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TECHNICAL PROGRESS
AND UNEMPLOYMENT

An Enquiry into the
Obstacles to Economic Expansion

BY
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FOREWORD

For some time past the question of the repercussions of technical progress on employment and unemployment has been the subject of discussion and research. As a contribution to the elucidation of the problem the International Labour Office published in 1931, under the title *The Social Aspects of Rationalisation* (Studies and Reports, Series B, No. 18), a volume of preliminary studies bearing on the influence of rationalisation on the output of labour, hours of work, wages, employment, health and the prevention of accidents.

During the last few years, the movement for the reduction of hours of work has occupied a particularly prominent place in the activities of the International Labour Organisation, and in the discussions which have taken place on this issue special attention has been devoted to the economic consequences of technical progress, with special reference to employment and unemployment. The International Labour Office offered a further contribution to the investigation of this problem by the publication in 1935 of a study by Professor Woytinsky entitled *Three Sources of Unemployment* (Studies and Reports, Series C, No. 20), in which the author sought to determine the part played by technical progress as one of the several factors which affect the total volume of unemployment.

There still remained, however, the need for a comprehensive and detailed study of the effects of technical progress on employment, and it is this study that Professor Emil Lederer has undertaken in the present volume. As the author indicates in his summary, the purpose of the book is to examine the phenomenon of technical progress in its various forms and effects, and especially its effects on unemployment and on the formation of capital. He deals in succession with:

1. The various forms of technical progress;
2. The concept of technological unemployment;
In order to aid the reader in following the thread of his argument, the author has given at the beginning of the study a "Summary" containing a general outline of the points which are developed in the body of the work. In concluding this brief survey he reminds the reader that the study is essentially of a theoretical nature. He therefore puts forward a number of useful suggestions as to the directions in which further research might be undertaken, with a view to verifying the soundness of his theories and clarifying a question which is likely to continue to hold an important place in the discussion of economic problems.
The present study, which is intended to analyse the effects of technical progress on the labour market and on the dynamic economic system, is a sequel to a theoretical analysis published by the writer in 1931. Since that time, the problem has been stated in wider terms. It now extends to the influence of technical progress in stimulating as well as in retarding or arresting economic expansion. Consequently any discussion of the question must inevitably deal with the dynamic process. The writer has, however, endeavoured to keep this book within the limits of an adequate treatment of its subject.

The author's thanks are due to Messrs. H. Barger, Mr. G. Colm, A. Halasi, W. Lederer, F. Lehmann, and J. Marschak, who were kind enough to read the manuscript and make some very valuable suggestions. In addition, he is indebted to many colleagues with whom he had the opportunity of discussing the main thesis of the book and from whom also he received helpful hints and criticisms. It should be understood, at the same time, that the author assumes the entire responsibility for the book.

The manuscript, it may be added, was completed in March 1936, but for various reasons its publication has not been possible until now.

January 1938.

Emil Lederer.
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ECONOMIC GROWTH DURING THE PRE-WAR PERIOD

The problem of unemployment is characteristic of our time. During the nineteenth century on the contrary, the growth of the modern industrial system of production was hampered by a shortage of capital and labour alike. At the beginning of the industrial system all the conditions for a rapid expansion of commodity production were present, namely:

(1) Favourable expectations of profit in industry, owing to the reduction in costs of capitalistic production as compared with handicrafts and large-scale production, preceding industry (Manufaktur).

(2) Development of the new transport system which came with the building of a network of railways, and which resulted in the following three results: large capital investments, the employment of large bodies of workers in the building and maintenance of the railway system, the widening of the markets for many products, without any reduction in the number of workers employed in their production.\(^1\)

(3) Lowering of customs' barriers, which had the same effects internationally as the creation of railway systems within the individual countries.

(4) Availability of large supplies of cheap labour drawn from the surplus rural population as well as from the rapid natural increase in the population resulting from a reduced death rate.

(5) Availability of a large supply of savings which could be mobilised to set the idle means of production in motion.

\(^1\) The high cost of transport by road had prevented the transportation of goods from their place of production.
(6) Increase in the supply of gold owing to the expansion of gold production which accompanied the growth of industrial production and the opening up of new parts of the world; together with an increase in the active money stream brought about by national and international credit operations, the circulation of bank notes, and the use of means of payment other than currency.

(7) Gradual spread of confidence in this movement, leading to favourable expectations of profit from new investments. This in turn led to the

(8) Investment of savings and credit expansion.

(9) Simultaneous progress of this development in all European and most non-European countries for political reasons, since potential military power was also governed by the growth of the industrial system.

(10) The illusion that the process of expansion would continue indefinitely, which led to large-scale migrations of capital.

The tempo of economic development in each country was determined by the weakest link in the system. In many countries, e.g. China, this was capital; in others, e.g. France, the growth of the population. The migration of labour and capital tended to smooth out the discrepancies between different countries, but only to a certain extent; capital did not flow quickly enough into the regions where there was a surplus of labour, or labour into those where there was a surplus of capital. The Chinese and Indians, for instance, had only limited opportunities of migrating, for economic as well as for political and traditional reasons.

The weakest link in the chain, that is to say, that group of the factors of production — capital or labour — which could be expanded least quickly, varied from one period to another. Generally speaking, however, it is true to say that the expectation of profit from investments and the capital or credit expansion necessary to finance them would frequently have allowed of a more rapid expansion of production in the European countries and in America than was permitted by the growth of the population. This accounts for the big migration movements which took place. The fact that although migration was theoretically free, many millions of workers were obliged to stay in their own countries, where their labour was less productive, prolonged the period of expansion, and therefore the relative prosperity of
the capitalist countries, to such an extent that the upward trend of development began to be regarded as a permanent phenomenon.

The construction of this new and rational economy was necessarily accompanied by serious disappointments for capital. As a matter of course capital began by flowing into the most profitable enterprises, but the more the supply of capital expanded as a result of the accumulation of profits, the mobilisation of savings and credit expansion, the smaller grew the rate of returns. The fall in profits was indeed partly checked by a repeated destruction of capital values because technical progress, the shifting of markets, changes in needs, international and internal migrations, and lastly, war, were constantly necessitating the investment of new capital even before the old had been entirely written off. Every form of production in the old industrial countries rests on various layers of capital, the oldest of which are gradually sinking lower and lower. The same is true of capital investments in national loans, mortgages, etc. Hence a large part of accumulated wealth is always very unstable. But this is also the explanation of the fact that profitability, and therefore the rate of interest, periodically recovered again after a temporary decline.

The circumstances mentioned above did not, however, ensure the unbroken growth of the population and of wealth. The rapid expansion of the capital goods industries during the development of new industries, and the opening up of territories still in the pre-capitalist stage, periodically necessitated a slowing down in the rate of progress. These pauses in development led to depressions, owing to the cumulative effect of every disturbance. But the market conditions of the depression, bolstered up by the rigidity of the incomes of large classes on the one hand, favoured by the fall in the rate of interest on the other, and stimulated by the persistence of old fields for investment or the creation of new ones, soon led to a fresh revival of enterprise and to a new phase in the process of growth. Nowhere were serious difficulties able to prevail in the long run. Accordingly the main theme of economic discussion before the world war was not unemployment, but the distribution of the national dividend among the various classes of the population. That the national dividend itself would continue to grow uninterruptedly was accepted as an axiom both by employers and workers, as well as by Governments. Even
Marxist theory saw the historical justification and function of capitalism in the rapid development of the forces of production. The rise in the wage level which was one result of increased efficiency was probably over-estimated, but no one has ever sought to deny that, taken in the mass and save for brief periods of reaction, production, employment and real wages all rose steadily from 1800 to 1914.

**Changes since 1914**

Since 1914, significant changes have taken place in four directions:

1. Political disturbances, destroying confidence among investors;
2. Collapse of a large number of currencies, uncertainty of exchange rates, restriction of international trade tending to throttle it entirely by means of quotas, the principle of reciprocity and attempts at autarchy, which again aggravate the political unrest;
3. Restrictions on migration;

These four groups of disturbing factors are interdependent and have their roots in the world war. They are not all of the same kind, however, for whereas groups (1) and (2) are the direct consequences of political ambitions and the currency confusion provoked by the war, the third group is attributable to the general spread of nationalist principles and the victory of monopolistic tendencies among the workers. And lastly, technical progress is to-day concerned very largely with the solution of different problems, in particular that of cost reduction, and only to a minor extent with the creation of new industries. This change in the character of technical progress was also originally connected with the war and with the military superiority conferred by mass production on the largest possible scale and with the greatest possible precision.

It would be impossible to isolate the deep-seated economic disturbances in the world in general and in the different national economies and to trace them back to each of the causes mentioned. The separate factors are too important and their ramifi-
cations too extensive for one or other cause to be regarded as pre-eminent. Moreover, as their effect is cumulative, it is equally difficult to assess their respective influences. All that can be said with certainty is that even the removal of the political disturbances alone or the compensation of displacements due to technical progress would appreciably improve the general situation.

The restoration of a political atmosphere which would restore confidence is not an economic problem — less so indeed than ever before, since in some of the most important countries political considerations are now allowed as a matter of principle to override economic ones. This practically eliminates the possibility of discussing political problems from the standpoint of economic common sense. To-day freedom of migration no longer exists, so that this question too must be excluded from the field of practical economics. As a result, attention is being focused more and more on solutions which will enable the process of development, interrupted or retarded within the individual States, to be revived. Here we come up against the problem of technical progress, which is hotly debated in present-day economic theory, and the elucidation of which may have an important bearing on economic policy even within the boundaries of a single country.

**Technical Progress an Economic Problem**

The purpose of this book is to study the phenomenon of technical progress in its various forms and effects, especially in its effects on unemployment and on the formation of capital. These effects are by no means simple. If the question is considered under all its aspects, it at once becomes clear that the problem is one of expansion in general that is to say, a problem of growth in the dynamic system. A large part of my remarks are therefore devoted to an analysis of our dynamic economic process.

**The Dynamic Process and Increasing Returns**

The cardinal point of my description of the process of economic expansion is the thesis that, except for specific industries and during brief phases of the business cycle, production is pre-
dominantly governed by the law of increasing return. The term is given various interpretations. Sometimes it is taken to mean the rate of increase in the volume of production which results from increased application of one of the factors of production while the others remain constant, and sometimes the change in returns after a simultaneous increase in all, or at any rate the most important factors of production. It is more or less generally agreed that when all the factors of production are increased simultaneously gross returns will increase at least rapidly. For the purpose of our argument, however, it is important whether the marginal productivity of an additional dose of one factor of production, with the other factors remaining constant, rises, remains stationary, or falls. The general view is that it falls. This view rests on the assumption that the other factors of production are already fully employed and that the optimum distribution of resources has been arrived at and that accordingly any increase in the volume of one of the factors of production necessitates a technical reorganisation which forces down the return of the extra factors of production to below the previous level of marginal productivity. My analysis is based, however, on what I consider the more realistic assumption that in the vast majority of cases the factors of production, and in particular the technical equipment of undertakings, are not being fully employed, and therefore that marginal productivity, in terms of goods, will at any rate not be likely to fall when employment increased. Hence, within limits which in practice are fairly wide, any sudden extra supply of workers can be so applied in a given system of production that labour productivity per worker does not decline. This applies a fortiori when the extra workers are employed partly in producing capital goods and partly in producing consumption goods. If the whole economy is permanently operating below its full capacity, the marginal productivity of one of the factors of production can only fall if some of the other important factors of production are being fully utilised and cannot be increased. This applies even in the short run when we may assume that the other factors of production are constant.

If the discussion is shifted to the ground of value productivity — that is, to variations in profitability instead of variations in physical productivity — quite a different set of questions is raised. Admitting that extra doses of the factors of production do not increase output by less than those previously applied, the
sudden occurrence of unemployment cannot be due to the main¬
tenance of real wages at their former level. The argument that as the marginal productivity of labour has fallen wages must follow in order to enable all the workers to be employed does not apply in this case because marginal productivity has, on the con­trary, increased. If therefore industry fails to absorb an extra quantity of labour although unused capacity is available, parti­cularly during a depression, this is due to the impediments to an expansion of production inherent in the capitalist system. These impediments would not exist in a planned economy.

The position is rather different as regards the marginal pro­ductivity of capital. In all industrial countries the supply of capital grows more rapidly than the population. Even if all the labour available is employed, this will not necessarily mean that the marginal productivity of additional doses of capital will diminish; but it will only fail to do so, i.e. increase or remain constant, if, with an increasing supply of capital, every increase in capital equipment (even if the number of workers remains unchanged) would lead to an equivalent increase in output. In this case — admittedly a most unlikely one — the rate of interest would not fall even if the supply of capital expanded, since under the conditions described the same price as for the capital already invested could be paid for the additional capital. If reserves of labour are available, a diminishing return from capital is not to be expected.

Effects of "Inventions"

Once the general character of this dynamic system has been established, the next step is to analyse the effects of technical progress. This requires a preliminary definition of the pheno­menon of technical progress itself. I propose to distinguish inventions proper from technical improvements in the narrower sense. The term inventions will then cover such technical innova­tions as led to the production of goods which enlarge the scale of needs (bicycles, the telephone and the like). Inventions of this type will increase the total volume of production during times of unemployment. They are therefore eminently fitted to keep a rapidly growing population permanently employed and to absorb unemployment arising from any other source. Both, a shift in the scale of needs and, under certain circumstances, an
expansion of international trade, will have the same effect. This
growth in the total volume of production will last until the new
product has become firmly established. The process may take
several dozen years, and throughout this period an ever-growing
number of workers can be employed in the new industry without
reducing employment in the other branches of production.

Effects of Technical Progress

The most important question, however, is that of the effects
of labour-saving technical progress. As a rule it is assumed not
only that all industries are working without reserves, and there­
fore employing their full capacity, but also that any change,
whether in tariffs, markets or the prices of raw materials, or
merely in the supply of production goods (e.g. the formation of
new capital, the emigration of workers, or even the appearance
of a new class — the middle class — on the labour market), can
be adjusted by corresponding changes in the prices of goods or
in the remuneration of the factors of production. If this view
were correct, even labour-saving technical improvements would
not increase unemployment, since all unemployment, whatever
its cause, could be eliminated within a short space of time by the
mechanism of compensation. Even this process would need some
interval, because the adjustment to new conditions takes time.
This is particularly important in the case of cyclical unemploy­
ment. If adjustment does not take place within a given time,
then according to this view it is only the rigidity of specific
prices, or, in the case of technological unemployment, of wages
that can prevent the full employment of factors of production for
any length of time. Most economists would agree, however, that
in certain cases adjustment is impossible, e.g. if the industry
affected is one in which the workers cannot leave their homes nor
be retained for a different occupation. In such cases full employ­
ment can only be restored by diverting the younger generations
into other industries and gradually introducing new undertakings
into the district.

But apart from such special cases, it is generally held that
technical progress speeds up the development of production
because it reduces costs. This must lead either to a fall in prices,
with a consequent expansion of markets, or to higher profits
resulting in increased investments or consumption by the producers. As the total amount of purchasing power, the argument proceeds, does not change, neither will the number of workers employed, and the national dividend will therefore increase immediately if the price of the product is lowered, or later if the profits are invested, to the benefit of all concerned. It is indeed maintained in the same breath that labour-saving technical improvements by which workers are displaced diminish the marginal productivity of labour and thus necessitate a reduction of wages which would not have been necessary had the demand for labour remained unchanged. But in spite of this inner contradiction this argument is of considerable importance. The contention is that all the workers could easily find employment at lower wages; that profits would then rise, production would expand rapidly, prices would fall, and real wages would soon return to their old level. It is therefore held to be a mistaken policy on the part of the workers to resist the lowering of wages when technological unemployment occurs. On these grounds the possibility of the existence of technological unemployment is denied. As already stated, these two arguments are mutually contradictory. They also assume a process of development in which cyclical fluctuations are unknown.

Effects of Technical Improvements in a Harmoniously Growing System; The Process of Compensation

The starting-point of my analysis is the simple case of a harmoniously developing system in which production expands uniformly and steadily. It leads to the conclusion that cases may conceivably arise in which perfect equilibrium is restored within the technically dynamic industry after a certain proportion of labour has been forced out by technical improvements, so that within the enterprise in which the labour-saving devices have been introduced no fresh demand arises capable of absorbing the released workers. These cannot therefore be re-employed as a result of the technical improvements themselves, but only through the operation of the general forces of adjustment latent

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1 In spite of this contradiction the statement that marginal productivity of labour will decrease in consequence of labour-saving improvements makes sense under certain conditions.
in the market, and consequently subject to a reduction in wages.

The reason for this somewhat surprising state of affairs is that the lowering of costs of production may lead to a transfer of the income, and therefore of the goods formerly consumed by the displaced workers, to other persons (producers or consumers) so that the exchange system contracts and the income of the community dwindles. This, however, is a special case. In others conditions may be more favourable, and it is the purpose of this analysis to enquire into the main possibilities of adjustment. This demands considerable patience on the reader’s part, but I think that a detailed exposition of these possibilities is essential because the effects of labour-saving technical changes are many and various and depend on the other conditions obtaining. These conditions include in particular the organic structure of the industries, the elasticity of demand, and the possibility of the formation of extra capital.

The first part of my analysis is based on the assumption that all the factors of production are being employed, and that consequently the supply of capital available is limited to current savings. If the labour-saving technical improvements demand additional capital, there will be a change in the organic structure not only of the dynamic industries but also of all the other branches of production. Under these conditions there will be a substantial primary and secondary decline in the rate at which employment would have increased if these technical changes had not taken place; it cannot be counterbalanced by the changes produced by the technical improvements themselves.

I then proceed to consider how this unemployment can be reabsorbed in those industries which are the centres of disturbance. As the only possible method of bringing this about is to expand the output of the products which can now be produced at lower cost, a great deal will depend on the elasticity of demand; but even when elasticity is larger than unity it is possible to show that an expansion of production to the point when all the workers can be reintegrated into the process of production would involve such a drastic reduction in wages as to place it beyond the bounds of practical possibility. Although therefore the equilibrium theory is correct in abstracto, from the standpoint of practical economics it is worthless. Hence in isolated cases of technical progress the workers will, wherever possible, seek an outlet in other industries or in the personal services.
Where this is not possible, because they are tied to their homes or because special training would be necessary, for instance, or where technical improvements are introduced simultaneously in a number of important industries, unemployment will be prolonged and stubborn. Under our assumptions even a transfer to other industries will be difficult, because the latter will be short of capital and consequently will only be able to increase their output with rising costs, which will prevent them from expanding. The only remaining way out of the difficulty will then be to reduce wages; this, however, will not be merely a temporary expedient but will last for some time. Moreover, it is more than questionable whether the producers will be inclined to increase their output at a time when large bodies of workers are being rapidly displaced.

As already stated, this process must be analysed in great detail, and it will then be seen how far wages need to be reduced in order either to make technical improvements less advantageous, and therefore to retard them, or to restore the workers to employment. These points are seldom put forward because the theory of automatic adjustment is regarded as a divine or natural law which is bound to prevail whatever its consequences for one section of its victims, in this case the workers. By pointing out that under our assumptions such a compensatory adjustment is impossible in practice we do not in any way detract from the theoretical value of the abstract notion of the tendency to equilibrium, although it is not sufficient, without much closer investigation, to solve the unemployment problems arising out of technical progress.

The disturbances created by labour-saving technical improvements are thus examined under very strict assumptions. Following the practice of most economists, I have ignored the possibility that unused capacities may be available. But even if this factor were to be taken into account, it would only temporarily prevent the secondary unemployment which arises when the flow of investment into the static industries is diverted by the urgent demand for capital from the dynamic firms. Within an expanding economy which has constantly to reckon with such labour-saving and capital-requiring technical improvements, and in which the demand for capital therefore exceeds the normal volume of savings, unused capacities will in fact very soon be brought into full play, thus permitting only of a temporary
increase in total output with an increasing number of workers.

