goods sector.

Several economists have emphasised the growing importance as a source of employment provided by new investment resulting from technological change. For instance, Marx, in the words of Gourvitch:

> . . . indicated schematically how technological progress, with the resulting increase in the share

[4]Neisser, "'Permanent Technological Unemployment," p. 58.

> of constant as compared with variable capital, is reflected in a growth of the producers'-goods division faster than that of the consumers'-goods division.[5]

Keynes, though not attempting to establish the basic long-term motives for new investment, made clear the crucial role that continued investment has in maintaining full employment. Hansen saw the spur of this new investment being population growth, expanding markets, and technological progress. Writing in the late 1930's he stated:

> We are thus rapidly entering a world in which we must fall back upon a more rapid advance of technology than in the past if we are to find private investment opportunities adequate to maintain full employment.[6]

Professor Beach has shown that, in a typical modern economy in which a steady expansion of investment is taking place, technologically displaced labour can be quickly

[5]Gourvitch, op. cit., p. 215.

[6]Alvin Hansen, "Economic Progress and Declining Population Growth," American Economic Review, XXIX (March, 1939), p. 10.

reabsorbed within the same enterprise or elsewhere in the economy.[7] If continued technological progress is, as Hansen postulated, an important basic determinant of the rate of investment, then the crucial question posed is how long and how steadily the process can be maintained.

The point which appeared obvious to Neisser and others was that employment in the construction of labour-saving equipment being of only a temporary nature and, by the necessity of the cost-saving motive, less than the amount displaced, it could not by itself offset the unemployment of technologically displaced workers. Marx presents this case in discussing the application of machinery in a carpet factory:

> . . . suppose . . . that the making of the new machinery affords employment to a greater number of mechanics, can that be called compensation to the carpet-makers, thrown on the streets? At the best, its construction employs fewer men than its employment displaces. The sum . . . that formerly represented the wages of the discharged carpet-

[7]Earl F. Beach, "La mécanisation et l'emploi," L'actualité économique, XLVII (July-September, 1971).

> makers, now represents in the shape of machinery: (1) the value of the means of production used in the construction of that machinery, (2) the wages of the mechanics employed in its construction, and (3) the surplus-value falling to the share of their "master." Further, the machinery need not be renewed till it is worn out. Hence, in order to keep the increased number of mechanics in constant employment, one carpet manufacturer after another must displace workmen by machines.[8]

E. Lederer combined this concept with a theory of investment through credit expansion to postulate a theory of cyclical fluctuations similar to Schumpeter's.[9] Unlike Schumpeter, however, Lederer stresses the permanence of unemployment which becomes evident after the innovation boom has ended.[10] New investments in equipment embodying the labour-saving technological change are financed through credit creation and result in a

[8]Marx, op. cit., Vol. I, pp. 438-439.

[9]Joseph A. Schumpeter, Business Cycles (New York: McGraw-Hill, 1939).

[10]Emil Lederer, Technical Progress and Unemployment (Geneva: International Labour Office, 1938).

temporary boom of full employment as jobs are made available in building the new equipment. But in Lederer's view, this investment boom only succeeds in disguising and deferring the displacement of workers through the introduction of labour-saving techniques:

> . . . when the boom is over, the decline in the mechanised industries, which was concealed by the general increase in employment and activity while the boom lasted, will begin to make itself generally felt . . . employment capacity is lower than before and large groups of workers will be thrown out of employment.[11]

Although Lederer is not explicit about the length of the cycle he was describing, it would seem that his analysis, if valid, is as applicable to the "Long Wave" Schumpeter refers to[12] -- a whole epoch of cumulative innovative activity such as England's Industrial Revolution -- as it is to shorter-period fluctuations. Such a scheme thus makes it plausible that the labour-displacing effects of technological change could

[11] Ibid., pp. 244-245.

[12] Schumpeter, Business Cycles, Vol. I, p. 168.

be deferred for decades on end, without being realised unless the continued expansion of the economy should ever be curtailed. It was evident to Neisser that, since "displaced labourers would not be reabsorbed in the production of the labour-saving device itself," employment could only be maintained through investment in new fixed capital for new purposes.[13] The important issue to Neisser, therefore, was whether technological progress by itself would ensure a sufficient output of unconsumed surplus which could absorb displaced labour using new fixed capital financed by this surplus production.

This leads us, then, directly to the second employment-creating mechanism which is supposed to absorb technologically displaced labour: the process whereby new fixed capital made available through the increased productivity of new techniques is sufficient to employ all the workers displaced by mechanisation. To counter the several positions taken in favour of this idea would necessitate a repetition of all the arguments presented in the preceding four chapters, since all of the traditional theories ruling out the possibility of "permanent"

[13]Neisser, "'Permanent' Technological Unemployment," p. 58.

technological unemployment rest essentially on the asserted validity of this mechanism. The most plausible alternatives to the infallibility of this compensation mechanism are associated with perhaps the two best-known figures in economic thought -- Marx and Keynes. The relation of Keynes' analysis to this and other facets of Neisser's work will be discussed in Chapter VII, but at this point we shall briefly examine Marx's system.

Neisser notes Marx's predicted outcome of the "race" between labour displacement through technological change and its reabsorption by newly accumulated capital:

> Marx believed, mainly on the basis of the twenties and thirties of the last century, that displacement more and more would outweigh accumulation . . .[14]

In fact, Marx did more than just believe that accumulation would not completely offset displacement; he asserted it as a necessary consequence and condition of capitalist production in order to keep the wage rate at the (social) subsistence level:

> . . . if surplus labouring population is a neces-

[14] Ibid., p. 70.

> sary product of accumulation or of the development of wealth on a capitalist basis, this surplus-population becomes, conversely, . . . a condition of existence of the capitalist mode of production . . . it creates, for the changing needs of the self-expansion of capital, a mass of human material always ready for exploitation.[15]

While it is hoped that the arguments in the four preceding chapters have demonstrated that employment in newly produced fixed capital need not be great enough to absorb workers technologically displaced, nor is there any explicit factor in the Marxian system to ensure that sufficient compensating investment cannot occur through technological change. Mark Blaug makes the point that the asserted outcome of the Marxian "race" depends on a crucial assumption about the nature of technological change:

> Booms deplete the reserve army and slumps replenish it, but secular growth at full employment levels is conceptually impossible, according to Marx. . . . further accumulation must involve a sufficient flow of labour-saving inventions so as to produce chronic unemployment. Thus, the Marxian

[15] Marx, op. cit., p. 632.

conception of mature capitalism is predicated upon a bias towards labour-saving technical change.[16]

But, while the postulated outcome of Marx's model depends critically upon the assumption that technological change, on the aggregate level, diminishes L/K (required labour per unit of capital) at a more rapid rate than K (the total quantity of capital) increases,[17] his model is extremely valuable in noting the two inseparable counteracting influences of technological change on the level of employment. Above we quoted Neisser's opinion that "displacement and accumulation are two largely independent factors," so that, "it is impossible to predict the outcome of the race between the two on purely theoretical grounds." In fact, he qualified this statement to say that:

Without doubt the two contestants of the race are

[16]Mark Blaug, "Technical Change and Marxian Economics," in Marx and Modern Economics, ed, by D. Horowitz (New York: Monthly Review Press, 1968), p. 228.

[17]This is stating the condition in a very simplified manner and for the context of a stable labour force (i.e., L is constant). It is not supposed, of course, that either L/K or K are measurable values in a real-world economy.

> not entirely independent. A rise in aggregate income, generated by technological progress, would increase also the rate of accumulation (per time unit), and thus speed up the reabsorption of labour. . . . [However] the same process that reduces the number of years [of labour-time required to accumulate enough capital to re-employ one man], by speeding up the rate of accumulation, also increases this number by enhancing the amount of capital per worker.[18]

In this way Neisser explained the help that technological progress gave to each of the two contestants in the race, without making any prediction as to the final outcome.