Our investigation of all the consequences involved by technical improvements shows that, under the assumptions made at the outset, a good deal of technological unemployment will remain in most cases although there may be a certain amount of compensation. Even if the lowering of costs leads to a corresponding fall in prices, this will never be sufficient to restore the released workers to employment, except where the elasticity of demand is unusually high. Even with elasticity between 1 and 2 it will often be impossible to prevent unemployment, because prices also include allowances for the remuneration and amortisation of capital, so that the percentage fall in costs, and therefore in prices, is smaller than that in wages. Hence it is only where demand in a given industry is unusually elastic that any fall in prices following the lowering of costs will lead to such an expansion of demand as will restore employment to its previous level. A reduction in wages, and often a very substantial one, will therefore have to take place in order to bring this about.

Lastly, the sum corresponding to the amortisation and remuneration of this capital does not represent new income, given our previous assumptions, but would have appeared in some other sector of the economy even had no technical improvements taken place, so that it is one of the factors to which the whole system is already adjusted. Hence the utilisation of these sums on the market does not mean that new openings for employment are created. That is why a considerable residue of unemployment often remains even if prices are lowered. This is also true when any extra profits are invested; this again leads to the re-employment of only one section of the unemployed, and it is only gradually that new openings are created permitting of a permanent increase in employment. The extra workers will, however, be absorbed in the course of time, unless fresh technical improvements are constantly creating fresh unemployment. Technological unemployment is thus a medium-term phenomenon.

These various possible forms of compensation and their extent can only be explained with the aid of numerical examples and I have tried to base these on realistic assumptions in regard to organic structure. These numerical examples may seem tedious to many readers, and I have considered whether they could not be replaced by general formulae. But this is impossible owing to the nature of the processes described, which have
so many aspects and must be followed in all their ramifications. Moreover, it is in the nature of a general formula to show only the final equilibrium achieved without throwing any light on the intervening stages necessary to establish it and on the time which these may be expected to last. Nor can I see how such formulae can prove anything at all without numerical coefficients. If we base our argument on numerical examples, on the other hand, we shall not be tempted to console ourselves with the thought that a final state of equilibrium is mathematically conceivable once we can prove that for social reasons the achievement of this equilibrium is impossible. Human labour too has its physical, and above all its social, cost of production, and we can only assume that the supply of labour available will always and under all circumstances be able to find full employment if we ignore the lower limit below which wages, or the cost of human labour, cannot be allowed to sink. Had this not been done in the past, the fallacy of the argument which assumes that the problem is solved, although the full employment of all who are seeking work involves the permanent exclusion of some workers by the operation of the "economically justified and necessary wage", would long since have been exposed.

It must be emphasised again that we are here merely describing the effects of labour-saving technical improvements. So far as entirely new industries are concerned, it can easily be shown that the general result in case of full employment will merely be that one industry will supplant another, whereas if there is unemployment the demand for labour will rise. Hence, provided that their employment capacity is sufficiently large, new industries can rapidly absorb any unemployment which may arise even without a reduction in wages. But it is characteristic of the present phase of economic development, as contrasted with the nineteenth century, that such new industries seldom appear.

**Effects of Technical Improvements within the Framework of a Business Cycle**

The effects of labour-saving technical improvements are rather different when rationalisation is considered within the framework of the business cycle. If the labour-saving technical improvements are financed during the upswing, credit expan-
sion will also enable the needs of the technically unchanged industries to be satisfied, so that not only will no secondary unemployment arise but the rising demand for capital will lead to extra employment. This will result in a cumulative increase in production and employment in the manner already described on several occasions. The fact that a substantial proportion of the new investments are used to lower costs in existing industries, and not to extend them or to build up new ones, has no effect on the upward movement of the business cycle, nor need the rate of investment be higher than in a normal period of prosperity. But it may nevertheless happen that even during the upward trend the tempo of the increase in employment is seriously retarded. If the labour-saving methods begin to take effect while the boom is rising, employment will decline in the industry which is being rationalised, and this will also involve additional unemployment. Thus even during the upswing, employment may lag behind the increase in productivity, as happened in the United States in 1929, for instance, when although the index of production was 134 employment had risen by only 3 to 4 per cent. from the 1923-1925 index figure. It is this slower rate of increase of employment which also explains the present substantial volume of unemployment which remains, although production has again reached a high level.

When the upward trend of the cycle comes to a standstill the investment boom collapses, especially as replacements are also postponed during depression. But if the rationalisation movement was dominant during the upswing and continues during the depression in the form of adjustment to the changed market conditions, employment will also fall off in the consumption goods industries. The greater the decline in employment, the greater also will be the cumulative effects, and therefore the surplus capacity created. Technological unemployment then merges with cyclical unemployment, which it very greatly aggravates. But our analysis shows that it is particularly difficult during a depression to set those compensating factors in operation which are described in our scheme of a dynamic system unaffected by cyclical fluctuations. In the first place, the demand for labour falls off suddenly because the displacement latent throughout the foregoing period takes place all at once; while secondly the profits which would normally result from rationalisation are no longer earned because the severe shrinkage of production, even in the
rationalised firms, which have to set aside larger sums for the remuneration and amortisation of their capital, practically eliminates them. Such profits as are still earned are made at the expense of a still more severe contraction of the output of the technically backward firms. These profits will not, however, be invested during the depression. If, on the other hand, a reduction is made in prices to correspond with the reduction in costs, this means heavy losses if production is seriously cut down. Consequently prices will usually merely fall in comparison with the boom period, but not to the full extent permitted by full employment in the new undertakings and by the economy in wages. As a result, neither will demand rise enough to compensate any considerable part of the displacement. If it is also remembered that consumption too falls off in the depression because many consumers want to enlarge their reserves, we find ourselves confronted by a phenomenon which is indeed a familiar one, but is here of greater magnitude than before. The cumulatively disturbing effects of this shrinkage of production and of employment may go so far that Government intervention is necessary to check the collapse of markets. In any case deflationary policy, which would be salutary though painful in a depression of normal magnitude, would in this case, by steadily reducing purchasing power, only undermine the ground it might gain if prices or wages or both could be lowered without affecting total purchasing power.

On the other hand, if rationalisation did not proceed on a large scale during the boom the subsequent reaction would not be so severe; the new industries founded during the upswing would be in operation and once the unprofitable items in the balance sheet had been wiped out a new movement of expansion could set in.

The Case of Capital-saving Improvements

So far we have been discussing labour-saving inventions. The capital-saving inventions which are often contrasted with them in economic writings do not, however, differ from them very much in their effects, for capital-saving inventions are also, without exception, labour-saving inventions for the firms producing capital goods, e.g. excavators in railway building, or-
mechanical tools in coal mining. Hence it cannot be assumed that these capital-saving inventions will counterbalance the unfavourable effects of labour-saving inventions; on the contrary, they merely aggravate the position and create a fresh problem, that of how the savings, the efficiency of which has been increased by the capital-saving inventions, are to be invested. They also introduce a fresh disturbing factor by reducing the value of older capital goods.

In a depression of the type here described, with extensive unemployment and idle capacities, the difficulty lies in the fact that even when the financial situation has been straightened out and the capital market freshly supplied, the channels for new investment are still blocked. They will remain blocked so long as nearly all industries are still operating below their full capacity and a forced expansion of production in the consumption goods sector is impossible because, given the circumstances, any such expansion would flood the market with goods which could only be sold at a loss.

**HOW A PLANNED SYSTEM WOULD COPE WITH "TECHNOLOGICAL UNEMPLOYMENT": CONSEQUENCES FOR A CAPITALISTIC SYSTEM EXAMINED**

This difficulty could be overcome more easily in a planned economy because the latter can better afford to produce temporarily at a loss. Even if such a situation were to arise within a planned economy (e.g. as a result of a disproportionate expansion of production in connection with armaments), which is in itself unlikely, the expansion of the output of consumption goods would merely mean that in certain economic branches costs were higher than returns, a situation which actually arises during depressions and mitigates their severity. These losses would be borne deliberately and as it were with a quiet conscience. In any case, they would probably not be larger than the unavoidable deficits of private undertakings during a depression and the cost of unemployment relief. In a planned economy they would result from the fact that labour and means of production were being employed in producing consumption goods instead of capital goods. As the aggregate workers' income would remain the same, the prices of consumption goods would have to be drasti-
cally reduced. Supposing for instance that all the unemployed were transferred to the consumption goods industries, and that as a result the number of workers in these industries increased by 10 per cent. and the output of goods by 15 to 20 per cent., with unity elasticity prices would also have to fall by about 15 to 20 per cent. and the consumption of all workers would rise accordingly.

This expansion of output in the consumption goods industries would, however, very soon necessitate the production of fresh capital goods for these industries, and would thus relieve the labour market, reduce the output of consumption goods, and so raise prices far enough to cover costs.

So long as the over-production of consumption goods continues, the consumption goods industries will remain in debt to the central bank. During this period part of the goods produced, i.e. that part the proceeds of which would in the normal course of expansion be sold to finance the replacement of worn-out plant and new investments, will be “given away” to the consumers. The losses in the consumption goods industries will therefore be equivalent to the value of the replacements and new plant which are temporarily not required. These losses are inevitable when there is a surplus of capital goods resulting from over-production in a foregoing period. So long as the economy is still over-equipped for production they are harmless, and it can therefore also do no harm to write off the debts of the consumption goods industries to the central bank, a thing which is often done in capitalist economies as well. This avoids the necessity for deflation. But if the debt is left standing and has to be paid off, purchasing power is withdrawn from the consumption goods industries and diverted to the central bank, where it is destroyed, thus leading to a fall in the price level which is unnecessary.

The explanation of the fact that the writing off of losses does not damage the economy as a whole any further, whereas on the contrary its expansion might be hindered by the effort to cover them subsequently, is that the “losses” (to employ the

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1 The effect of this regrouping of the factors of production would be less drastic, however, if a substantial proportion of the workers released from the production goods industries could be transferred to the production of durable consumption goods, such as housing. The supply of houses would naturally rise much less rapidly than the rate of increase in their output because the new housing-space would represent only a small fraction of that already existing. Consequently the effects on the price system would also be milder.
term used of private economies to describe a situation which in a planned economy is nothing but the deliberate employment of surplus factors of production) took place as soon as the total returns from the product fell below the total costs. They cannot therefore be eliminated by subsequent repayment. This indeed improves the position of a debtor within a private economy, but has no adequate economic justification in a planned economy. On the contrary, the covering of losses which involves the destruction of purchasing power, because the latter cannot be re-invested, either cuts down the volume of production or entails an unnecessary fall in prices. But if the sums repaid to the central bank are lent out again, there is no change in total purchasing power and the consumption goods industries could just as well have used these sums themselves. Whether they are to be spent in the same economic sector or elsewhere will be decided in a planned economy by a central authority.

There is nothing very extraordinary in this argument, but it simply serves to show the absurdity of cutting down production and consumption precisely at a time when unusually large supplies of capital goods and labour are available, that is, at the end of the upswing.

In a capitalist economy the course of events is similar, but involves considerable unemployment. Here too the producers will accept such losses in order to escape still larger ones; and they too will thus give away part of their output without any return from the consumer. Moreover, if unemployment relief is paid out of public funds which are by no means entirely formed by taxation but also by the mobilisation of savings, consumption goods will be distributed, the price of which would have gone to purchase capital goods in a harmoniously developing economy. The same applies in regard to the economic importance of public works; this again is a method of distributing to the consumer goods which would normally go to workers employed in the private manufacture of capital goods.

In a capitalist economy too the capital goods industries will sooner or later be revived by orders from private industry, and consumption goods will once more be sold mainly to persons deriving their incomes from private industry. In the meanwhile the State will have become indebted to the community, and a sum large enough to pay interest and amortisation on its debt will have to be found out of taxation. But after this period the savings
which were temporarily used to maintain the unemployed will gradually again become available for investment. In spite of the extra burden of taxation involved by this public indebtedness, however, investments in general will not fall because the subscribers to the loan will invest the interest they receive on it, even though the taxpayers may meet the extra taxation out of parts of their income which they would otherwise have invested. Hence the extra taxation in itself does not reduce the purchasing power available for investment because the interest on the loans is not used for public expenditure, but forms private income. It is at the floating of the loan that a charge is placed on the community, owing to the fact that the services of one or more of the factors of production do not flow into private industry, and therefore do not form private capital, but are used on public works or paid for without being used at all (relief). From the standpoint of the whole economy, the important point to determine is whether the supply of capital goods, land, plant and labour, is larger or smaller after the depression than before, irrespective of the monetary expression of this process. As a rule public works will check a decline in the real forces and potentialities of production. As public loans merely represent a claim of the community to the payment of the interest on them, they do not in themselves reduce national income or place a further burden upon it. It is only when in the course of the process of financing the loans fractions of real wealth are destroyed, and the future possibilities of production are thus diminished, that a charge is laid on the future.

It would therefore be possible even in a capitalist economy to re-employ idle capital equipment and thus to remove the difficulties arising out of an over-rapid expansion of productive capacity. Owing to traditional resistance to energetic measures for fighting depression and its social consequences, however, it is more difficult for a private economy to overcome the maladjustments of rapid growth than for a planned economy, which has greater freedom to choose its ways and use its means. Analysis of a similar situation in a planned economy indicates how the workers displaced through technical progress can be reabsorbed into the process of production.
Suggestions for Research

The treatment given in this work is theoretical and it has necessarily been complicated, but some at least of the points it raises could well be verified by appropriate research: an investigation of the following relationships would do much to clarify this question which is one that continually arises in current economic problems.

(1) A historical analysis of inventions and technical improvements during the nineteenth century and at the present time, throwing if possible some light on the relationship between these two types of change.

(2) An analysis of the protracted period of prosperity 1923-1929 in the United States with special reference to the fields of investment and a corresponding investigation of the present period of recovery in the United States and in Great Britain.

(3) An enquiry into the relationship which capital investment (i.e. charges on account of interest and amortisation) bears to economy in labour-costs.

(4) An analysis of the effects of the building of railways on the organic structure of production.

(5) An analysis of the expansion of service-industries and their importance for the reabsorption of displaced workers.

(6) An examination of industrialisation favoured by capital-saving inventions, illustrated by a comparison of industrialisation in China compared with the same process in Japan.
CHAPTER 1

VARIOUS FORMS
OF TECHNICAL PROGRESS

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TECHNICAL PROGRESS BEFORE THE INDUSTRIAL REVOLUTION

It is only since the industrial revolution that technical progress came to be an economic problem. In the ancient world, in the Middle Ages and in the first two centuries of the modern era, technical changes sometimes came slowly, sometimes more quickly. But the inventions of this period were usually due to chance, rarely to systematic observation. The inventors are often unknown. In many cases centuries passed before some of the technical methods that we should consider obvious were discovered. No conclusions were drawn from observations that might have led to important technical developments. It was only gradually that the knowledge of material, and of the technical methods of using it, evolved into a system that could be steadily and logically developed on the basis of scientific research.

So long as the Cartel system and manual labour predominated, all technical improvements resulted simply in an improvement in the standard of living, generally only of the ruling classes. It was only with the introduction of the machine — that is, a tool driven by mechanical power — under capitalism that an industrial proletariat was created and that technical progress was at the same time transformed into a sociological problem, unless indeed the occasional revolts of craftsmen against machines can be taken as examples of the same movement. Owing to the rapid expansion which took place in the early industrial era, both in indivi-

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dual national economies, and in the economy of the world as a whole, the first considerable reactions of the workers to machinery were soon repressed and overcome. Only much more recently, indeed only since the war, has the phenomenon of technological unemployment become an urgent question.

In discussing the problem whether technical progress can result in unemployment, the phenomena under discussion are rarely analysed in detail. The general concept of technical progress, by which is meant the discovery of new and more efficient methods of producing an existing product or the development of a new product, is at once too wide and too narrow for the purposes of economic analysis. It is too wide because not all technical progress is economically advantageous. Generally the new method must go through a long process of improvement before it can be introduced into the process of production and increase the profits of existing undertakings or serve as a basis for new profitable undertakings. It is only then that a technical improvement becomes economically important. The concept is, on the other hand, too narrow because it excludes changes which may not be technically new but which may have similar effects. For instance, every improvement in the methods of utilising raw materials, labour power, or plant increases the productivity of the undertaking. These changes, which may be called improvements in organisation, have exactly the same effects as technical progress itself. Moreover, the line of demarcation between technical progress and improvements in organisation is very difficult to draw. Thus, it is questionable whether an improved division of labour within the undertaking should be considered as a change in organisation or as technical progress. In any case everything that will be said in the following pages with regard to cost-reducing technical progress applies equally to improvements in organisation.

Cost-reducing technical progress, however, is only one special type of technical change.

**Inventions and Technical Improvements; Differences of their Effects**

I propose to distinguish two types of technical changes:

(a) Technical innovations that serve to produce new commodities. These may be called inventions. They result in the
VARIOUS FORMS OF TECHNICAL PROGRESS

substitution of a new commodity for one already in use, or they allow to produce a commodity, which was not known at all;

(b) Technical improvements which serve to produce a commodity, already known, with lower costs. Technical changes of this type may be called technical improvements or technical progress.

(a) Inventions differentiate production. New commodities appear on the market, replacing commodities used before or serving to satisfy necessities which are only felt on the arrival of the new commodity. The first sub-group comprises all substitutes, such as margarine for butter; or the motor-car in so far as it replaces the railway. But many of these inventions belong to the second sub-group as well. Examples of inventions which mainly or to a great extent serve to satisfy new necessities, are: the bicycle, the telephone, the telegraph, the gramophone, the films, the radio, many medicines, the fountain pen, the railway, the motor-car, the aeroplane, electric light, water mains, central heating and so on. Most of these commodities have a double character: they lead on the one hand to the realisation of new necessities and lead so far to an expansion of the total production, but in most cases they compete with other branches of production too. Thus the railways eliminated the mail-coach; the motor-car superseded the horse-drawn carriage and encroached later upon the market of the railways.

The gramophone can be considered as a competitor of musical instruments, and the cinema has undermined the theatre as a profit-making institution. Similarly, wireless affects the possibilities of marketing many other things, such as newspapers, orchestral concerts and the opera. It is only inventions such as bicycles, the telephone, the telegraph, many medicaments, and fashionable novelties that represent additional consumption: for example cosmetics or overshoes, which create a market that does not compete to any great extent with existing markets. In these cases entirely new needs arise, the satisfaction of which, if the needs are felt to be urgent, certainly precludes the satisfaction of certain other needs so long as the income of the individual remains stationary, but does not affect the intensity of the subjective need for other products. (The only reason why needs that have previously been satisfied do not continue to be so is that income is limited. There are only a few cases in which the new needs reduce the subjective urgency of other needs.)
As a rule the effect of such inventions is a composite one. In part they will reduce the demand for other products and in part they will form the basis for new types of consumption, creating hitherto unknown "genuine" or "social" needs. For instance, fountain pens to some extent drive ordinary steel pens off the market, but at the same time they satisfy a need that had previously perforce remained an unfulfilled desire — the wish to possess a pen that is always suited to the personal needs of the writer and the possibility of writing in ink without inconvenience under any circumstances. Electric light has taken the place of gas or, in the case of many rural dwellings, of oil lamps, but at the same time it has extended the demand for lighting because now the demand can be satisfied in cases where it was formerly difficult on account of the danger of fire (e.g. in barns) or was technically impossible (e.g. on roadways), quite apart from the fact that gas and electric light have created a demand for stronger lighting and introduced quite new uses for light, as, for example, for advertisement purposes. The same is true of many of the inventions mentioned above.

(b) Technical progress covers an extremely wide field. It includes all the changes by which machinery is substituted for manual work, such as the mechanical spindle, the mechanical loom, excavators, coal-cutting machines, sewing machines, the machines used in the boot and shoe industry and many others. But the fuller utilisation of raw materials and the more effective utilisation of the heat content of coal also represent technical progress, as do all improvements in machinery that reduce the duration of the production process. Ultimately the purpose of all these improvements is to reduce the time required to carry out a given task, irrespective of the stage of production at which that reduction takes place.

The economic effects of this second group of technical changes are very varied. If we consider only the short period and medium period effects, which are the subject of the present study, it may be said that only the second group — "technical improvements" — can produce technological unemployment. Certainly the technical changes included in this group directly reduce the demand for labour. Whether and when this will produce unemployment for a long or a short period is the subject of the present investigation.

Inventions, on the other hand, in so far as they create new
needs, will not have this effect. In so far as inventions fall under
the first sub-group ("substitutes") and in so far as the new
production processes provide employment for exactly the same
number of workers as were employed in the undertakings whose
products have now been driven off the market, there is merely a
transfer of labour and no decline in the volume of employment.
It is true that the capital invested in the undertakings which
have had to close down or reduce their production will yield less,
and their profits will therefore disappear. But capital will be
invested in the new undertakings and will yield a profit there, so
that there is fresh income from capital to take the place of that
which was lost. The total profits in the economic system will
therefore not be reduced. If the economic system be taken as a
whole, inventions of this type will not reduce the volume of
employment but may even increase it temporarily during the
period of actual investment. The new demand for labour
comes first in point of time, and there is therefore not even
temporary unemployment. It is true that in such a case no
permanent additional employment is created, but at least the
demand for labour as a whole is not reduced. We could speak
of technological unemployment only in the sense that owing to
the absorption of newly formed capital in this type of undertak­
ing the total volume of employment cannot increase, so that if
there is an increase in the supply of labour available unemploy­
ment will result. But employment will not diminish; it is
merely that there are no fresh openings for additional workers.
In accordance with the terminology that is used in this study,
secondary unemployment will ensue. Consequently, the further
increase in the social product which usually takes place in the
course of this development will not occur. If in the new indus­
tries the amount required to take the place of the product that
was previously used can be produced with less labour, then the
result will be the same as for group b: the invention will be
combined with technical progress in the sense defined above and
will therefore lead to the displacement of workers, with all the
consequences which will be examined later.

Cf. the present writer’s article: "The Problem of Development and
Economic Expansion induced by Inventions

When inventions belong to the second sub-group of group 1, they open up a new field for the production of commodities. The process is then more or less as follows: a new industry, such as the bicycle industry or the wireless industry, is brought into existence. Normally this industry, like all new branches of the economic system, will, unless supplementary credit exists, be created by the investment of savings. When it comes into being and finds a market for its products, permanent employment will be created for a certain number of workers. If we assume the least favourable results, whereby the income of all the other consumers, workers and employers remains unchanged, the new development in the economic system will still not produce any serious disturbance. The existing producers in their capacity as consumers will now use their income differently and transfer a fraction of their demand to the new products. If, in the language of the marginal utility theory, the new product represents a higher value for them than the marginal utility that can be realised within the limits of their income, they will consume less of other products, perhaps of food or clothing. An example of such a transfer of demand on a large scale can be seen in the United States since motor-cars became cheap: people, of a given level of income, are spending less on their houses, in order to enable them to buy and run a motor-car; or, alternatively, they occupy houses farther from the business centre and so spend less on rent and on services.

But this limitation of demand in the application of the existing incomes is counterbalanced by the fact that the additional workers for whom employment has been provided and the owners of the new undertakings represent additional demand, most of which, in so far as it does not go to purchase their own products, will necessarily be devoted to those products the consumption of which by the older consumers has declined. Apart from a slight temporary dislocation (which in reality may be overcome without any friction thanks to the existence of stocks) the volume of existing production can be maintained unchanged side by side with the additional production, and there will be an increase in the total number of workers and employers as also in the number
of salaried employees, the volume of transport required, the volume of public services, etc.

Theoretically the productive system should be able to expand smoothly when population increases, even if no new branches of production are introduced. In reality, however, there is a certain amount of friction that makes development of this kind difficult, whereas new inventions provide a particularly advantageous and simple form of increasing the volume of production. The effects of inventions will be all the greater if the system develops in such a way that the old consumers are in a position to maintain the whole of their previous consumption. This can occur if they increase their own efficiency or if they are able and willing to perform more work and can find an opportunity for doing so within the productive process. A general fall in the consumption of an important section of the consumers, accompanied by the maintenance of the sales of those industries whose products are no longer consumed to the same extent by that section, is one of the strongest incentives to the restoration of the previous level of consumption. Circumstances are particularly favourable if the desire to restore the former level of consumption is shared by producers in a large number of industries, because then the amount of work performed can be uniformly increased. In many cases the "old" consumers will decide to maintain, at least temporarily, their former level of consumption out of savings. That will help to expand the total volume of production, to increase the incomes of the "old" consumers and will enable them to pay for a permanently increased consumption. It is then possible for a general expansion of production to take place without any serious disturbances and, in particular, without the displacement of any workers.

Reference must now be made to the psychological aspect of this process. In the normal course of development of any economic system, all the persons in that system desire to increase their consumption. They are not, however, always prepared to increase the amount of work they do to a corresponding extent. Even if they were, there would be considerable obstacles to an increase in the intensity of labour or to an extension of the working day. The position is different if new needs provide a stimulus for increasing the productivity of labour. Probably dynamic forces, in so far as they were active in the evolution of our modern economic systems, would never have become so strong.
if the constant development of new needs had not made the psychological incentive to further production a permanent factor and indeed a social habit. It is of course true that these psychological incentives can be directly felt only in the case of a producer producing for himself (Eigenwirtschaft), but they do have a certain effect even in a capitalist system. Moreover the proportion of this production, even in a modern economy, particularly in agriculture, is far from unimportant.

**Monetary Aspect of this Expansion**

With regard to these new products, it may be assumed that as the economy develops the capital and the labour required for the establishment of new undertakings will always be available. In so far as this assumption does not hold good, the course of development will be slower.

This increase of production will naturally, like every other stage of the process of economic growth, require to be financed. Resources for financing the new industries will become available as development proceeds. In so far as genuine savings only are used in founding these new industries the purchasing power is already available for the manufacture of the means of production which are necessary. Some capital may be diverted from other uses, as, for instance, from the building of houses. In any case the question of finance offers no difficulties and will not produce any disturbances in the system. On the contrary the regular investment of savings is an important and necessary factor in maintaining the balance of development.

Nor will any difficulty be met with in the disposal of the new products. It is true that purchasing power will have to take another course, and the path it must follow if all the products are to be sold will include one additional stage.

Let A, B, C, D and E be the existing branches of production, the products of which are exchanged between the producers. Even if there is a given expansion in the amount of money income and in the volume produced, the paths followed by the various money payments remain the same. If a new product, F, appears, the necessary capital will, as has been seen, already exist. The sale of these products will not involve any serious monetary difficulty; for part of the existing money will simply have to travel
one stage further than formerly. If we assume that the income of A, B, C, D and E is 100, and that 5 per cent. of this income is devoted to the purchase of the new products, then 5 per cent. of the money in circulation in the form of income must follow the route passing through F. Along that route it will eventually return to A, B, C, D and E. The velocity of circulation of money, in so far as it is bank money and in so far as payments can be made by book transfers, is extraordinarily elastic and as a rule full advantage is not taken of this elasticity. Even as regards cash payments, statistics of the velocity of circulation show that in reality far greater fluctuations take place than would be necessary in the present instance. If, for example, the velocity of circulation of money is 10, it would have to increase to 10.5 on the above assumption, but a sudden deflection of perhaps 5 per cent. of the previous expenditure on consumption goods to the new industry is more than likely to take place, even if the new industry developed rapidly. Consequently an increase in the velocity of circulation from 10 to 10.2 or 10.3 should be ample to meet all the necessities arising out of the change in production. Changes of this extent in the velocity of circulation of money frequently occur without anyone even noticing them. Every increase in output, every change in mode of life (e.g. summer holidays), every change in habits of payment, leads to concentrated dislocations which put a far greater strain on the monetary system but which, nevertheless, are easily met.

Moreover, when an economic system is growing, the money system itself is elastic — that is, it must necessarily be prepared for an expansion of purchasing power proportionate to the increase in production. In that case the means required to purchase the new products are automatically available. Even if the volume of money remains the same no difficulties will arise.\(^1\)

There is one other point in connection with the capital required for the development of this new production: within an economic system that is developing uniformly, with constant capital formation, capital will have to be diverted from other fields

\(^1\) It has sometimes been suggested that the increase in the volume of employment when such new industries are set up will be hampered by the impossibility of increasing the rate of circulation of money (Otto Conrad: "Die Möglichkeiten einer Erweiterung des Arbeitsbedarfs" in Jahrbücher für Nationalökonomie und Statistik, III. Folge, Vol. 83, 1933, p. 36). In the light of what has been said above it will be seen that this view underestimates the elasticity of the velocity of circulation of money.
of activity (supplementary credit being excluded in this assumption) and this will slow down the rate of production of "other products". This does not mean any decline in the total demand for labour, provided that no change takes place in the structure of the productive system as a whole apart from the normal displacement that may be expected. There is no reason to expect the existence of such new products to increase the amount of capital per head used in production. The situation is different in the case of labour-saving technical advances, which by their nature bring with them a change in the amount of capital per head.

Thus inventions stimulate the process of growth. When, for some reason, this process slows down and the expansion of old industries meets with difficulties (as, for instance, saturation of the market, rigidity in costs, increasing risk or disproportional distribution of factors) monetary funds become idle and available for new industries; this type of expansion is especially likely to create employment for workers who would otherwise have been without.

It has been said that the present age is as rich in inventions as was the nineteenth century and that there should therefore be no difficulty in securing a constant increase in production; in particular it is suggested that the effects of the motor industry on employment are exactly comparable to those of the railway. The demand for modern roads, for example, received its decisive impetus from the development of the motor-car. If all the labour required for repair work and in garages be added to the volume of labour required for the construction of automobiles, it may be concluded, the argument runs, that the importance of the motor-car for economic development is as great as that of the railway. It is further suggested that an equal amount of capital has probably been required in the two cases. Why therefore, it is asked, should the railway era have been a period of almost uninterrupted growth and why should not the motor industry, provided no other disturbing factors intervene, bring about a similar extended period of growth?

**Railway and Automobile compared in their Effects**

This reasoning serves to show how little we know about these processes. In point of fact we have no reliable data on
which to take a decision. The following points seem to me to be of importance:

(a) How far does the motor-car create new needs as the railway did? To that extent the remarks made above with regard to inventions in general will apply. But it is impossible to make a true comparison without knowing how much capital was required for the railways and over what period this capital was invested. Moreover, the comparative importance of the capital required in the two cases would have to be taken into account (in proportion to the total amount of new capital).

(b) Railway construction not only gave a tremendous impetus to the investment industries, but indirectly opened up new fields for investment as a result of the development of large towns (particularly in housing). The effect of the motor-car is in exactly the opposite sense and it leads to the development of suburban areas; the activity arising in this way has, however, probably, a smaller compass than that involved formerly in the building up of large industrial and commercial centres.

(c) The demand for capital for railways created additional investment and additional income wherever railways proved profitable. In any case this investment did not reduce the value of any other capital except to some extent the canals whereas the motor-car has taken the place of the railways and had other destructive effects.

(d) Nevertheless, the development of the motor industry and of its subsidiary industries has had an extraordinary stimulating effect on economic growth; the promotion of new investment is in itself the most important point, and the question of whether old capital thereby loses its value or not is merely of secondary importance.

(e) The construction of a network of railways by reducing the cost of transporting goods in bulk introduced a further opportunity for the division of labour and thereby increased the total volume of production. The motor-car has had but very little influence in this direction.

(f) The widespread adoption of motor transport in the larger industrial countries was accompanied by labour-saving technical devices in other branches of production; in fact it is the moving-conveyor method developed in the motor industry that provided the stimulus for a number of new labour-saving methods in many other industries.
Summing up, it may be said that the influence of the motor-car has a certain similarity to the influence of railways, but that the railways did far less to destroy existing values than the motor-car has done. The decisive difference, however, is that the railways initiated and made possible the modern industrial system, while the automobile is only a new, though very important element within an economic structure, which has not been fundamentally changed.

Returning to the question of inventions, it can be said in conclusion that in the case of full employment, inventions cannot increase the number of people employed; they will, however, improve the "utility balance-sheet" and may bring about a lengthening of the working day. If there is unemployment then jobless workers will be reabsorbed, even under general conditions which would not allow of an expansion of existing industries.

AUTONOMOUS AND INDUCED INVENTIONS

Another suggested classification of technical progress makes a distinction between spontaneous or "autonomous" (Kaldor) and induced inventions, according to the way in which they came into being, and between capital-saving and labour-saving inventions, according to their economic effects (Hicks and Pigou).

In many cases it is easy to decide whether an invention is spontaneous — that is, growing out of the natural development of technical work — or whether it is induced — that is, due to changes in price relations. New technical ideas such as wireless would probably be generally considered as spontaneous inventions. But no one can deny that even these spontaneous inventions are subject to market considerations; it is only when they can be commercially used that they are of any importance as factors in the economic process. Until that time they may exist technically, but they do not exist economically. On the other hand, most of the economic advances in the technical process of production are, in the general sense of the present distinc-

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tion, "induced", i.e. they are made with a view to increasing the profits of existing undertakings. It is only in comparatively rare cases, however, that they are "induced" in the sense that they are intended to counteract an unfavourable development in price relationships, such as an absolute and relative increase in wages as compared with capital costs or vice versa, or to counterbalance losses resulting from an increase in wages.

An examination of the rationalisation process in modern industry, which can, in the main, be considered as an induced process, will show that the increase in the efficiency of labour has been extraordinarily large and that, on the assumption that all the goods produced could easily be sold, the methods adopted would be more remunerative than the former ones even at a very low level of wages. This is true, for example, of the belt-conveyor system and the mechanisation of mining, to quote only two examples.

It is difficult therefore to describe such extensive increases in efficiency as being induced in the narrower sense of that term. The adoption of mass-production in the automobile industry in the United States was not the result of forced (artificial) increases in wages while the relative scarcity of the labour factor remained constant; it was the result of a quite different trend of economic thought, in which the general high level of wages provided the potential market at which the process aimed. This shows the close inter-connection between conditions of production and of sale (market conditions), which is overlooked in the concept of an induced invention. It implies a line of thought which deals only with the conditions of an isolated undertaking or of a single industry and leaves out of account the structure of the market of the economic system as a whole.

In general it may be said that most of those technical advances which might well be expected to be induced by rising wages are in fact applied during periods of depression when wages are falling. For instance, certain improvements which led to a saving of raw materials or to their fuller utilisation (e.g. the utilisation of fuel) were introduced during the recent depression while wages were falling just because the comparative efficiency of the new process is so great that it actually outweighs the fall in wages, i.e. they improve the cost-price relation whatever the absolute level of wages.
CAPITAL-SAVING AND LABOUR-SAVING

The distinction between capital-saving and labour-saving inventions and improvements pays too little attention to the close inter-connection between all economic phenomena. It is based on a sharp distinction between capital and labour, which may certainly be of importance in the individual undertaking. From the point of view of a national economic system as a whole, however, capital-saving improvements will also be found to be labour-saving in so far as labour is the main element in costs even in the production of capital goods, provided that land is left out of account as an element in cost. From the point of view of the total demand for labour it is clearly in the last resort immaterial whether labour is saved in the production of producers' or consumers' goods.

Hicks gives as a typical capital-saving invention, for which, as he admits, it is difficult to find examples, wireless telegraphy. This example shows how it is possible without loss of efficiency to reduce both the physical extent and the cost of the plant required. In this case the capital that would be necessary for the production and laying of cables is saved. But in the economic system as a whole capital-saving inventions in the industries for producers' goods have exactly the same effect as labour-saving inventions. There can be no doubt, for instance, that an excavator is a labour-saving device in railway construction and also a capital-saving device for the railway company.

Consequently this distinction is of little use when we are considering the process of the economic system as a whole. A special feature of the latest phase of technical progress is precisely that labour-saving inventions have come to be of such importance in the manufacture of the means of production — for example, in building. Here again most of the methods used are so efficient that they are introduced not because the rate of interest is high, but because the saving effected justifies their use irrespective of what the rate of interest may be.

For these reasons I consider the classification I have proposed to be more suited for our present purpose, for it takes into account the effects on the economic process as a whole and not simply on isolated undertakings. In a later chapter the special
problems arising out of capital-saving improvements will be dealt with in more detail 1.

THE PROCESS OF ECONOMIC GROWTH BY INVENTIONS; OTHER STIMULI OF GROWTH

I am convinced that the main impetus given to the growth of the European national economic systems was the development of their industries by means of inventions, or of phenomena of development that had the same consequences as inventions (e.g. changes in demand, to which reference will be made below).

The effects may have been partially disturbing in character, but, on balance, every new industry for the products of which there exists an effective money demand — that is, for which a real need exists among the consumers — is bound to increase the total volume of production, and also the volume of employment. This is particularly important whenever, for any reason, the investment of new capital proves difficult.

The expansion of production as a whole by the creation of an entirely new form of production such as has been described above involves a much more far-reaching extension of economic activity in general than might be expected in view of the scope of the new product itself. All production requires the existence of commercial machinery, the products must be transported, administrative work must be done, the new workers often gather in new centres where they demand dwellings for themselves and schools for their children, and so forth. The nature of the aggregate expansion resulting from a new investment has recently frequently been analysed and many attempts have been made to establish what is known as "the multiplier", referring to the additional production induced by the original investment. This phenomenon will occur in the case of what are here called inventions just as it would in any other case of investment. But inventions sometimes lead even further as the history of the rail-

1 Hicks defines labour-saving inventions with reference to their effect: they lower the marginal product of labour in relation to the marginal product of other factors; but if the marginal product of labour (provided that it can be ascertained) is suddenly and greatly lowered, the displacement of workers will be unavoidable. Thus his concept means in the end much the same as the popular notion of labour-saving devices, namely technical improvements which permit the production of the same or even a greater quantity of commodities with a smaller number of workers.
ways and automobile has shown (another case would be an inexpensive system of air conditioning); they can entail a transformation of the whole productive system with large effects on employment which cannot be expressed by means of any formula constructed to show the increase in national income resulting from a given investment\(^1\).

The new products fit smoothly into the exchange system, without any necessity for the creation of corresponding articles to be exchanged for them, as would be necessary if there were a sudden isolated increase in the volume of output of one existing branch of production during a state of economic equilibrium. When that happens, equilibrium can naturally not be restored unless there is a demand for the extra amount that is produced, and that again will not occur unless a corresponding amount of fresh production in other fields takes place to provide this supplementary demand, for the existing demand is already satisfied by the existing output. It is very unlikely that all the existing branches of production will expand at such a rate that the demand will increase \textit{pari passu} with the growing output. On the other hand, the only condition for the success of a new product is that there is a sufficiently strong demand for it. When that is the case, the new product will attract to itself the necessary and sufficient stream of purchasing power, and will fit itself, without disturbance, into the organic structure of the economic system. The only danger of such a development lies perhaps in the fact that, if it is assisted by measures of inflation, it may proceed too quickly. It is really enterprises of this type that give an energetic impulse to economic development. If the development takes place without friction, then all the necessary transport and other services which the production of these new commodities requires will naturally be called into existence.

The production of new articles is particularly important during a period of depression and is certainly preferable to a policy of public works. New production in this sense, if it is of sufficient magnitude, is already the beginning of prosperity. When

new production begins on the basis of inventions, on the other hand, the way is automatically opened for incorporating the necessary new fields of production into the general economic structure by enlarging the productive apparatus. The accompanying adaptation of the money system to this extended apparatus carries with it no danger, because it was accompanied by a corresponding extension of the volume of production, and because markets for the sale of the new product already exist. Consequently, expansion resulting from new production can be compared to genuine organic growth. The expansion of purchasing power will take place without any friction, if the expectations about the extent of the demand for the new commodities prove to be correct. If the new investments are made in the later phase of the depression, sufficient capital will be available, at moderate rates, and if the magnitude of the new production is great enough, a new prosperity might be ushered in.