Neisser did state that "displacement and accumulation are two largely independent factors," but did not specify the kind of independent forces determining each. Other than technological change (which, as Marx showed, does not influence the factors independently), it is difficult to conceive of factors which would systematically act to displace labour. On the side of forces which further accumulation, however, one could postulate the kind of incentives

[18] Neisser, "'Permanent' Technological Unemployment," pp. 70-71.

to further investment that Hansen envisaged -- expanding population, foreign markets -- as providing sources of employment. These kinds of independent forces on the side of accumulation could then be seen to offset any tendency towards relative displacement caused by technological change, if such a tendency were indeed operative. Also, a "Long Wave" investment boom of the nature Lederer and Schumpeter described, could have the effect of deferring "permanent" technological unemployment for several decades.

The point of the above discussion is to indicate that the Marxian scheme of uncompensated technological displacement of labour, while not a certain or even probable outcome, is not theoretically impossible. Neisser states:

> In no case would it be permissible to use simply the current unemployment statistics as a verification or a repudiation of the theories which affirm or deny the existence of technological progress that creates unemployment.[19]

By this we might take him to mean that independent

[19] Ibid., p. 52.

factors, such as those Hansen mentioned and the investment booms that they set off, could serve to offset and disguise an increasing rate of technological unemployment. But, on the other hand it may be that technological progress has, by itself, maintained in the past and can be expected to continue maintaining the levels of fairly close to full employment that have been generally manifest in most periods of capitalist development. Unfortunately, the present economic theory gives no conclusive method of isolating the different influences on the level of employment nor, as Neisser tried to prove, does it give any a priori reason to accept either the inevitability of the impossibility of the existence of "permanent" technological unemployment.

CHAPTER VII

KEYNESIAN AND "PERMANENT" TECHNOLOGICAL UNEMPLOYMENT

In Chapter I we stated that Neisser was well aware of the possibility that unemployment might arise due to insufficient aggregate demand, a possibility which Keynes' General Theory had brought to the forefront of economic thinking by the time that Neisser wrote the article on which we have based our arguments. In fact, as will be illustrated by examples below, Neisser suggested some ways in which technological change could cause a fall in the level of employment through the medium of a decline in aggregate demand. However the concept of "permanent" technological unemployment that Neisser was specifically interested in can, we feel, be distinguished from unemployment attributable to a lack of aggregate demand, whether this insufficiency of demand is due to technological change or other factors. This is best shown by laying out and comparing the most basic concepts of unemploy-

ment as theorised by Keynes and Neisser.

Keynes' theoretical explanation of the possibility of involuntary unemployment depends on the following basic principles:

> In a given situation of technique, resources and costs, income (both money-income and real income) depends on the volume of employment N. . . . The amount of labour N which the entrepreneurs decide to employ depends on the sum (D) of two quantities, namely D_1, the amount which the community is expected to spend on consumption, and D_2, the amount which it is expected to devote to new investment. D is what we have called above the effective demand.[1]

If, in this simplified model, the expected amount of investment in any one period should fall below the level of households' and firms' savings, the level of income and employment would necessarily have to fall to a lower equilibrium level. And there is no mechanism, Keynes felt, to ensure that this equilibrium level should ever be one of full employment.

In Neisser's most simplified model, the determinants of the level of employment at a given moment in

[1]Keynes, op. cit., pp. 28-29.

time can be summarised by the following statement:

> The most logical conclusion (which was, indeed, drawn by Marx) would be to have current employment governed by the quantity of fixed capital available and the nature of the respective industry.[2]

In the most rigid sense, then, the amount of "permanent" technological unemployment can be defined as the difference between the actual amount of employment at full capacity utilisation of all fixed capital, and the amount of individuals who offer themselves up for employment at any wage rate (perhaps taking the subsistence level as the lower limit). Analogously to Keynes, Neisser felt that there was no mechanism ensuring that these latter two quantities would at any time be equal. Indeed, the whole point of his article was to attempt to prove that no such mechanism existed.