Certain other phenomena that have played an important part in the development of modern economic systems have the same economic effects as inventions and are important whenever, for any reason, the process of growth has met with difficulties. They may be discussed here because, notwithstanding their apparent difference, they all have the same effects as inventions.

(a) Foreign Trade

At first sight, it might be thought that foreign trade does not lead to the growth of the economy as a whole. It only means that part of the home output which would otherwise be sold within the country goes to a foreign country, and is exchanged for other commodities which in many cases satisfy needs that could not be satisfied by home production. At the beginning of the period of modern industrial development more especially, foreign trade meant the importation of products that could not be produced within the country. But a closer analysis of this colonial trade clearly shows to what a great extent it could provide an incentive to new production. If foreign trade merely meant the exchange of foreign products for products of the country in such a way that the population of the importing country gave up a certain fraction of their previous consumption in order to purchase foreign produce — as, for instance, spices — then the scope of production as a whole might not change very fundamentally. But
foreign trade implies the existence of a variety of additional economic activities in the importing country: shipbuilding, commercial firms and offices, warehouses, harbours, administrative organisations, etc. All the persons who are directly or indirectly engaged in foreign trade — that is, in the turnover of goods — are performing additional services which must be paid for in the price of the imported product in addition to the trader's profit. Consequently not only are goods imported, but also, in order that the imported goods may be paid for, part of the existing production must be given over to the body of persons who create and maintain the complicated structure of import and export trade. In this way, therefore, the introduction of foreign commodities into the economic process brings about a direct expansion of the economic system of the country concerned, because the larger sums that can be obtained for home produce when exported provide the basis for all the necessary supplementary services.

But foreign trade includes other possibilities, of which two only may be mentioned here. In the first place, it is possible that certain export commodities, such as glass beads, textile products, metal articles, etc., may be manufactured for which there is no demand in the country of origin. In this case, it is quite clear that the demand for labour in the production process will increase. Theoretically, then, it can be said that these export articles actually produce imports. In that case, the problem is the same as when new industries are built up on the basis of inventions: a new branch of production is fitted into the system, and the number of direct producers increases. In the second place, the production of commodities that are used within the country of origin may be extended with a view to export. If, for example, 105,000 textile articles are produced instead of 100,000, in order to pay for spices imported from abroad, then the consumption of the home population in respect of the commodities they previously consumed will, of course, fall for the time being, since the imports can be paid for only by reducing the expenditure on other products. That means that certain consumers' goods are set free, but a demand for them will come from the producers of the extra textile goods required for export. In both these cases there is an extension of home production, because a new product has been introduced into the process of exchange. The monetary problem is exactly the same as in the case dis-
cussed above of the production of a hitherto unknown commodity within one country.

Take now the case of two commodities entering into international exchange that can be, and hitherto have been, produced at home. When such a commodity is imported from abroad, it conquers a certain fraction of the existing market. Goods to an equivalent value must then be exported. Production will therefore be adjusted so as to produce goods for export. A fraction of the textile industry, say, will cut down its production for home consumption, because some of the undertakings cannot compete at the new low prices resulting from the competition of imported textiles. The workers who are dismissed and the undertakings that are closed down will endeavour to find a place again in the economic system, but this will prove difficult. Under the most favourable circumstances, the degree of employment will remain the same after the necessary adjustments if the capital and workers in question can find employment in the production of export goods. In that case there is no possibility of a direct extension of the system of production as a consequence of the importation of some commodity which was previously produced within the country and vice versa. What happens in this case is a mere increase in the supply of one commodity the demand for which, at the prices in force, was satisfied by the previous output. As prices decrease, marginal producers are eliminated and are absorbed, if everything goes well, by industries producing for export. Since the prices of the imported goods must necessarily be lower than the home price for the same commodity, the consumers’ needs will be better satisfied but the volume of employment will not increase apart from the effects described on page 17. This will be especially the case with an elasticity of demand equal to unity. (The fall in the profits of the competing home industries will be counterbalanced by an increase in the profits of the export industries.)

(b) Transformations in the Scale of Needs

Let us assume that there is a sudden change in the scale of needs within some economic system. The consumers, without any change in income, increase their demand for textile goods in consequence of a change in fashion. The demand, say, for clothes or shoes becomes greater, and will not be restricted to
goods actually consumed before. Other things being equal, such a change in demand can only occur if the consumers reduce their consumption of some other products. The products for which demand has declined will probably then be consumed largely by the producers of the extra goods in the first industry. Let us assume that in a particularly cold winter the demand for coal increases. This means an extra employment of labour. For the reasons mentioned above, the rest of the production process will not decline, and therefore the total volume of employment will increase. So also a serious fall of snow that involves considerable expenditure out of the revenue from taxation will lead to a shrinkage of consumption, and the transfer of purchasing power to the workers who are employed in clearing away the snow. That means that tasks of this kind lead not only to a shift of employment, but also to an increase in its volume. In the last two cases the psychic income (i.e. the warmer apartment or the removal of snow) will give greater satisfaction now, than the maintenance of the former consumption would have given, under the changed conditions.

Conrad, in the article referred to above, states that this line of argument cannot be correct, since a rearrangement of demand would be all that is required in order to produce an effective increase in the volume of employment. This objection is correct except for the word "all". It would be extremely difficult to change systematically the subjective intensity of individual needs. To a certain extent such a change can be brought about by the producers in fashion industries, but this is something quite different from the example given above of an increase in the demand for coal. In most cases (apart from the creation of new and additional needs), all that happens is a change in the outward form of the same articles. Production continues as a rule in the same undertakings in which the goods previously consumed were produced and mostly with the same workers and therefore there is no extension of the total volume of production beyond its previous limits. Cases of this kind can be theoretically constructed where previously produced goods simply change their form, while the amount of raw materials and labour required remains the same. Consequently, a change of fashion will not always have the effects indicated above.

A real transformation in the scale of needs is therefore very rare. Often it is only temporary, as in the case of the demand for
coal mentioned above. It cannot be induced by measures of economic organisation or by the initiative of the producers (the position is quite different in the case of the creation of new needs). The same conclusion will be reached when it is remembered that the bulk of income, and more especially of the income of the working masses, is required for a definite purpose, and that any change in the uses to which a person puts his income when 90 per cent. or more of it is required for his subsistence needs must be restricted to very narrow limits. The same limits are set to the birth of new needs and the sale of new products for mass consumption. That is the reason why new products the cost of which demands more than a very small percentage of the workers' income can be produced only on the basis of consumer credit. So also the capitalistic building of houses involves the same problems as consumer credit, and the capitalist alone has to bear the risks involved in letting the houses.

The above remarks do not exhaust the problem of growth in the economic system\(^1\). But they may provide some more exact indication of the laws, of the main stimuli and of the course which the process takes than can be obtained by a discussion based only on the conditions of an individual firm. As a rule, indeed, especially as it usually constitutes an essential part of the dynamic process the question of growth is not dealt with as a separate problem. It will therefore be well to consider for a moment the process of growth that takes place without the introduction of any new form of production — that is, within the framework of the existing system.

Such growth is much more liable to be influenced by disturbances. It presupposes that the volume of production will change at a speed that is not only adapted to the supply of savings but that also takes into account the changes constantly occurring in the demand curve. It presupposes also the adaptation of income to the needs of the process of growth. If any disturbance occurs, so that the existing producing capacity cannot be fully used, then the equilibrium between the industries for consumers' goods and the industries for producers' goods will be disturbed, and this leads to a cumulative restriction of production. The process of readjustment which takes place during the depression

may then be lengthy and involve considerable losses. The process of growth of any economy presupposes the existence of effective dynamic factors, and that means the systematic extension of the scope of production as a whole. This cannot take place as a result of the impulses existing within the single industry. On the other hand, the possibility of new production to meet an urgent need does give sufficient stimulus to guide the reserves that are always present in the economic system into the paths of accumulation, and the way is at once paved for a new equilibrium based on an expansion of production as a whole. Such growth will take place irrespective of the stage in the business cycle, provided that the prospects for the new product are definitely favourable. Thus, the winter sports industries showed an excellent record of employment in 1931 and 1932, when industry as a whole was passing through a severe slump, because the development of these sports created new needs, and the necessary purchasing power required for the satisfaction of these needs did actually exist. The further such new products extend, economically speaking, and the more far-reaching the change in the habits of the consumers, the greater will be the share of the new products in the process of economic growth.
CHAPTER II

THE CONCEPT
OF TECHNOLOGICAL UNEMPLOYMENT

DISPLACEMENT BY TECHNICAL PROGRESS AS PART
OF UNEMPLOYMENT IN GENERAL

Unemployment does not necessarily result from every change in technical processes; that is to say, if there is such a thing as technological unemployment, it is connected with certain special types of technical progress. On the other hand, unemployment as a mass phenomenon and as a general economic problem is produced by numerous causes. A distinction must therefore be made between various strata of unemployment, each of which may be attributed to various causes. Technological unemployment is therefore only a fraction of unemployment in general, and the question arises whether it can be distinguished from the other forms.

Every economic phenomenon that disturbs the equilibrium may give rise to effects that either intensify or counterbalance the original disturbance.

(a) Unemployment may produce further unemployment by propagating the decline in demand, just as an increase in demand arising from new production may lead to further waves of new production. In so far as such unemployment, having been temporarily overcome by the creation of purchasing power, subsequently leads to a far-reaching process of deflation combined with a decline in the volume of employment, it may lead to a cumulative increase in unemployment. In such cases, however, the phenomenon is closely linked up with the whole business cycle and is therefore difficult to separate from other forms of unemployment either theoretically or in its statistical expression.
(b) Unemployment may be overcome by counterbalancing factors. These may take effect quite independently of the unemployment, as for instance the natural tendency of the economic system to develop, which may be strong enough to provide employment for an increase in the population and in addition for those who may have become unemployed. The inherent tendency towards equilibrium may also in certain circumstances produce secondary effects that lead to the reabsorption of the unemployed workers to a certain degree. The extent to which changes in prices and wages act in this manner will be discussed later. Just as we talk of unemployment only when it has not been counterbalanced, so we will assume the existence of technological unemployment only when there are no sufficiently strong counterbalancing factors at work. Technological unemployment, therefore, like unemployment due to any other cause, is to be considered simply as a net result.

In accordance with the terminology established in Chapter I, the displacement of workers may be expected only in cases of technical progress in the narrower sense of the term. In all these cases the total volume of production will increase considerably while the number of workers remains the same or possibly falls. This process will involve an increase in the proportion of capital used in the process of production. It is true, of course, that the technical improvement may be of a type that saves capital, but the effects of that type will be discussed separately.

We shall therefore deal here with those forms of technical progress which aim at increasing the efficiency of labour, for it is only in these cases that the dismissal of workers occurs as a direct result of the technical changes in question. To what extent that occurs can be seen, more especially for American industry, from certain publications of the International Labour Office and certain enquiries of the Department of Labor. The results of these enquiries do not provide any conclusive evidence for the existence or scope of technological unemployment, but they give some idea of how great the direct disturbances are that are produced on the labour market by technical progress which must be overcome before the technological unemployment can disappear.

1 Cf. footnotes 1 and 2 on p. 215; 1 and 2 on p. 216.
The displacement of workers by technical progress is difficult to isolate from a complex network of phenomena, for it is mixed up with various other forms of unemployment: workers who have lost their employment on account of seasonal influences, cyclical unemployment, unemployment as the result of a change in the age composition of the population or overcrowding in certain branches of the labour market (e.g. the middle classes or women workers) and "necessary" unemployment which represents the reserve supply on the labour market. There are also special causes that may lead to unemployment, such as the withdrawal of short-term credits in recent years, the undue accumulation of stocks, political disturbances, changes in currency which hamper imports and therefore restrict exports, tariff changes, etc. Another important factor in recent years was the coincidence of an agricultural and an industrial depression, but this was closely bound up with technical progress. Since both structural and technological unemployment give rise to (opposing) factors which immediately reduce unemployment, it is difficult to see what should be considered as technological unemployment. How is it going to be isolated from the phenomenon of unemployment in general? It is indeed impossible to determine which of the various causes of unemployment give rise to compensatory influences in any given case.

We have touched above on the question of the absorption of the unemployed and we have suggested that in the case of technological unemployment as in the case of unemployment in general, this is a medium-term problem (i.e. appearing in a period longer than one year but not greater than three or five years). On the one hand, it is true to say that the occurrence of unemployment is in itself of no economic interest, since it may be of very short duration. It does not become a real problem unless it continues throughout the whole of an economic period and beyond. On the other hand, it is equally correct to say that sooner or later, if one can wait long enough, unemployment will disappear, particularly if the development of fresh waves of unemployment can be prevented. It is therefore only the medium-term problem that has to be dealt with.

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1 A good survey of the various forms of unemployment is given by Henry Clay, *The Post-war Unemployment Problem*, London, 1928.
"Technological Unemployment" defined

Having explained all these difficulties, one may attempt, with all the necessary reservations, to give some definition of technological unemployment. It may be said to be that fraction of unemployment which, being caused by technical progress, is not counterbalanced within a given period of time by the effects of technical progress or the changes it produces, or by the spontaneous automatic development of the economic system. The existence of technological unemployment must therefore be assumed only when the rate of technical progress exceeds the normal. This "normal" rate depends on the intensity of growth of the economic system and the accumulation of capital, and these again are not constant factors. But in every dynamic economic system there must always be a certain amount of technical progress, for that is one of the essential features of a dynamic system. This "expected" technical progress would not lead to any displacement of workers. In the following pages we shall consider only such unemployment as lasts for a period longer than one year; the choice of this period is completely arbitrary; it is however sufficiently long when it is remembered that most of the equilibrating forces will be called into action within that period. It is moreover a desirable figure for practical reasons, since the unemployment insurance laws of the various countries do not continue to provide benefit for more than one year.

Velocity of Technical Progress until 1914 and in the Present Period. Statistical Data examined

It is practically impossible with the data at our disposal to calculate the exact amount of technological unemployment in any given instance or to devise a formula showing technological unemployment as a function of certain data; but there is a way by which an approximate result can be achieved. It should be possible to determine to what extent technical progress in the sense in which it is here used (not including every type of invention) increased the average efficiency of human labour in industry before the war and throughout the nineteenth century. That figure could be set over
against the rate of increase at the present time. If it be assumed — and the assumption is perhaps not unduly bold — that this increase in technical efficiency before the war found its counterbalancing influences in the economic process and that this process of compensation — but this is a bold assumption — could scarcely deal with any greater increase in efficiency, the difference between the rates of increase in efficiency then and now would indicate the upper limit of technological unemployment during the period under consideration.

Let us assume as many theorists do, that in the long run real wages correspond to efficiency. What was the increase then of real wages in Europe during the 120 years preceding 1914? Were they really quadrupled? ¹

On the basis of the figures given in the footnote and on the assumption that changes in real wages reflect changes in efficiency the average annual increase in the efficiency of labour must have been well below 2 per cent., perhaps not more than 1 per cent. Between 1914 and 1926, on the other hand, the efficiency in Ame-

¹ Cf. Bowley’s article on “Wages” in the Encyclopaedia Britannica and the article on index numbers in the same publication. According to the figures given there, wages in England rose from 8s. 6d. in 1795 to 17s. in 1850, whereas prices, after fluctuating and in particular rising considerably after the Napoleonic wars, ultimately returned to their original level. Similarly, real wages were doubled from 1850 to 1914. These estimates appear to the present writer to be somewhat doubtful. He considers that the starting point selected was a period of very high prices and very low real wages. Moreover, the selection of bread prices as a standard of real wages is not desirable because as income rises consumption is spread over a greater variety of products. Sombart in “Der Moderne Kapitalismus”, Volume III, Part I, page 513, on the basis of the data selected by him, arrives at a considerably lower figure for the increase in real wages from the end of the eighteenth century to the pre-war period. He gives it as being from 2 to 2½. His figures for real wages are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Index number : 1900 = 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1810</td>
<td>55.5</td>
</tr>
<tr>
<td>1820</td>
<td>53.5</td>
</tr>
<tr>
<td>1830</td>
<td>54.0</td>
</tr>
<tr>
<td>1840</td>
<td>57.0</td>
</tr>
<tr>
<td>1850</td>
<td>59.5</td>
</tr>
<tr>
<td>1860</td>
<td>63.0</td>
</tr>
<tr>
<td>1870</td>
<td>69.0</td>
</tr>
<tr>
<td>1880</td>
<td>74.5</td>
</tr>
<tr>
<td>1890</td>
<td>89.5</td>
</tr>
<tr>
<td>1900</td>
<td>100.0</td>
</tr>
<tr>
<td>1910</td>
<td>106.0</td>
</tr>
</tbody>
</table>

From : Tyska, in Schriften des Vereins für Sozialpolitik, 145, 64.
rican industry increased by 50 per cent., which represents from $3\frac{1}{2}$ to 4 per cent. as an annual average.

In comparing these figures, the following points should be noted. An increase of about 1 per cent. in efficiency corresponds in view of the quick expansion of industrial production very closely to Cassel's assumption of an average increase in production of 3 per cent. and an average simultaneous increase in the number of the working population of from $\frac{1}{2}$ to 1 per cent. annually. As was mentioned in the preceding note, the accuracy

<table>
<thead>
<tr>
<th>Year</th>
<th>Great Britain</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1790-1799</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td>1800-1809</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>1810-1819</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>1820-1829</td>
<td>47</td>
<td>-</td>
</tr>
<tr>
<td>1830-1839</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>1840-1849</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>1850-1859</td>
<td>58</td>
<td>52</td>
</tr>
<tr>
<td>1860-1869</td>
<td>63</td>
<td>53</td>
</tr>
<tr>
<td>1870-1879</td>
<td>74</td>
<td>77</td>
</tr>
<tr>
<td>1880-1889</td>
<td>84</td>
<td>85</td>
</tr>
<tr>
<td>1890-1899</td>
<td>98</td>
<td>103</td>
</tr>
<tr>
<td>1900-1909</td>
<td>102</td>
<td>103</td>
</tr>
<tr>
<td>1913</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>


The article of Rufus S. Tucker, "Real wages of artisans in London 1729-1935" (*Journal of the American Statistical Association*, March 36), published after the present book was written, fully corroborates my assumption. Taking the year 1900 as base with real wages in that year = 100, Tucker gives for 1729-1739 an index of 67. (His index is very carefully constructed and takes into account the changes in habits of consumption.) This real wage (represented by 67 for 1729-1739) soon fell to 32.6 (1800) as a consequence of rising prices, while money wages remained the same. Later on real wages rose again, but it was not before 1870-1880, that they reached the level of 1729-1739; the next three decades brought an increase of about 50 per cent. (to 100:1900), but real wages decreased again during the war, but rose afterwards to 100 in 1927, and 112 (1935) with an accompanying decrease in working hours. The opinion that wages were quadrupled during the nineteenth century, must be considerably modified when we realise the very low level of wages at the beginning of the century, i.e. during the base year.

Whether we can therefore assume that movements in wages during that period reflect changes in efficiency (output per head) is open to question; because it can be argued that technical progress was much slower than the figures suggest. The reduction in hours however has to be taken into account, at least in comparison with 1800; while working hours for skilled workers were much shorter in the first half of the eighteenth century than at its end.