With regards to conceiving the amount and embodied technique of fixed capital as the determinant of the level of employment, Joan Robinson notes that "in this part of Marx's argument Say's Law holds undisputed

[2]Neisser, "'Permanent' Technological Unemployment," p. 61.

sway."[3] However she points out that in various other aspects of his theory of capitalist production he showed himself to be well aware of the mechanism of effective demand and its role in determining the actual level of employment. Similarly, Neisser indicates in various places how a decline in aggregate demand, set off by labour-saving technological change, can cause actual unemployment to be higher than the amount which can be called "permanent" unemployment according to the definition offered above. Two examples of Neisser's implicit references to the Keynesian concept of unemployment should demonstrate his recognition of the importance of effective demand.

In the following sentence, Neisser mentions one of the short-run implications of a wage reduction:

> It is still an unsettled question of economic theory whether the assumption of an unchanged state of demand is compatible with the general decline in the wage level.[4]

After making this point, he proceeds to concentrate

[3]Joan Robinson, An Essay in Marxian Economics (London: Macmillan, 1971), p. 85.

[4]Neisser, op. cit., p. 63.

on what he regards to be a more important issue in the context of his discussion: the limits to which the declining wage mechanism can be relied on to ensure the reabsorption of technologically displaced labour in the theoretical long run where aggregate demand is assumed to equal aggregate supply. Later in his article, Neisser mentions an additional complication which enters into the two-sided effect (according to the Marxian schema) of technological change on the demand for labour:

> A rise in aggregate income, generated by technological progress, would increase also the rate of accumulation (per time unit), and thus speed up the reabsorption of labour. However . . . the favourable effect on accumulation can only materialize if a "moving equilibrium" is preserved in the economy; if, contrariwise, displacement of labour (in the absence of compensatory investment) by reducing consumers' purchasing power ushers in a depression, the favourable effects on accumulation of displacement might not materialize.[5]

The more basic, underlying forces to which Neisser chooses to give his attention, however, are the counteracting forces of displacement through labour-saving

[5] Ibid., pp. 70-71.

innovations and reabsorption through capital accumulation. We could perhaps then see the level of "permanent" technological unemployment as the limiting case; that is, the amount of unemployment still present when all fixed capital is being employed at full capacity utilisation.

However this interpretation of the concept of "permanent" technological unemployment would seem to be unjustifiably rigid in that it rules out completely the possibility of technological unemployment being "disguised" for whatever reason, such that the actual level of unemployment is less than the definable level of "permanent" technological unemployment. The latter possibility certainly was considered by Neisser, as the following admonition indicates:

> In no case would it be permissable to use simply the current unemployment statistics as a verification or a repudiation of the theories which affirm or deny the existence of technological progress that creates unemployment.[6]

At this point we can say that the presence of Keynesian

[6] Ibid., p. 52.

deficient-demand unemployment may falsely tempt one to verify the existence of "permanent" technological unemployment on the basis of given unanalysed unemployment statistics. But what about the converse case where unemployment statistics are so low that one may feel it warranted to accept these as a repudiation of "permanent" technological unemployment? Neisser's statement implies that there may be forces which allow the level of employment to rise above the limits set by the state of technological development. In his article Neisser does not specify the nature of these forces, but the few statements he does make should allow us to speculate on this matter.

Putting aside the question of aggregate demand, the level of employment at any moment in time (assuming full aggregate demand we may call this the potential level of employment) depends on the given technique and the supplies of other factors of production. Thus it is possible that labour displaced through labour-saving technological change which is not absorbed through the additional capital made available by the increased productivity of the new techniques, might be employed because of an increase of factors of production inde-

pendent of technological progress itself. We suggest that this may explain Neisser's opinion that:

> The relative small size of [actual as opposed to "permanent"] technological unemployment in history is attributable, partly, to the independent forces increasing employment . . . [7]

The "independent forces" increasing the volume of employment, then, we could categorise as increases in the volume of fixed capital which are not due to the process of technological change. Joan Robinson notes:

> The study of the supplies of natural resources and labour [which together produce fixed or "constant" capital in the Marxian terminology] involves the whole problem of Imperialism, on which the hints thrown out by Marx have been elaborated by later Marxists . . . [8]

Also to be considered is the possibility that at any moment in time there may be a temporarily concentrated use of relatively labour-intensive technique in the production of capital goods. This would be the case if the economy were at the peak of the kind of innovation

[7] Ibid.