These figures refer to skilled workers; it would probably be a quite different story, if we compared variations in the wages of unskilled workers over the same period.
of the magnitude of the rate of increase of the real wages of workers is open to question.\footnote{Cf. for example Douglas: Theory of Wages, p. 387, "Real Wages in England." According to this writer the index of real wages rose from 91 in 1861 with certain intervening drops to 170 in 1900 and fell again to 157 in 1912. In fifty years, therefore, the increase of real wages was about 72 per cent., which would correspond to an increase in efficiency of a little over 1 per cent. per year. According to Wolman, in Recent Social Trends (p. 820), real wages in every branch of employment, including workers and salaried employees in industry, transport and agriculture, during the twenty-four years 1890-1914 fluctuated between 96 and 100. After this period of comparative stagnation they rose jerkily from 100 to 132 in the fourteen years from 1915 to 1928. If this rate of increase had begun in 1890 then wages in 1928 would have been 180 per cent. of the 1890 figure. These data serve to show that we are on rather uncertain ground. These data for wages seem to be in accordance with changes in the average volume of production during this period; Frederick C. Mills shows a 20 per cent. increase in the volume of production per head between the years 1899 and 1914. (A publication of the National Industrial Conference Board — "Machinery, Employment and Purchasing Power", 1935, p. 55 — gives only 16 per cent. for this period.) The fact that the period preceding the war — at least in important industries whose heyday had already passed — produced no great increase in efficiency is shown by the data compiled by G. T. Jones, according to which production costs in the textile industry fell by about 17 per cent. from 1850 to 1910. The reader may be referred to his book Increasing Returns, Cambridge, 1933. This result is confirmed by Colin Clark (National Income and Outlay, 1937, p. 265) who provides evidence which shows that there was no increase in average output per head in Great Britain during the period 1907-1913.}

If these data are taken as a basis and if the increase in the real income of the workers be taken more or less as an index of the increase in the efficiency of labour, it must not be forgotten that during the nineteenth century a particularly large fraction of the available or displaced labour probably found employment in the newly created branches of production, so that new needs were created and led to the process described above in Chapter I.

If the increase in the efficiency of labour during the nineteenth century be compared with the corresponding data for the period after 1914, the following points must be borne in mind.

(a) In both these periods the data refer to industry only and do not cover agriculture. Before the war agriculture, at least in Europe, was governed by the law of decreasing return. In so far as foreign countries were competing with Europe, small tariffs (up to about 20 per cent. of the commercial value) were sufficient to reduce foreign competition to the level that could be borne by European agriculture. The introduction of more labour-intensive methods of production in European agriculture
facilitated the placing of the growing oversea output on the world market. After the war the modern technical methods adopted in agriculture and in the production of raw materials played a very important part and were responsible for the displacement of hundreds of thousands of workers and farmers. Data which reveal the increasing efficiency of industry only do not show the full extent of the changes to which the economic system had to be adapted for the new technique in agriculture was an additional cause of unemployment. (In the decade 1920-1930, 1.2 million workers were displaced in the agricultural production of the United States; a part of this reduction must be attributed to technical progress.)

(b) A comparison of efficiency over a very long period is difficult because within such a period new branches of the economic system have arisen for which no comparable data for earlier years can be given.

With 1914 a new period sets in, which can be divided into two parts: during the war, 1914-1919, output per worker did not increase at all, as industry probably had to employ any workers it could obtain regardless of their ability; thus (according to Mills) the whole increase of output per head of the working population between 1914-1920 was only 5.6 per cent.; but the new methods of production elaborated during the war and afterwards proved their efficiency, for output per head increased from 1921-1929 by 34 per cent., or almost 4 per cent. per year.

Similar observations were made for industrial production in Germany showing that production per head increased by 1½-1¾ per cent. from 1890-1904; remained stationary until 1913, and increased after the war by 3½ per cent. the year.

TENTATIVE ESTIMATE OF TECHNOLOGICAL UNEMPLOYMENT

On the basis of the data given above, the following tentative line of argument might be drawn up. If the annual increase in the efficiency of human labour during the nineteenth century be taken at 1.5 per cent., and if on the average over a period of twelve years it was 3½ per cent. annually, and if an increase in efficiency of 1.5 per cent. can just be counterbalanced, then an increase

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of $3\frac{1}{2}$ per cent. as an annual average might lead to unemployment which could amount to 24 per cent. at the end of the twelve years. If the average period of absorption is 3 years, the technological unemployment would be 6 per cent.; if 7 years 8 per cent.; if 5 years 10 per cent. To these figures cumulative effects would have to be added. The assumption that a 1.5 per cent. average increase in efficiency per head does not lead to serious disturbances and can be compensated for is based on pre-war experience, for serious unemployment never occurred for a long period before the war. But if the rate of increase in efficiency is more than doubled, and, moreover, is concentrated in some fields of production rather than others, the process of adjustment is much more difficult — especially if no new industries develop. It is the aim of the analysis in later chapters to show this. Consequently, after twelve years the technological unemployment would be hardly below 10 per cent., which is more than the highest level of unemployment in European countries before the war.

It takes time for technical progress to show its effects on the labour market. The first phase is generally combined with a rising demand for labour as a result of the boom in capital investment, which may proceed to a dangerous extent under the influence of favourable credit conditions, the impetus given by technical progress, the anticipation of future consumption and the extensive export of capital, which always means the export of commodities.

If technical progress was the special feature of the prosperity period in the United States, then we should expect that employment would not increase as quickly as output in the boom period, ending in 1929, and that unemployment would be especially great during the following depression; we should further expect that fluctuations in the output of producers' goods would be of greatest violence, as technical progress is very likely to lead to over-capacity and therefore to a standstill in the demand for producers' goods, after the mechanisation has been carried through. The following figures are in harmony with these expectations. If the index figure of 100 for the years 1923-1925 be taken as the basis employment in the United States during the last cyclical period has increased as follows: to 125 in the engineering industry (in 1929 only), 102 in the iron and steel industry, 115 in the chemical industry, 110 in the rubber indus-
try, and similarly, as a result of increased employment and the rise in real wages in some of the finished products industries, such as the foodstuffs industry (113) and the textile industry (104).

As always happens in the business cycle, the gap between the lowest and the highest degree of employment is greatest in the industries for producers' goods. Employment rose in the iron and steel industry from 66 in 1921 to 102 in 1929 and in the engineering industry from 77.5 to 125.8, which is an increase of 62 per cent. In the foodstuffs industry it rose from 93.6 to 113, or more than 20 per cent., and in the textile industry from 92.7 to 104.8 or about 13 per cent.¹

The degree of employment then fell correspondingly to 58.8 in the engineering industry, 58.6 in iron and steel, 95 in the chemical industry and 74 in the rubber industry, but only to 94.4 in the foodstuffs industry, and 88.1 in the textile industry. All these index figures are much lower than the lowest point for 1921; this may be attributed to certain special features of the period of the cycle preceding 1929, which were largely due to the effects of technical progress.

The general figures comparing the volume of production and the number of the workers employed reflect the quickly increasing efficiency and the latent ² as well as the actual unemployment during this period ³.

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume of production</th>
<th>Employment</th>
<th>Weekly hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1923-1925</td>
<td>100</td>
<td>100</td>
<td>48.1</td>
</tr>
<tr>
<td>1929</td>
<td>119</td>
<td>104.7</td>
<td>48.3</td>
</tr>
<tr>
<td>1932</td>
<td>64</td>
<td>65.5</td>
<td>34.8</td>
</tr>
<tr>
<td>1935</td>
<td>90</td>
<td>85.9</td>
<td>37.2</td>
</tr>
</tbody>
</table>

With all the necessary reservations, a comparison of the increase in efficiency in industry and agriculture (the latter not being included in the figures given above) leads to the conclusion that, on the assumption that it is difficult for a rapid counter-balancing movement to take place, medium-term technological unemployment occurs periodically. This medium-term unemployment will lead to long-term unemployment if several waves of technical progress follow each other rapidly. If, for example,

² Latent unemployment occurs in spite of an increase in employment if it is smaller than the increase of the employable population.
³ The figures refer to Manufacturing Industry (Survey of Current Business, 1936, Supplement).
the hypothetical assumption made on page 51 is applied, that the reabsorption of the displaced workers requires three years (which naturally does not mean that the individual worker who has been thrown out of employment must wait three years before he finds fresh employment) then technological unemployment would remain at the chronic figure of about 6 per cent. (as all the assumptions are probably too favourable, the figure would be perhaps 7 or 8 per cent. for many countries). In the course of the business cycle, the volume of technological unemployment would naturally be greater during the depression period. It would be a very valuable contribution to our knowledge if someone would study the business cycles of the nineteenth century from the point of view of discovering whether and to what extent the duration and intensity of unemployment followed changes in technical efficiency (excluding inventions as defined in Chapter I). More or less satisfactory material for such investigation might perhaps be obtained by careful research in the history of modern industry.
CHAPTER III

INCREASING AND DIMINISHING RETURNS

RETURNS IN SINGLE FIRMS
AND IN THE ECONOMIC SYSTEM AS A WHOLE

Before analysing the process that is brought into operation by technical progress of a labour-saving character it is necessary to discuss a more general basic problem, the importance of which for the present subject would seem to be fundamental. It must be dealt with at this point, for otherwise our discussion of certain aspects of the subject would be lacking in clarity.

When considering how unemployment in general and unemployment caused by technical progress in particular can be overcome, more especially from the point of view of wage policy, it is extremely important to know whether production is governed by increasing or by diminishing returns in the economy we are considering. This question is generally considered in economic literature from the point of view of the individual undertaking and under circumstances which economically are otherwise stable. The problem must not, however, be considered in such isolation, but must be studied from the point of view of the economic system as a whole. If the system is governed by the law of diminishing returns, as in the picture drawn by Malthus, then an extension of production, or the employment of unemployed workers, is possible only if wages fall. If the economic system as a whole is subject to increasing return then other measures might be taken to relieve unemployment, and it is

1 Many authors deal with increasing returns in discussing problems of monopolistic or imperfect competition. But most of these treatises analyse the price-policy of single enterprises or industries, while in the present study the interdependency of all the branches of production is always considered.
doubtful whether a reduction in wages is necessary in order to absorb the unemployed workers or at least if it is necessary further reasons must be given for this necessity. It is therefore of the utmost importance to know what is the technical structure of the productive machine and whether an increase in production would actually and inevitably involve rising costs for increments of product.

The data given in the preceding chapter show clearly that from the beginning of the industrial era the efficiency per head of the workers employed in European productive activity has increased; it did so at a very rapid rate if the decrease in hours of work be taken into consideration. There is therefore no doubt that the development of a capitalistic economic system proceeds on the average under the law of increasing return.

**Physical v. Value Return**

But although the actual historical movement of production in a capitalist State certainly shows increasing returns, so soon as the supposition is made that technical methods and capital invested remain unchanged, we discover the necessity for another (and familiar) concept of returns (namely rate at which output increases with reference to successive equal doses of one of the factors of production) useful in the analysis of short-period problems.

Before going further into this question it is necessary to examine in more detail the concept of increasing and diminishing returns. It is one that came originally from agriculture, and it always refers to the physical return. In agriculture, when the area of land already under cultivation is fixed and when there is no change in agricultural technique, an increasing application of labour and capital beyond a certain limit will produce a relatively lower yield — that is, a steadily declining additional output. This lies in the nature of things. For any given area and quality of land there will always be one certain combination of each type of land with capital and labour that will produce a position of equilibrium. The combination chosen will be the one in which the marginal return for each unit of capital and labour coincides with the marginal return for one unit of capital.
and labour in industry. How much of the existing land will be employed does not give rise to any problem, because the "unemployment of land" always affects the least productive ground and does not exercise any social or economic pressure on the market, so that it cannot lead to any change in the situation. In the production process in agriculture there are two possibilities:

1. If the volume of capital and labour is increased while the area of land remains the same the return may increase relatively. This is possible even when technical conditions remain the same if, for example, the previous combination was not able to make full use of labour and capital and if, for technical reasons, the volume of labour and capital could not be combined with a smaller area of land. If the technique of agriculture should change, the possibility of comparatively increasing or constant returns is all the more possible. But we are supposing, for the time being, the absence of technical change.

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1 In order to avoid confusion it may be said that the comparison of marginal returns in different branches of production must refer to a value concept, since the physical returns of agriculture (e.g. wheat) and industry (iron) cannot be reduced to a common denominator. The intensity of demand measured in terms of money people are prepared and able to pay determines the proportions in which the different commodities will be produced and so also the way in which the factors of production will be used; but this decision, once made, the problem remains whether or not the addition of new elements of one factor (labour or capital) at any given time will increase the physical returns to a smaller, or to the same or to a greater extent than the factors of production have been increased.

Now it may be said, that the increase in production will imply a reduction of value and that this is the meaning of the hypothesis of decreasing returns. But that also is not true: if more factors are employed either (a) income is increased also, and therefore, with an adequate distribution of the additional factors to the different branches of production prices remain the same; or (b) with the quantity of money remaining unchanged, money-prices decrease, but not relative prices, which alone matter; or (c) if an all-round increase in physical productivity makes for a perceptible decrease in the marginal utility (satisfaction) of spending, the working day will be shortened and no addition to the factors of production will then have been made. But in all these cases it is possible to determine whether or not returns in the physical sense increase or decrease. The present writer is of the opinion that the interpretation of returns as value-returns suggests the elimination of decisive problems of the economic development and especially of those questions which arise in connection with technical progress. (The point of view taken by the present writer is very similar to that of Ph. A. Wicksteed : The Common Sense of Political Economy, Vol. II, Chapter V : "The Theory of Increasing and Diminishing Returns ".)

2 On this point the reader may be referred to Marshall : Principles of Economics, Book IV, Chapter II, section 1. The fact that, in spite of an increasing (physical) return, a further amount of capital and labour cannot be used in agriculture can be caused by the fact that industry is also governed by the law of increasing return.
2. In countries where all the land is utilised an increase in the amount of labour and capital will normally produce a smaller increase in the total yield than was obtained during the original development of the same area with labour and capital. This will always be the case when the available land is already entirely under cultivation and the optimum yield has been reached. A greater amount of labour and capital is applied to a given area and therefore the volume produced will also decline.

The same principle will apply if the land is purchased on the market with a view to its use for an agricultural undertaking. The land is then shown as an item in costs. At any given prices for land, capital and labour there is some combination that is the most profitable. In a free market the price of land will settle at that level at which the future proprietor or manager of the undertaking, with the means at his disposal, will be able to pay the average rate of interest on the invested capital, together with profits and the usual rates of wages (and the other items in costs). That means that any increase in the number of workers or the volume of capital will lead to a decrease in the marginal return. If the supply of labour in agriculture increases there will be an increase in land rents, because the workers already in employment will be obliged to accept a lower wage. The generally accepted law of diminishing return, developed theoretically along the lines suggested by Ricardo ¹, is thus implicit in these assumptions ².

¹ Ricardo is assuming: increasing demand, equal wages for additional workers, and thus increasing costs and prices for additional quantities produced. The theoretical scheme, however, is the same.
² The law of diminishing return in agriculture is here understood in its usual form (as used by Marshall) as being the law governing the change in the volume of output when there is a change in the quantitative ratio of land on the one side to capital and labour on the other (cf. Marshall, Principles of Economics, eighth edition, pp. 150 et seq. and p. 169, note). It is understood that the ratio of capital to labour will change whenever such a change is advantageous. What Marshall proceeded to investigate was the change in the return for one dose of capital and labour, meaning by a dose a combination of capital and labour that was equal to the value of ten ordinary working days. This dose was presumed to be so made up that it gave the maximum return. If we were to assume that the area of land and the extent of capital development were constant and that the amount of labour applied to the land increased (and similarly also for changes in capital equipment), we get formally a similar result. Such a restriction of the problem of a single factor (e.g. labour) is necessary in order to obtain a basis for answering the question whether the absorption of suddenly increased unemployment implies the reduction of wages.
TECHNICAL PROGRESS AND UNEMPLOYMENT

Increasing Return in Industry

Over against the law of diminishing return in agriculture is generally placed the law of increasing return in industry. This is done by Marshall, by Pigou, Wicksteed and in general by succeeding English writers such as Hicks and G. T. Jones. The law of increasing return is taken to mean the phenomenon whereby the continued application of capital and labour in industry, i.e. increasing the scale of production, will, within wide limits, produce an increasing yield because of certain internal and external economies. (As in agriculture, the return is considered as being the volume of the physical product.) The phenomenon on which the law is based is therefore quite different from that of diminishing return. This was already clearly indicated by Marshall, following Bullock, when he said, "The forces which make for Increasing Return are not of the same order as those that make for Diminishing Return: and there are undoubtedly cases in which it is better to emphasise the difference by describing causes rather than results and contrasting Economy of Organisation with the Inelasticity of Nature's response to intensive cultivation" (p. 319, note.) (Cf. Wicksteed, op. cit., pp. 528 et seq.)

If the same state of affairs were artificially created in agriculture there would be an increasing return, for the increase of capital and labour in industry would correspond to a uniform increase in land, labour and capital in agriculture. In so far as a large undertaking in agriculture can be more economically run because of external and internal economies provided that the management has the necessary qualities for the control of a large undertaking, the law of increasing—or at least of constant—return will apply equally in agriculture. The law of increasing return in the traditional sense of the term refers to the increase in the total output when every factor of production is increased. The state of affairs from which the law of diminishing return in agriculture is deduced would therefore correspond to a position in industry.

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3 Wicksteed: Common Sense of Political Economy, Vol. II, Chapter V.
4 J. R. Hicks: Theory of Wages.
5 G. T. Jones: Increasing Return.
whereby one factor was increased and all the others remained constant. That is exactly analogous to the position we are considering when we ask whether the absorption of the unemployed into the process of production will necessarily lower the marginal productivity of labour and therefore produce a reduction in wages (real wages) if there is no change in the capital equipment.

In reality the problem does not arise if progress takes place without friction, because the additional doses of capital tend to increase more quickly than the number of workers. This question of the return in industry and in agriculture as a short-run problem must be discussed from the point of view of the change that would take place in the physical yield of production if the dose of one factor were changed, while the amounts of all the other factors in production remained constant. This assumption is particularly important as a starting point for discussing the problem of imputation (Zurechnungsproblem). It is also very important as the theoretical basis for any doctrine of fair wages.

LAW OF DIMINISHING RETURN AND IMPUTATION

Thus the law of diminishing return crops up once more in the discussion of the imputation problem. The generally accepted formulation, following that of J. B. Clark\(^1\), is that if the capital equipment remains the same the addition of further units of labour gives a decreasing physical return, and similarly for the addition of units of capital while the number of workers remains unchanged. This law of diminishing return, which is perfectly obvious in agriculture, holds good in industry only on condition that capital and labour can be combined in any desired proportion. That is to say, that a given technical equipment can, according to the number of workers available, be so transformed that a larger or smaller number of workers can be equally well employed\(^2\). In reality, however, with a given capital equip-

\(^1\) Distribution of Wealth.

\(^2\) It is obvious that this argument constitutes a parallel to what happens in agriculture. In agriculture more or less labour-intensive cultivation is possible on the same area of land. In Clark's view the relation of capital to labour is the same as that of land to labour in agriculture. It was all the more natural for him to take this view because the application of the marginal theory to consumers' goods is based on the idea of unlimited divisibility — the infinite variability of consumers' goods. This liberty to change the proportions at the margin by infinitesimal amounts is
ment, output can be increased in at least the same proportion as the number of workers, provided the undertaking is not working to its full capacity. If it is working to capacity no further increase can, strictly speaking, occur. If, for example, a blast furnace or a cotton spinning mill is steadily working to capacity, there can be no room for additional workers. In general, then, the output will increase with any increase in the number of workers and then suddenly come to a point beyond which a further increase is impossible unless by means of a lengthening of the working day. If demand seems to guarantee that production will be profitable, even in excess of the full capacity of the existing undertakings, then obviously an additional unit of production will be added or new undertakings will be added to the old ones. In this case average costs will naturally rise at first, but this will be the consequence of a reduction in the return on capital. This phenomenon of rising costs accompanying an increase in production must be clearly distinguished from the situation under which the law of diminishing return applies. Clark's argument is therefore unrealistic and, in so far as it can be applied, it is only within narrow limits.