[8] Robinson, op. cit., p. 93.

cycle outlined by Lederer (described above in Chapter VI), and if the techniques used for producing capital goods were indeed more labour-intensive than those used for producing consumption goods.

With regards to the question of what is the definable level of "permanent" technological unemployment, states Neisser, "it is necessary to keep constant other factors as far as they are truly independent."[9] "Permanent" technological unemployment would therefore appear to be defined as that level of unemployment that would occur if only that portion of fixed capital which has been accumulated through the medium of technological progress were in existence, and this capital is used at full capacity utilisation so as to rule out the possibility of deficient-demand unemployment. It would also be mandatory to define this level in the context of some kind of "stable period," where it can be assured that there is not occurring an inordinately heavy use of, say, labour-intensive techniques in order to fulfil the capital-goods requirements of a "Long Wave" investment boom. Specifying the nature of this stable period;

[9]Neisser, op. cit., p. 53.

differentiating between capital made available through technological progress rather than "independent forces;" defining a level of full capacity utilisation; -- all of these obviously pose severe if not impossible problems of both a practical and conceptual nature.

These apparent difficulties perhaps explain why Neisser did not follow up on his first article to elaborate precisely on what he defined as "permanent" technological unemployment, and how one would measure its level. However, it should be noted that Neisser did not at all imply that "permanent" technological unemployment was a measurable quantity. Instead, his intention in writing the article had been to demonstrate that the effects of technological change on the level of employment could most reasonably be conceived of as a process of labour displacement through change in technique and reabsorption through further capital accumulation. The primary point he made was that there is no mechanism to ensure that the rate of reabsorption should match the rate of displacement, and the bulk of the article was devoted to proving the invalidity of those widely-held arguments that such a mechanism existed. Thus Neisser arrived at the following:

> The conclusion is inevitable: there is no mechanism within the framework of rational economic analysis that, in any situation, would secure the full absorption of displaced workers and render "permanent" technological unemployment in any sense impossible.[10]

From the basis of our own examinations in this paper, we must conclude that the major criticisms Neisser held against the three traditional schools of economic theory with regards to the issue of technological unemployment, remain unrefuted. We have examined writings of some of the most eminently-regarded thinkers on the subject and found that, while a considerable sophistication of approaches has been approached in some areas, in others economists have based their analyses on the kind of unrealistic assumptions that Neisser attacked. And on some points, it appears that Neisser's arguments have been considerably strengthened by more recent publications. We find, in all, that in spite of the views of those who would wish to prove the contrary, the eventuality of "permanent" technological unemployment remains a logical possibility that has yet to be invalidated.

[10] Ibid., p. 71.

As has been noted, Neisser, unlike Marx, did not express any definite opinion as to whether the factors of labour absorption would in future offset technological displacement of labour. Neisser observes that the evidence of the half century after the publication of Capital provide an apparent refutation of Marx's own prediction that displacement would exceed reabsorption. But, writing from his 1942 vantage-point, Neisser states that "the experience of the last twenty years is less favourable, at least more controversial."[11]

The three decades of economic experience since the publication of Neisser's article have, in a post-Keynesian world, seen an entirely different perspective put on the problem of unemployment. Since, according to the new orthodoxy, government fiscal, monetary and, more recently, manpower policies are capable of alleviating high levels of unemployment, government intransigence has usually been laid to blame for permitting excessive levels of unemployment. However, certain sectors of public and academic opinion, concerned about

[11] Ibid., p. 70.

high unemployment and unconvinced that it is solely attributable to the government's unwillingness to act, have not ruled out entirely the possible prospect of the kind of technological unemployment that we have defined here as "permanent." Certainly the numerous explanations which purport to deny such a possibility seem to be no more plausible than the ones available at Neisser's time.

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