It may be said that although the structure of the capital equipment of an industry and its ratio to the volume of transferred by Clark to the field of industrial production. It is, therefore, a technological factor that is the decisive one in his theory. If technical ratios are rigid his argument breaks down — an interesting instance of the fact that the validity of abstract theories is dependent on very concrete conditions. (In the history of the theory of distribution technological facts in general are of much greater importance than the theorist has generally been prepared to admit — e.g. the physiocrats, Marx, Ricardo with his law of diminishing return, and Böhm von Bawerk in his theory of the roundabout processes of production.) In every case, however, the technical facts are of importance. They constantly make their presence felt in the history of economic theory; they are indeed of more importance than social structure, which can at least be presumed not to exist, whereas the process of production is necessarily a technological one.

1 Cf. D. H. Robertson: "Wage Grumbles", in Economic Fragments, London, 1931, pp. 42 et seq., and particularly pp. 50 and 51. He points out that in a rationalised world the demand curve for labour would take a very alarming form, being "nearly flat for part of its length and then suddenly dropping almost vertically". Consequently a completely rationalised world might have a labour market in which a fraction of the workers could find employment at very high wages "while the remainder could hardly find it on any terms at all".

2 It is shown below (pp. 62 and 63) that even this expansion of production does not necessarily entail increasing costs for the marginal quantities.

3 Clark's premises lead to the conclusion that the demand for labour is continuous. This is, however, doubtful.
labour cannot be changed from one day to another it can be over a period of time. Capital is constantly being used up and can therefore be renewed in some other technical form. But even this suggestion does not strengthen the argument. As a rule the structure of the plant cannot be changed piecemeal over a long period but must be changed all at once. One cannot transform the capital equipment of an automobile factory or a spinning mill or a blast furnace from an undertaking in which labour is relatively little used to one in which it is intensively used simply by gradually increasing the number of workers available, as is possible from one year to the next in agriculture, in particular as regards the ratio of the number of workers to the area of land. The suggestion that the new undertakings can vary the technical coefficient of production if the supply of labour is increased and its price reduced is generally at variance with the facts. The cost-price relation for large undertakings is usually so favourable that even a great reduction in wages would not induce the entrepreneurs to employ more labour and less capital. The important practical question, therefore, is whether the capacity of the undertaking is being fully utilised or not. If it is not, then the addition of extra workers will not cause a diminishing (real) return. If it is, then no matter how great the available supply of labour and the consequent decline in wages, production cannot be increased much unless there is further capital investment apart from working in two shifts, which is, however, too sudden a change to be relevant to our problem. If new undertakings are set up, the production of the additional units will at first be more expensive. Later, however, especially as further developments may be expected in the technical field, it will be even cheaper than in the older undertakings. This case, however, implies the addition of capital and is therefore outside the scope of our present argument. In any case there is no justification for the idea that additional labour will (within certain limits) produce a diminishing physical return when the existing amount of capital remains unchanged.
Reserves of Capacity and the Law of Returns

Much closer to reality than Clark's view is the idea that the capacity of an undertaking is generally not fully utilised and that there is always a certain reserve of capacity.

This assumption is fundamental and is imposed by the logic of facts. It will therefore be made throughout the present study, even though it constitutes an important departure from the usual assumptions of static theory. Static theory assumes by definition that all the factors of production are being fully utilised in a position of equilibrium, but it does not go into any detail of what is meant by complete utilisation. The static theory, however, applies to an artificial world, the assumptions of which are therefore not binding. Indeed, the assumption that no reserves exist is by no means necessary for this theory. On the contrary, it is much truer to reality to assert that it requires the existence of certain normal reserves. Every economic distribution of resources and every process of production requires a certain freedom of movement which can be obtained only by the existence of reserves. The idea of reserves must here be understood in quite a general sense. In the present study the existence of reserves is always assumed if output can be increased with the existing factors of production and without new investments. The possibility of overtime and the possibility of taking raw materials from stock or of manufacturing for stock are elementary phenomena of the simplest and most limited production process. Yet these phenomena presuppose the existence of reserves. Just as in the human body there is sometimes an increase in effort followed by a period of recreation, so in the production process there can be a more or less elastic reaction to demand without preceding investment; that and that alone is what is implied by the existence of reserves. It may be added (though it belongs to another problem) that without reserves the phenomenon of growth and the expansion of production would both be unthinkable. What happens is that in a period of growth even at the height of a boom, the stream of production is increased apart from new investment by the utilisation of the existing reserves.

It is in this way especially that an increase in the production of consumers' goods can take place simultaneously with an extension of the production of producers' goods. This development takes place on the basis of the existing reserves; the additional investments provide the basis for a still greater productive capacity in the future, and at the same time new reserves which allow for a temporary increase of production in the future without new investment.

This situation is well reflected by the way in which "utilisation of full capacity" is usually understood. There is a "theoretical capacity", which entails a full utilisation of all the means of production. But it is assumed that capacity is fully utilised at 80-85 per cent. of this "theoretical capacity", in order to acquire a certain margin for such eventualities as repairs and internal disorganisation. The admission of full capacity in this sense does not preclude the probability that the theoretical capacity will be utilised from time to time when this is required by market conditions (for instance the receipt of urgent orders). Now we can take it, that with the utilisation of 85 per cent. of the theoretical capacity the time is ripe for new investments, which will increase both the theoretical and the average "practical capacity". Within the dynamic system therefore, also, reserves are the condition as well as the result of the process of growth.

In the process of production itself the existence of reserves means that it is the rule rather than the exception for productive capacity to be incompletely utilised. During the opening phase of a boom there is always a reserve of capacity. The fact that during the boom periods of the nineteenth century the fundamental problem was the scarcity of labour shows that capacity at that period also was never fully utilised. Paradoxical as it may seem, the creation of new capacity depends on the existence of a certain unused margin of capacity. This is borne out by the fact that the production of consumers' goods per head of the workers employed continued to grow even when most of the additional capital and labour that came on the market were apparently used for the production of producers' goods. Thus the creation of fresh capacity was constantly linked up with the

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1 It is compatible with this larger production of consumers' goods that the workers' total income will, during the boom, increase less quickly than the entrepreneurs' total income. (Cf. this author's: "Konjunktur und Krisen", in Grundriss der Sozialökonomie, Vol. IV.)
utilisation of the existing reserves and could only be so linked up, because otherwise it would have been quite impossible to maintain or increase the level of real income as is done during a boom period. (It was only during the war that the creation of new facilities for the production of producers' goods took place to the detriment of the production of consumers' goods, but this was due to the shortage of labour and raw materials, which, again, could be attributed to the claims of the military machine and to political obstacles and blockades.) If reserves are presumed to exist, then an increase in the number of workers engaged in production will cause a corresponding increase in production even when no further capital is invested.

In these cases the physical return from labour will at least remain constant over a considerable period of expansion. The average return from labour in the strict sense will actually increase until the working capacity of industry is fully utilised, for it must be remembered that every undertaking employs unproductive workers, whose numbers do not increase with output. The curve representing this average return will, however, tend to flatten out as the number of workers increases. If, for example, 10 unproductive workers are required in an undertaking (as watchmen, for internal transport, for cleaning, for attending to the water supply in mines and so on) and if the output is 100 when 10 productive workers are employed, 110 when 11 productive workers are employed, 120 with 12 workers, etc., then the marginal output in each case is 10. The average output per person employed, however, is 5 when there are 20 workers (of whom 10 are unproductive) 5.25 for 21, 5.45 for 22, 5.65 for 23 and 9.09 for 110 workers. Thus the average return will approach the marginal return asymptotically. So long as this situation remains unchanged, production must expand, if prices remain constant, until the full capacity of the undertaking is being used. If in reality, even when there is a very great reserve of capacity, the expansion of production by the engagement of new workers at the same level of wages does not appear profitable, the reason is that, when production is extended, prices fall. In point of fact, the phenomenon of diminishing returns is often understood

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1 The curve will be different but the principle the same if the other overhead-costs (apart from labour-overheads) are also considered.
2 On this point cf. MARSHALL, Principles of Economics, Book V, Chapter XII, sections 2 and 3 and Appendix H.
in the sense that an expansion of production will lower prices, so that even if the physical yield remains the same or actually rises the money return will fall. This is correct from the point of view of a single undertaking if the increase in the volume produced by the one undertaking is sufficient to bring down prices. This state of affairs, however, has naturally nothing to do with the question of the physical return to labour or the physical marginal productivity of the labour factor. An increase in the number of workers in all undertakings would produce changes, not only on the supply side but also on the demand side, by creating new income. If the number of workers increases in an adequate proportion in all undertakings, then theoretically real wages cannot fall so long as the return remains constant. Consequently no capital investment will be required because of the existence of reserves. Since all production is transformed into income, it must all be able to find a market, even when prices remain constant, if the increase has been in the correct proportions. If the return rose, prices would fall, but money wages would not if the development was harmonious, and real wages would actually rise. In such a case there is no reason why the share of labour, generally speaking, should fall. It is more probable that, if reserves of capacity exist, the average volume of production per worker would rise, because the unproductive workers would then represent a smaller proportion of the total and because the return on capital had already been earned before the change. Such a unit of production might then be expressed in figures as follows:

Assume the invested capital to be 200, overhead costs 20 (10 for interest and 10 for amortisation), the expenditure on raw materials 40 (for 100 units produced) and that on wages also 40 (10 being paid for unproductive services).

The cost account will then be:

- 20 for overhead costs
- 10 for overhead labour costs
- 40 for raw materials
- 30 direct labour costs

100 units produced.

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1 This will be the case if, as Marshall, says, the isolated undertaking has not to deal with the market for a product in general, but with the restricted market for its special goods. This case is now in detail analysed in the theory of imperfect competition.
If production is increased by 10 per cent., the cost account will then be as follows:

- 20 for overhead expenses
- 10 for overhead labour costs
- 44 for raw materials
- 33 for direct labour costs
- 107 for 110 units.

Prices would sink (by about 3 per cent.) and the real income of the workers and of the entrepreneur would rise as a result of the fall in prices, if money incomes remain the same.

In this case we assume — and this is close to the real state of affairs — that the volume of money increases, because the extra expenditure on wages and raw materials can be financed out of bank credits; if then the additional borrowed capital and the additional labour are in the correct ratio to each other there will be no fall in the marginal productivity expressed in terms of money or in nominal wages.

**Faulty Distribution of Factors as Cause of Decreasing Value Returns**

Consequently, if the concepts of increasing or diminishing returns be understood in the strict sense of the volume of goods produced in relation to real cost, it will be seen that under the law of increasing returns the only obstacle to the full utilisation of all units of capacity is a faulty distribution of the factors of production. Are there then any industrial undertakings in which one can talk of diminishing returns (in the sense of physical output) either to labour or to capital? A distinction must be made between undertakings in which little or no capital is permanently invested and others in which the investment of a large amount of capital is normal and has become inevitable in consequence of technical progress. At the present time the first of these groups probably includes only building undertakings and the crafts, although even in these machines are beginning to play

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1 Another obstacle might be the failure of the volume of money to increase *pari passu* with the increase in the factors of production. But this obstacle would be by way of being a friction which could be overcome by a reduction in prices and wages without necessarily involving a reduction in real income or a redistribution of factors.
INCREASING AND DIMINISHING RETURNS

quite an important part. In all undertakings, in which the amount of plant is comparatively small, an increase in the number of workers will lead to a corresponding increase in output, provided that the workers, as must be assumed, are of equal quality. If machinery is introduced in undertakings with a small amount of fixed capital, the advantage of machines as compared with manual labour is particularly great, as for instance in the case of excavators, cranes, etc., used in building or the machines used in the manufacture of boots and shoes. Once this mechanisation has taken place, however, the ratio of capital to labour again ceases to be variable. It can therefore be said that in capital-intensive undertakings the law of increasing returns, in the sense given above, will apply. In a purely manual undertaking (of which it is difficult to find an example, apart from purely personal services) the law of constant returns will apply. Mining is usually given as an example of decreasing returns. Obviously, however, the marginal productivity in mining is lowered, not by any change in the ratio of capital to labour, but by the advance from richer to poorer seams. Consequently there is scarcely any undertaking or industry in which the law of diminishing returns holds good, inasmuch as the theoretical capacity is rarely utilised. Before this point is reached, an expansion of the undertaking is usually under way.

OTHER REASONS FOR DECREASING RETURNS

Another aspect of the question we have been discussing is the fact that an increase in production in a given branch of the economic system (e.g. the manufacture of cloth) may cause an increase in money costs even when the industry is subject to the law of constant or even increasing physical returns. There are several possible reasons for this. In the first place, the production of a necessary raw material (e.g. wool) may be subject to increasing labour costs. In that case, however, the cost of raw materials will rise and not merely the cost for the additional units of output. Diminishing returns in the production of the

1 The necessary equipment for the additional workers must, of course, be available, but this is provided either by the worker himself (in the building trade) or from an existing reserve. Strictly speaking, the situation here is the same as in a more intensively capitalised undertaking, even though the value of the equipment may be quite small.
raw materials will be reflected by a uniform increase in the cost per unit of output if production is increased.

In the second place, the price of one of the raw materials (e.g. wool) may rise, not because it is produced under the law of diminishing returns, but because the extension of the production of that raw material has not kept pace with the expansion of the industry in which it is used. This disproportion also causes an increase in the average cost per unit of output when production is increased in the branch of industry in question (the cloth industry), but that increase could have been avoided by a better distribution of the factors of production which will eventually take place.

A third possibility is that the price of one factor in costs increases as a result of a rise in wages in the production of that factor (e.g. coal or wool) while, at the same time, there is unemployment in the cloth manufacturing industry, which may be subject to constant or increasing physical returns.

The raising of wages at the earlier stage of production (in which the law of constant or increasing physical returns may hold good) will be due to the fact that no immediate supply of labour is available. The increase in the cost of labour will then have the same effect on costs in the cloth manufacturing industry as the case mentioned above of diminishing returns in the earlier stage of production. If there is unemployment in the cloth manufacturing industry, and if the increase in costs when production expands is due to a rise in wages at an earlier stage in the process, that means that there is a conflict between the interests of different groups of workers. A change must take place in the relative number of workers in the different occupational groups before the fullest possible employment can be given to all workers while returns in the cloth manufacturing industry are still constant or increasing.

In the cases here dealt with, the manufacture of cloth cannot be said to be subject to diminishing returns unless the increase in the price of the various cost factors (e.g. wool) is due to diminishing returns in the production of those factors and this increase in prices is not counterbalanced by increasing returns in the cloth manufacturing industry. The production of the raw material must then be considered economically as being part of the manufacture of the finished article. The question of the extent to which the production of certain factors (more especially
raw materials) is actually subject to the law of diminishing return is a technological one. (Monopolies in the earlier stages of production may have the same effect as diminishing returns.)

**Statistical Data for Increasing Returns of Total Production**

So far I have dealt mainly with the question of behaviour of the marginal return in response to a change in the supply of one factor while the others remain constant, which is a suitable hypothesis to analysing short-run disturbances. But we must now turn to the question of whether the total production of a country is subject to the law of increasing, constant or diminishing return.

But if we deal with a system of production like that of the United States or Great Britain we have a different situation to analyse from that of a single industry: we can never determine, by looking at the figures of total production employment and hours worked, to what extent an increase in the number of workers was accompanied by changes in capital equipment. In other words, these data refer to a process of growth in which all the factors change to a greater or less extent; we must accordingly be careful about the conclusions we draw from them. The following figures showing the ratio of the number of workers to output in the manufacturing industries in the United States are of interest:

<table>
<thead>
<tr>
<th>Year</th>
<th>Monthly average</th>
<th>Industrial production</th>
<th>Factory employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1923-1925</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1929</td>
<td>119</td>
<td>104.7</td>
<td></td>
</tr>
<tr>
<td>1932</td>
<td>64</td>
<td>65.5</td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>90</td>
<td>85.9</td>
<td></td>
</tr>
</tbody>
</table>

From 1923-1925 to 1929 output increased more rapidly than the number of persons employed. From 1929 to 1932 output fell more rapidly than numbers employed, and from 1932 to 1935 it rose again more rapidly. These are all indications of an increase in the productivity of labour, the inevitable expression of which is that a decline in the volume of output is regularly accompanied by a relatively smaller decrease in the number of workers required and an increase in output by a relatively smaller increase in the number of workers. (The slower
rate of increase in employment after 1932 is due to the extension of the average weekly hours of work.) In other words, even though we do not know how far capital equipment changed, we can assume that the changes in employment, after 1929, were of greater magnitude than the changes in capital equipment. The figures mean then that production decreased more than the number of workers employed which is identical with decreasing efficiency per worker while products shrink: they further indicate (between 1932 and 1935) that output increased from the lowest level more quickly than employment did. Both sets of facts express a tendency to increasing returns.

These results refer to the efficiency (average output) per worker employed; if we consider the average number of hours in the working day, we see that there is an almost constant increase in efficiency per hour from 1923-1925 on to 1935. The keener competition between the workers themselves and the selection of the most able workers are of importance here. But if we observe the changes in output per hour in the very short run, that is, from month to month, we find that the oscillations correspond closely to the changes in the number of hours worked, or that the output per hour of work done increases with an increasing number of hours and the reverse, which is just what we would expect under conditions of increasing returns (cf. Chart IV in the article of Dr. Alfred KAEHLER: "The Problem of Verifying the Theory of Technological Unemployment", *Social Research*, November 1935, p. 455).

Very interesting data for the economic system of Great Britain are given by Colin Clark: In comparing the changes in the volume of production with the average real labour cost per unit of production his table 113 shows that the latter rise when the former fall and the reverse. (I give only some data from the table; they refer to mining and manufacturing industry.)

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1 If we relate output and employment of the two years 1932 and 1933 and consider hours worked too, we find that the output per hour remained constant.
Clark (table 114, page 259) gives the relation between the level of output and marginal costs.

<table>
<thead>
<tr>
<th>Level of output</th>
<th>Marginal costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>87.5</td>
<td>44.9</td>
</tr>
<tr>
<td>92.5</td>
<td>43.2</td>
</tr>
<tr>
<td>97.5</td>
<td>37.4</td>
</tr>
<tr>
<td>102.5</td>
<td>40.0</td>
</tr>
<tr>
<td>107.5</td>
<td>28.4</td>
</tr>
<tr>
<td>112.5</td>
<td>27.4</td>
</tr>
</tbody>
</table>

In the second quarter of 1936 marginal costs were still falling (op. cit., page 259, note 1).

These data refer only to mining and manufacturing industry. Other forms of productive activity show no such tendency of increasing returns (op. cit., page 257).
rest rates) or cannot be reduced unless wages fall in the branches that produce them.

From the point of view of the economic system as a whole, however, the important thing is not so much to reduce prices as to establish a system of price relations which will result in the factors of production being properly distributed. This requires during a depression an uneven reduction in prices, which may mean a relative rise in certain prices. In this process prices, the volume of output, and consequently the capital value of firms will be so changed that the system returns to a position in which additional quantities of the factors of production can profitably be employed.

The disequilibrium between various branches of the production which is produced by a depression may continue for a long period without automatically correcting itself, because during a boom period there arises also a disproportion between income groups which intensifies the maladjustment between the main branches of the economic system (the production of capital goods and of consumers' goods). The great difficulty in restoring the proper relationship between various income groups is that an approach to this proportion can be secured only by lowering prices and wages, which naturally meets with opposition from those concerned. What is sometimes referred to as a process of liquidation or purification really implies the restoration of the proper relationships between the various elements. In such a case the weakest units of production are closed down in those industries which had previously been over-expanded. If, therefore, unemployed workers cannot again be employed or can be employed only at very much lower wages, this fact does not prove that wages are above the level of marginal productivity or that production is subject to the law of diminishing returns; it merely proves that the course of progress was not harmonious and that the system must go through a process of readjustment under which the workers in particular will suffer. There is consequently every justification for the efforts that are made to prevent this disproportion from coming into existence, for the collapse of the level of wages during the depression is not due to any decline in the efficiency of labour but to a faulty utilisation of it.
DECREASING RETURNS OF TOTAL PRODUCTION

It is, of course, also possible that wages may fall as a result of a decline in the productivity of labour. Such a decline may come about as follows; suppose that the equipment of an undertaking is fully utilised and the best possible ratio exists between the amounts of the factors used in production. Suppose that the number of workers actually employed being given, there are still unemployed workers on the market and that no new capital is available. Suppose, finally, the technical nature of the undertaking is such that the unemployed workers can be brought into employment either immediately or after changes have been made in the productive plant. There is then a decline in their productivity and wages will have to fall in order to restore the balance.

The mere enumeration of all these conditions is sufficient to show that in reality the pressure that is brought to bear on wages is rarely caused by a decline in the efficiency of labour.

It may be added that in another sense a change to a phase of diminishing returns takes place periodically when old undertakings are again brought into active use. This may happen during a boom period when the profits resulting from a rise in prices are so high that even the most inefficient undertaking working with high wages will pay its way. It is possible, though unlikely, that it will pay to close down modern undertakings with high overheads during a depression; this may be the case when the overheads of old enterprises are low and orders come in irregularly. This second case is a particularly striking example of the disastrous effects of a maldistribution of the factors of production, which has nothing whatsoever to do with the phenomenon of diminishing returns. (In all these cases we have

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1 Nevertheless, it may be necessary in a depression to reduce wages — not because of decreasing returns but in response to special market conditions, at least in certain regions of the labour market, in order to increase employment there. The most notable case is that of the building trades where a reduction of wages may stimulate the construction of new houses and "prime the pump", especially where the wages in the building trades are far above wages in industry. Even with a fall in the rate of interest such a reduction of wages may be desirable. But this example shows that the situation has to be analysed in detail. A general fall in wages may be very harmful. (Cf. my pamphlet: *Wirkungen des Lohnabbaus*, Tübingen, 1932.)
been dealing with the problem of the increasing or diminishing return from labour while capital equipment remained constant, which is approximately the case in short-run considerations; we have not considered the problem of the growth of the economic system as a whole except in the case of the data given above for the United States and Great Britain. It is undeniable, especially if there is a constant development in the technical field and a constant accumulation of capital, that the productivity of labour will increase steadily in so far as disturbances can be avoided.)

**INCREASING RETURN AND IMPUTATION**

The importance of increasing returns from the point of view of the theory of value must also be mentioned. The theory of marginal productivity cannot be applied to undertakings subject to increasing returns. It will be remembered that the principle of marginal productivity was invoked as a means of escape from a deadlock; it was used as a means of isolating the productive contribution of each factor from the contributions of the other factors. Böhm Bawerk's idea of "the final unit" (Schlusstück) was naturally only partially applicable and broke down if all the factors of production had available substitutes in unlimited supply. Wieser gave an empirical solution, or rather merely noted that a solution was found without suggesting how it could be theoretically formulated if a practical solution had not already been reached. Then came J. B. Clark, who put the question on a new footing, dealing with the problem by analogy with agriculture. According to him diminishing returns were the means of determining the shares of the factors. But it is only when the physical return declines continuously in each individual undertaking, so that the price of the various productive factors changes with any change in their amount, and only if this change in prices is reflected in each unit of the factors that the determination of the factor shares will take place automatically, in strict accordance with the theory of marginal utility. It is only with the help of the principle of diminishing returns that the imputation problem, which, as has always been recognised, can be solved in practice, can be theoretically interpreted in terms of marginal utility. Once we realise that production takes place under conditions of increasing returns, the simple application of the principle of marginal productivity is unten-
able\(^1\). How then will the prices of the factors of production be determined?

The best way to approach the question of determining the prices of various labour services and the rate of interest is probably the following. For every type of labour there is a subsistence minimum which is essentially based on physiological phenomena (varying perhaps from country to country and dependent partly on climate) in so far as the renewal of labour power depends on certain acts of consumption. This subsistence minimum can, however, be determined only in the case of simple physical labour, and even then it cannot always be ascertained objectively. In so far as work and ability to work represent psychological phenomena it is essential to provide also the psychological conditions for ensuring ability to work. The more highly skilled the work is and the more its efficiency depends on the active collaboration of the worker, the more important this psychological element becomes. But it is not a question of individual psychology; it is one of social psychology, in that a certain standard of living may determine the worker’s social status and it is only when this status is secured that favourable psychological conditions for the performance of work exist. Now, social status and the phenomenon of the standard of living on which it depends vary and cannot be reduced to a formula. Which types of work are of a social character and therefore traditionally require an appropriate standard of living are not determined objectively by absolute physiological or psychological needs. We may say that for any type of work only a certain larger or smaller fraction of the remuneration can be objectively determined by the necessity for renewing strength. Beyond that there is a relatively larger or smaller fraction, the objective necessity for which is all the more strongly felt the longer the worker has actually been in receipt of it. This fraction of wages is traditional and it can

\(^1\) Cf. Marshall: Principles, Appendix H. He assumes that if there are short rapid changes in demand production will follow the law of diminishing returns (but even this is not always true). He continues: “But in problems in which the tendency to increasing return is an effective force, there is no clearly defined marginal product. In such problems... we have to consider the cost of a whole process of production without any attempt to isolate that of a single commodity, such as a single rifle or yard of cloth.”

\(^2\) The situation for the single entrepreneur is similar to the analytical case of diminishing returns when he finds that his value returns are declining. But as that is mostly due to a faulty distribution of factors the situation should, under perfect competition, quickly change and show that the return is in fact increasing.
under considerable pressure be removed without endangering the renewal of the worker's working ability.

Within the economic system, therefore, the fixing of wages and remuneration will vary in individual cases, although in the long run the total volume of wages and remuneration will be determined on the one hand by the social product and on the other hand by the necessary amount of savings. The amount of the social product is a function of technical efficiency and economic organisation and will to some extent be dependent in turn on the level of wages, hours of work, and the allowances for social needs. This dependence is not rigidly fixed but is variable. In so far as this is the case, the amount of the social product itself remains indefinite even when the factors of production are being fully utilised.

**Development and “Equilibrium” in a Dynamic System**

The development of a capitalist economic system is linked up with the process of saving. Savings, in so far as they come from large incomes, are dependent on the rate of interest, not because the rate of interest has a decisive influence on the desire to save, but because the rate of interest and the level of profits have a decisive influence on the level of large incomes, which are the most important ones from the point of view of the ability to save\(^1\). In so far as savings come from small incomes they are largely independent of the rate of interest. If all the factors of production are being fully employed, then, *ceteris paribus*, low wages and the growth of the economic system as a whole will be closely correlated, for the lower the level of wages the greater is the possible amount of accumulation. The growth of the economic system as a whole is therefore to some extent dependent on profits earned, but the amount of total savings does not determine the rapidity of the process of growth, since not all capital that is saved is necessarily invested and the rate of investment depends upon expected profits. (Moreover not all investments are for production.) Apart from that the rate of development is determined by a variety of data such as the growth of population, technical progress, the development of foreign trade, and political conditions. If growth is hindered by the low rate of profits, which in turn implies a high level of wages, the

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\(^1\) This will not necessarily remain true for ever (cf. Colin Clark, *op. cit.*, p. 191).
impetus to expansion can still become effective in a capitalist system by means of foreign loans or credit expansion. In this way, if wages are "too high" either the other factors of production will be more intensively utilised or else wages will be brought to a lower level by price movements.

The interdependency of the wage-level and economic growth is further weakened by the fact, that the savings of workers and the lower middle classes tend to constitute a considerable part of the capital accumulated, and will necessarily increase with increasing wages; the capital-supply thus may not shrink below the level required for expansion of production even with reduced profits; the relative increase of savings out of lower incomes and the relative decrease of savings out of higher incomes increases that part of the capital-supply, which is not dependent upon the interest rate. It should tend to make the interest rate more flexible, and thus the rate of growth more independent of the wage-level. If the interest-rate however remains rigid, it reflects a greater weight of institutional elements.

The economic world thus appears as an interdependent system within which the main sections of income wages, salaries, and profits are not invariable but fluctuate within certain limits, more particularly during a process of general development in which the rate of growth is sometimes faster and sometimes less rapid and is in any case not constant but dependent on various factors. The equilibrium of a dynamic economic system is therefore not absolutely fixed but can move within certain limits without hampering the existence or further development of the system as a whole.

This concept of equilibrium is naturally quite different from that of static theory. In a dynamic system a disturbance of the equilibrium may prove the starting point of a progressive development, whereas in a static system the former equilibrium has either to be restored or to be replaced by a new but equally static equilibrium. In a static system, moreover, all prices including wages will be definitely determined, and the exchange ratio of the various factors of production will be determined by their marginal productivity under the law of diminishing returns. In a dynamic system these concepts lead us nowhere. All that they can do is to give a clearer picture of what a dynamic system means and lead to the conclusion that from the point of view of the process of price formation and of distribution the concepts of static theory prove entirely inadequate.
CHAPTER IV

THE EQUILIBRIUM OF THE LABOUR MARKET

I. Equilibrium under a Static System

EQUILIBRIUM CONCEPT AS THE AXIS OF THE STATIC SYSTEM

The problem of equilibrium is not considered here in its entirety but only with regard to its importance for the labour market, and more especially from the point of view of whether, because the economic system has an inherent tendency towards equilibrium, it necessarily follows that all the available labour can be employed. The idea of economic equilibrium can be effectively applied under a static system, but such a system is based on assumptions that remove from it most of the problems that have to be dealt with in actual practice. But it has some bearing also on a dynamic system, if we assume that the rates of change in the data are fairly constant. The assumption of the static system that human beings wish to remain in the situation in which they find themselves and that production proceeds without any reserves excludes from the outset the possibility of development, for which it provides no starting point. It must also be assumed that the population remains constant. In that case there are only two problems in the economic process: the first is, how can the process continue permanently, or, in other words, what must be the exchange ratios between the various factors in the system so as to ensure the constant renewal of the production process? The second is, what happens if this system is upset? Since even during and in spite of disturbances the above assumptions continue to be made, and since no disturbance in a static system can produce a fundamental change in the attitude of human beings, which means that they all desire to
return to the situation that existed formerly, considering the change to be merely a disturbance and not an advance or a backsliding to a different state of affairs, and since the absence of reserves continues, the only consequence of a disturbance is that it raises the problem of how to restore the lost equilibrium. It may be pointed out in passing that even this static point of view involves certain assumptions which themselves require critical enquiry. There is the technical assumption that production exists and the further assumption that the conditions for continued production can be maintained. There is again the assumption that human beings have needs and can satisfy them by means of production, and further that this production is conditional on the renewal of the forces on which it depends. It will thus be seen that the static theory makes a number of assumptions that are not purely of an economic nature, so that its claim to be "pure" is not justified.

On the assumption that in a static system the majority of the population is engaged in production under a system of division of labour, secondly that labour, land and the material means of production belong to different economic categories, thirdly that exchange is necessary in this society in which there is division of labour, fourthly that the quantities of the various factors in production (land, labour and material means of production) are fixed, and that two of these factors, namely, labour and the material means of production, are constantly being reproduced by an economic process (that is, one involving costs), then the central problem is to discover the law governing the exchange that unites production and consumption. Even then the law governing this exchange will be a static law only, if it incorporates a tendency to create a position in which it can remain indefinitely provided it is not disturbed from outside. Such a position is called equilibrium.

A further condition for the existence of a simple static trading system based on the division of labour is that every individual in the economic process continues to follow his accustomed path. Once a balance has been established it is not destroyed by any dynamic elements, such as a change in the intensity of labour or the discovery of new production methods.
EQUILIBRIUM DOES NOT IMPLY UTILISATION OF ALL FACTORS

But the given factors in such a system will not produce equilibrium in all circumstances\(^1\). It follows from the premises that there may be circumstances in which all the existing factors of production cannot be constantly retained and reproduced in the process of production. Thus a certain number of workers may become superfluous on account of a shortage of arable land or a shortage of other means of production which cannot be increased by the restriction of consumption because the productivity of labour just reaches the minimum for physical existence. Similarly with any given population, a fraction of the land suitable for cultivation may be permanently unused if the optimum yield per worker has been reached before all the land has been taken

\(^1\) The writer here assumes that the primary factors of production are given in advance, but does not assume that they must necessarily remain employed in the same quantities or the same quantitative ratios. The action of the laws governing prices may lead to market prices for the one or the other factor, e.g. labour, being below those at which the continuation of the economic process is possible. If that occurs the volume of the factors of production employed will have to be reduced. It is only then that a position of equilibrium will be reached, which simply means that the maintenance of the system on the same scale as formerly is guaranteed. On the other hand, a price that is higher than is necessary to guarantee renewal might lead to an increase in the volume of one factor in production. The distinction between this assumption and that made by Clark, whereby the factors of production in a static system remain fixed and all that is sought is an equilibrium between these given quantities, is obvious. What we are trying to show here is that although given quantities may form the starting point, situations are possible in which equilibrium cannot be reached until the ratios between these quantities have been altered. What interests us particularly among these possible changes is the exclusion of certain quantities from the economic process altogether. (With regard to the construction of a static system, cf. Lionel Robbins: "On a Certain Ambiguity in the Conception of Stationary Equilibrium". Economic Journal, June 1930.) The question with which Robbins deals, as to whether we must or can accept Schumpeter's view of static equilibrium as implying the absence of interest, is of little importance in the present connection. We must, however, assume that the income from interest, in so far as there is any in a static system, is just sufficient to replace the capital used by the other persons in the economic system, which means that a sum equal to the income from interest must be used for consumption. If that were not the case the stationary equilibrium would be disturbed, since all accumulation beyond the limits of the capital already invested would lead to an increase in the volume of production. Hoarding also disturbs the price system and would lead to another position of equilibrium, which might not prove to be a permanent one if hoarding still continued. What is considered as a disturbance from the point of view of the static system may be an essential element in the situation and therefore a necessary condition for an uninterrupted process of growth.
into cultivation. Material means of production may similarly remain outside the process. The static system solves this problem by destroying the surplus factors or by allowing the superfluous workers to die off or leaving the surplus material and natural factors of production to remain unused until they gradually cease to exist. These surplus factors are in a certain sense non-existent from the point of view of the system. Their destruction or neglect is a process that precedes the establishment of equilibrium and the attainment of the static system, and it is a process that cannot be avoided under the assumptions of that system. It is on the contrary one of the most important problems of the dynamic system to determine how the non-utilisation of the factors of production is avoided, and the problem is solved in ways that would not be possible in a static system, for example, by changes in technique.

This view of the static system is often taken over into the discussion of dynamic problems on the assumption that all the given factors of production are necessarily utilised. But this is entirely unjustified in the light of the assumptions of the static system, because according to that analysis the utilisation of all the factors of production depends on the previous removal of any surplus factors.

This optimistic part of the theory comes from the attitude of the laissez faire school, which invested the economic system with a harmony that is entirely unjustified within the dry and precise framework of the static system.

Every economic system in which the quantities are fixed works towards a position of equilibrium, under the usual theoretical assumptions, and the quantities are mutually adjusted by movements in the exchange ratios between them. From the point of view of the present problem the fundamental question is the utilisation of all the labour supply. If with any given supply of land material means of production and a given technique the number of workers exceeds a certain limit, then the remuneration for the services of labour may under certain circumstances fall below the physical subsistence minimum and the superfluous workers are mercilessly ejected from the system. Even if technical and natural conditions permitted the constant employment of all workers in the production process at the level of the physical subsistence minimum there might exist social obstacles to unrestricted competition on the labour market both
from those who have services to sell and those who wish to purchase services. This would reduce the number of workers who could be permanently employed in the system as long as these obstacles exist. As the barrier between the physical and the social subsistence minimum is an elastic one it is impossible to determine objectively the extent to which social obstacles exist. Whether such social obstacles are advantageous or not is an entirely different question, depending on whether the existence of the largest possible number of workers is in itself considered valuable.

If such obstacles are introduced, say in the form of an objection on the part of the workers to selling their labour at a price which would only just enable them to maintain their working strength, or on the part of the purchasers of services because they consider that a fall in the standard of living of the workers below a certain level may affect their efficiency, then a fraction of the workers will be permanently excluded from the static economic process.

There is a third case in which employment cannot be guaranteed for all workers. This is when the number of workers suddenly increases by a large amount. Even a decrease in wages in such a case will not guarantee employment for all workers unless a variety of combinations is possible with a given supply of material means of production and of land. If it is assumed that when capital equipment and the means of production are fixed the number of employed persons is also strictly limited, then any increase in the number of workers might cause wages ultimately to fall to nothing without any increase in the demand for labour.

In discussing these cases we have already gone beyond the

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1 From the point of view of the problem as here stated it is not a question of the correct relative quantities of various commodities or various types of labour. These can always be brought into their correct proportions by changes in prices if it be assumed that the means of production and labour can be used for various branches of production. The question at issue here is rather whether with any given quantitative relationship between the final factors in production all these factors can always be permanently employed. As was suggested above, the same problem may arise with regard to capital if the supply of capital is dependent on a certain return being guaranteed or if the demand curve for capital falls sharply for a time or actually drops to the horizontal axis.

Marshall also points out the different forms that the problem of equilibrium on the labour market may take, more especially as regards temporary equilibria (pp. 335 and 336).
THE EQUILIBRIUM OF THE LABOUR MARKET

scope of the static system. They can, however, be considered as disturbances of that system. In reality therefore a fraction of the workers will remain unemployed, and equilibrium would be established by excluding a proportion of the supply of labour from the market. This is possible, of course, only on condition that the workers excluded from the market submit to their fate, or that society in some way carries them as a dead weight. The exclusion of a fraction of the workers would be not merely temporary but permanent if the necessary capital equipment for their employment was not forthcoming.

All the conclusions that apply to a static system will also apply over a short period to the dynamic system, and even over a medium period if there are structural obstacles to any rapid change in quantitative ratios or in prices in the dynamic system. That means that in a dynamic system also it may happen for a variety of reasons, of which technical progress may be one, that states of equilibrium are formed which result in the exclusion of labour for a comparatively long period (or also of land or the material means of production).

It is now generally recognised that the tendency towards equilibrium does not in reality necessarily imply the full utilisation of the available factors of production over a period of medium duration. Indeed, the contrary view could only have been held under certain conditions and on the basis of undoubted optimism. This optimism was indeed so strong that it blinded the majority of economists to the most obvious facts of reality. It is this position of equilibrium, or perhaps we should rather call it a position of disequilibrium, under which certain quantities of one or other of the factors of production are excluded that is now attracting theoretical interest. It is a form of equilibrium that cannot be taken as implying social harmony.

It must be emphasised that the case under discussion here is different from other cases in which the equilibrium even under static conditions, is indefinite or indeterminate, for example, when the supply curve of labour swings back because a fall in the price of labour has been accompanied by an increase in the

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supply. There are then two possible solutions of the problem of equilibrium. This point is also of practical importance, for it may be assumed that when wages fall in the modern economic system the workers will be all the more prepared to accept a longer working day. If this negative elasticity of the supply curve of labour is sufficiently great there is naturally no prospect of reducing unemployment by lowering wages.

Under the conditions of the static system an equilibrium that has once been reached will continue, particularly if "static" be understood in the narrower sense of the term, for in that case there is, by hypothesis, no possibility of any departure from that equilibrium and from the mere repetition of previous economic processes. These psychological conditions are of the utmost importance because the existence of any dynamic economic impulse will lead to a departure from the position of equilibrium. Even if it is assumed that no changes take place in the technical process, a dynamic psychological attitude would in itself be sufficient to break down the position of static equilibrium. But if any typical changes are presumed to take place (e.g., a change in any of the quantities in the economic system) then there is no limit to the possible chain of consequences.

We then find ourselves entangled in a network of secondary changes; the data acquire new proportions pointing to further changes, which soon lead us to realise that what we have before us is a progressively moving system which can only be regarded as free from disturbances so long as it develops continuously. In such a system the idea of equilibrium does not imply rest but, on the contrary, movement in a definite direction. Therefore the

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1 On this point, cf. Schumpeter: "The Instability of Capitalism", *Economic Journal*, September 1928, p. 364. Schumpeter deals mainly with the problem whether in a static system all prices are determinate, and he endeavours to prove that this is more frequently the case than is generally accepted. The definite fixing of prices, which means that by the laws governing prices only one price is possible at any given moment, is one of the notions in which the concept of economic stability can be interpreted, more especially in a static system. When considering dynamic problems, however, account must be taken of the social influences on economic factors, and therefore in the real economic world a position of equilibrium is not secure even if prices are unequivocally fixed on the assumptions on which the static system rests.

2 Schumpeter would extend the scope of the static system further, for he says that it does not imply a state of rest. On the contrary, the conditions may change. There are, for example, seasonal changes and chance alterations in the data which can be incorporated in the picture if the
reaction to these changes merely represents an adjustment. In many cases there will be more than this mere adjustment, but if it is possible we have before us, in the present writer's opinion, simply a change from one static position to another. Finally, and this is the most important point, Schumpeter includes in the scope of the static system the growth of population and of capital and therefore the increase of the national income. The changes, he says, continue constantly and therefore there is constant adjustment to meet them (loc. cit., pp. 373, 374). This view of the static system, which differs from the one which Schumpeter formerly strongly upheld (cf. Wesen und Hauptinhalt der oekonomischen Revue, passim, e.g. pp. 184-186), appears to have a close resemblance to John Stuart Mill's attitude to the problem (Principles, Book IV, Chapter I).

I believe, however, that there are sound reasons for restricting the term "static system" to the narrower situation outlined above. In the first place, the mere growth of population and of capital under the law of diminishing returns from land, which inevitably takes effect so long as no improvements are made in technical processes, must sooner or later lead to a completely static position in the sense of a repetition of what went before. That means that the growth of the population will come to a standstill and a static system in the strict sense described above will be established (Ricardo). Further, during this whole period of movement within a stationary circle there must necessarily, if the law of diminishing returns from land applies, be changes in the shares of the national income going to the various income groups, because the fraction that represents the rent on land must rise and the share going to remunerate labour and capital must fall. This involves changes in the demand curve, because the real income of the first group will increase and that of the other groups will fall. Changes in demand mean changes in profit rates in different industries, a decline in the value of certain means of production and an increase in the value of others in short, a number of phenomena will occur that are typical of a dynamic system, although there will not be the strong impetus away from a static equilibrium which technical progress produces in the dynamic system. The fact that these changes may be very slight does not seem to me an adequate criterion for the distinction between a static and a dynamic system. What is important is the fact of changes being introduced to which adjustment in the other factors cannot take place owing to a constant tendency towards further changes. If such a constant tendency exists; we must be dealing with development, even though this development may be a retrograde one for many sections and though it may be very slow and although it eventually leads to a stationary position. If it is assumed that the rent on land which rises will in part be accumulated, then a new line will have to be added to the picture which makes the position still more complicated and accelerates the rate of development, more especially if accumulation from the reduced income from interest still continues.

In the third place, I have ignored above the fact that the existence of profit on capital must be assumed in such an economic process, so that there must be dynamic undertakings which, if profits follow a downward trend, will react in the one possible way to that tendency by changing their technical methods. We have thus introduced all the elements of a dynamic system, which would be distinct from the static one only in its rate of growth.

The whole question of how a static system should be defined is, of course, merely one of terminology which, at first sight, does not seem
II. Equilibrium of the Labour Market under a Dynamic System

Dynamic Factors

Historically, it may be said that there never was a static system. The idea of such a system is merely imaginary and depends on the systematic development of certain features of mythical or mediaeval economics. The peculiar features of such an economic system, such as the retention of food as constantly representing the standard of life, are not really the natural features of the homo œconomicus but are rather intended to maintain a monopoly or to bolster up an existing situation. In fact, the idea of a static economic system was evolved to meet theoretical requirements.

The concept of a dynamic system includes a variety of phenomena, for there are several factors exercising a dynamic influence, and consequently economic development may follow various courses. It will be necessary first of all to enumerate the dynamic factors.

(a) The first is a dynamic psychology on the part of individual economic subjects. Persons who are not satisfied with the beaten track strike out along new lines when they see a prospect of profit. This dynamic attitude may be deduced from the economic principle that man is always endeavouring to better his situation. This particular kind of initiative is restricted to the entrepreneur type. The desire for advancement which people who are not entrepreneurs also experience induces them to save. Saving satisfies the desire both for future improvement and for security. Saving is, in fact, the dynamic behaviour of the static mind in a dynamic system. Saving, however, only pays the people extremely important. But it is important, because the static system must serve as a basis of comparison for the dynamic system and because the results of the analysis of the static system can be directly used if the elements of a dynamic situation are thought of as becoming stationary (for instance, if it were assumed that no further technical progress was to be expected). It is, therefore, desirable to adhere to the strict concept of the static system because the accidental inclusion of one or more elements of the dynamic system creates confusion in which it is difficult to distinguish the essentials of a static system and the consequences of disturbances from outside. This is particularly serious because conclusions are constantly drawn from the idea of static equilibrium which are applied subsequently to the reality of the dynamic system.
who perform this function in so far as the entrepreneurs invest and they themselves are willing to hand over their savings to the entrepreneurs for this purpose.

(b) A second factor is a growing population, or at least a growing proportion of workers in the total population.

(c) Inventions leading to the production of hitherto unknown commodities or technical improvements in the system of production constitute a third factor. Technical improvements in the system of production include the division of labour, improvements in organisation with a view to reducing costs, and improvements in quality. Cheap imports work in the same way.

(d) Another dynamic factor is the development of a monetary system that is sufficiently elastic to enable the marketing of the rapidly growing volume of production at prices that will avoid such a devaluation of existing stocks and of fixed capital as would constitute an obstacle to the process of development.

Such a monetary system will always be an institution which cannot work entirely automatically. It may be pointed out that the gold currency of the nineteenth century which satisfied these conditions fairly well did not arise automatically from the play of economic forces but was an institution based on the predominating position of England in international trade and the great advantages that the principle of a gold currency brought for England in particular.

1 In considering the importance of elasticity in the monetary system a distinction must be made between two possibilities. There is, on the one hand, an increase in the volume of production as a consequence of an increase in population and the continued accumulation of capital (saving). If the quantity of money increases at the same rate as production, prices remain unchanged. On the other hand, in so far as the increase in the volume of production was a consequence of technical progress, the decrease in prices would not cause a fall in income or in capital values unless the differences in the elasticity of demand and the investments required for technical progress produced disturbances in the system. The smooth adaptation of existing capital values to a falling price level is an important condition for frictionless progress. The problems arising out of this constitute an important part of the present study. (An outline of the obstacles to development when the volume of money remains constant is given by NissR in his article, "Monetary Expansion and the Structure of Production", Social Research, November 1934.)

2 On this point the reader may be referred to the "Butler Report", Columbia University, New York, 1934. The most important monetary institutions at the present day are the commercial banks, which can, by means of the cheque system, increase the quantity of money in circulation. These institutions would prevent any automatic international gold currency at the present time from working in the same way as it did before the war.
None of these dynamic factors would in itself be sufficient to constitute a dynamic system. It is, however, not difficult to see that (a) and (c) are closely connected with each other, which means that a dynamic impetus reaching out upon the existing situation necessarily implies technical changes with a view to increasing efficiency. Even if the population remains stationary, therefore, the system may still be dynamic, but a certain minimum of technical progress will then be essential because otherwise the competition of employers for labour (assuming constant accumulation) would very soon bring profits down to zero, which would stop accumulation for the purposes of investment and would necessarily lead to a stationary system.

The Harmonious Dynamic System

The combination of the first and second factors without technical progress would make it possible to have a uniformly developing dynamic system without cyclical fluctuations — that is, a system in which population, plant, and production would increase uniformly from year to year. In such a system, total production would increase at the same rate as population (the rate of savings being supposed equal to the rate of increase in population). If the rate of increase in savings and equally of investments is greater than the rate of increase in population, for instance 2 per cent. of total capital as compared with a 1 per cent. increase in population, then it must be assumed that the organic structure of production would gradually change and there would be technical progress and a gradually increasing output per head.

Such a system of uniformly progressing movement may be referred to as a harmonious dynamic system. It lies between the static system described above and the wave-like cyclical dynamic system which actually exists in a capitalistic economy. Such a harmonious dynamic system cannot exist unless capital accumulation (investments) keeps pace with the uniform growth of population. This can easily occur even when profits fluctuate. Such a system cannot come into being without a tendency to

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1 If it be assumed that the abolition of profit would not interfere with savings or with the urge to invest, then if the population increased and the technical structure remained the same the increasing demand for labour would actually lead to a loss. That, however, would naturally put a stop to accumulation altogether and make the process a stationary one. (Saving might continue but it would take the form of hoarding.)
increase production, although the development may eventually become so much a matter of accustomed routine that all incomes, including the incomes from profits, are considered as static.

In the harmonious dynamic system, as also in the dynamic process of cyclical economic development, the monetary system must be elastic so as to prevent a fall in prices which would constitute an obstacle to development. As was already mentioned, all prices would not fall uniformly, and this again would necessarily lead to considerable disturbances.

In reality, this problem does not arise, for in the normal course of development an increase in the quantity of money generally goes hand in hand with an increase in production. If money is a commodity, the general tendency towards expansion will be felt also in the conditions of production of the money-substance; if not, the increased purchasing-power of money, resulting from the greater output of all other commodities, will in itself bring about such an increase. If money is merely a token, we are dealing with a social institution managed from a central headquarters which traditionally has always reacted comparatively quickly to any increase in the volume of production by increasing the quantity of money and as a rule has even in some measure anticipated that increase.

**Technical Progress in the Dynamic System**

In the light of what has been said above, the most important factor in the dynamic process as we know it in its cyclical form is technical development. If the methods of production remain the same, output can expand only at the same rate as population. Indeed, the increase in the volume of production would then strictly correspond to an increase in the factors of production, so long as there were no technical progress. If the increase in the volume of production is at most only a gradual process, then the disturbances that take place are generally not cumulative but merely lead to readjustments and can consequently be overcome by adaptation. We are, therefore, justified in attributing most importance to technical changes, for they produce sudden considerable changes in important branches of the economic system. In fact, they introduced and have constantly accompanied the whole modern phase of capitalist development. Technical revolutions such as took place in the eighteenth and nineteenth cen-
uries were able by their direct and their cumulative effects to produce the extensive ups and downs in production that are typical of our modern capitalist process. Technical progress provides the motor power for the rapid expansion of production, which was for a long time held in check only by the fact that the progress of saving was too slow and that at times, particularly when production was at its height, there were no reserves whatsoever on the labour market. It is this interplay of action and reaction between the application of technical progress on the one hand and the effects of a sudden change in costs in certain industries on the other without which the cyclical process would be unthinkable. It is idle to consider technical development simply as a non-economic phenomenon and therefore of relatively little importance, involving merely a change in data which cannot change the nature of the economic process. Just as the law of diminishing returns from land, although also merely a technical fact, determines not only the economic structure of agriculture but also the whole nature of the economic system and is the indispensable condition for the creation and development of the concept of marginal productivity and therefore of the modern theory of distribution, so technical progress as the basis for the growing efficiency of industry and at the present time also of agriculture is therefore a real factor which alone could have moulded the course of modern economic development along the lines in which we know it. That does not mean that the economic process itself is a technical phenomenon or that it must be taken as a purely technical development. On the contrary, this argument is the logical consequence of the fact that the economic process as a process of production cannot be deduced by abstract reasoning from principles but can be grasped only in its actual manifestations and by a full appreciation of its real substance. The analysis of the technical process naturally cannot suffice to reveal all the peculiarities of the economic system. The picture will be out of focus, however, if the real facts are not taken into account. Similarly, the specific importance of the monetary aspect of the cyclical process cannot be appreciated unless it is linked up with technical changes, and it is completely misleading to describe or to analyse the cyclical process simply in terms of money or alternatively to pick out some one technical feature, such as the change in the relative output of producers' to consumers' goods; these are indeed important characteristics of the
process, but do not reveal the mechanism of dynamics without further analysis.

**Growth as the Basic Concept of the Dynamic System**

There is a danger that the theoretical problems of the dynamic system may be treated in isolation. This is not possible because the dynamic system is essentially interdependent. Even when considering it over a short period, one must take into account the mutual dependence of all economic phenomena and, more particularly, the interdependence of the various income streams. The dynamic system, like the static system, must be considered in its entirety and as a complete entity, and it is therefore essential to have a mental central position from which all isolated phenomena can be taken as parts of a composite whole. The question arises whether this mental centre of gravity can be supplied by the idea of equilibrium, as it is in the static system.

A dynamic system could be considered as a movement towards equilibrium only if it were made stationary at the moment of examination. That would mean that the data would have to be fixed and the inherent or observed tendencies towards change would have to be ignored. It might then be assumed that in this restricted situation an equilibrium would be arrived at. The price and quantity relationships arising and continuing in the position of equilibrium would thus be those which would occur in the long run if the given circumstances remained the same. Such a point of view, however, cannot do justice to the real problem of the dynamic system. In particular, it cannot be used as a basis for the analysis of the real course of economic development with a view to arriving at practical conclusions. For this purpose it is necessary to consider a longer period, with the changes that may normally be expected to occur within it. In that case the concept of static equilibrium has no meaning. That is why the concept of moving equilibrium was developed in its place. From the point of view of the static system, this moving equilibrium means a system of "disturbances"¹ which, when they

¹ This was most clearly brought out by Schumpeter, who rightly said (loc. cit., p. 369, note) that the expression "moving equilibrium" might lead to confusion, because what actually happened was a disturbance of
fit harmoniously into each other, constitute a dynamic system which is either free from any regressive movements or which may necessarily include certain regressive movements as a preparation for further progress.

But even this view of the dynamic system as being a system of disturbances from an ever-approaching and never-entirely-realised static equilibrium is very artificial. The concept of moving equilibrium is not satisfactory, because movement is such an important feature of the system that the idea of equilibrium would have to take on an entirely new aspect. Therefore the dynamic system should be considered as a process of growth, within which the tendency to genuine equilibrium is replaced by a tendency to overcome disturbances, which, if they became cumulative, would destroy the system; this tendency to overcome disturbances implies, however, the constant expansion of the volume of production. As we are considering a process of growth, a long period must always be taken as the unit, and that is another essential distinction between the static system and the dynamic one, which latter can be mentally grasped and analysed only as a process and not as a state. An analogy to this method can be seen in the way in which modern financial theory treats the budgets of public corporations; it does not consider them as the problem of a single financial year, in which the income must cover the expenditure, but as a problem covering a considerable period, in which deficits may be part of the normal financial situation. The fundamental (or, one might say, a priori) conception of the dynamic system is therefore not a movement towards equilibrium but a comprehensive view of a process, the various phases of which appear to be disturbances only when considered from the static point of view, appearing from the point of view of the dynamic system as necessary phases in development.

The discussion of the process of growth in our capitalistic economic system is identical with the discussion of the business equilibrium in the ordinary sense of that term. It is quite true to say that dynamic development can be adequately understood only if its essential feature is taken as being not a tendency to equilibrium but a series of impulses constantly driving it beyond the point it has reached. In this movement the tendency towards equilibrium exists only as an undercurrent which becomes visible as soon as the data of the process are considered as stationary at the moment of observation.

cycle in general. If all the dynamic factors enumerated above are actually present, there can be no harmonious dynamic system in the sense of a steady development without any reserves. The regular impulses towards movement given by the dynamic factors mentioned above must, however, be distinguished from real disturbances that come from non-economic fields, such as a sudden interruption of international trade, or a sudden withdrawal of capital, as a result either of the economic conditions in other countries or of political causes. Frequently such apparently non-economic disturbances are produced by one of the dynamic factors in question, as when there is an increased tendency to restrict imports on account of technical developments in agriculture and industry.

Reserves as the Necessary Condition of the Dynamic Process

A steady and uniform development in a dynamic economic system can be expected only if there are proportionate changes in the quantities of the various factors of production. An important symptom showing that this is the case is the stability of their comparative prices. The stability of relative prices does not, of course, mean rigidity in the price system, but on the contrary implies that degree of mobility which is necessary to express a change in needs and a relative change in costs, and which is indispensable before the volume of production can be completely adapted to changed conditions in a dynamic system.

As the various elements in the dynamic system do not fit closely into each other as they do in a static system, and as the change from one stage of development to another involves adaptation requiring a certain period of time, there are always certain factors of production that remain unemployed in a dynamic system. The writer has already included in the static system the idea of reserves, representing the factors of production that were not completely utilised. In the dynamic system every economic unit has even more need of reserves. They may be classified as follows:

(a) Every industrialist requires a certain freedom of movement, because the production of commodities, their sale and the re-expenditure of purchasing power may often require a period of considerable but varying duration. Reserves thus appear in
the production system in the form of stocks of commodities, raw materials and auxiliary materials, in the form of semi-manufactured products and of surplus producing capacity.

(b) The volumes of purchasing power which are necessary in the normal course of development to maintain production without undue disturbances. These monetary reserves enable the single entrepreneur to draw on means of production or stocks held as reserves elsewhere.

(c) In emergencies, even the material means of production may be considered as reserves, as for instance, if nothing is written off for depreciation. Flocks and herds constitute another example of such reserves.

(d) If the disturbance is unusually great, then the other means at the disposal of the industrialist and outside credits will also be used as reserves, either in order to meet overhead costs (for interest or the technical maintenance of the undertaking) or in order to continue production at a loss. Reserves in the narrower or wider sense of the term will always be used to tide the undertaking over an unfavourable period until it is again working normally.

(e) The consumer also needs reserves. They take the form of cash and durable consumers' goods. They help to maintain the standard of living though the income may fluctuate. Different from these genuine reserves, though the border-line is not entirely strict, is the holding of cash depending on the intervals at which the consumer receives his income.

The importance of genuine reserves for the process of development is that they lessen the violence of the movements or spread their effects over a longer period. In a static system the immediate reaction to a change in data allows a very slight alteration in, say, the volume of labour to cause considerable changes in income if the producing apparatus is difficult to transform. In a dynamic system the violence of the change will be eased either by producing for stock (accumulation of reserves) or by selling from stocks (disposing of reserves). Therefore the dynamic theory must always reckon with the existence of reserves, which must never be allowed to be completely exhausted if serious disturbances are to be avoided.

Everything that takes place in the dynamic system is at the same time a monetary transaction. The same is true of every act of production or consumption. Money is not, however, as in
the static system, neutral in its relation to other commodities, for an economic system that works with credit and in which the monetary circulation and active purchasing power can be very greatly increased or reduced within a short period must be prepared for fluctuations in the value of money. This fact of the fluctuating value of money must, of course, always be taken into account.

In view of what has been said, it will be realised that to overcome disturbances in the dynamic system does not mean to strive towards equilibrium, but either to remove obstacles to growth or to make use of disturbances as a starting point for further and perhaps more rapid development. These problems constitute the most important part of any policy intended to control cyclical fluctuations, since a dynamic system is necessarily implied in the cyclical process.

III. Reabsorption of Unemployed in a Dynamic System

We will not go into a detailed description here of the way in which the constant tendency to overcome disturbances operates in a dynamic system, but turn now to the question of unemployment. The reabsorption of the unemployed has several aspects, varying with the process of expansion and the structure of the dynamic system of production. The following different cases must be distinguished:

(a) Increasing cost under free competition.
(b) Increasing cost under a monopoly.
(c) Diminishing cost under free competition.
(d) Diminishing cost under a monopoly.

We are here dealing with unemployment in general, irrespective of its cause, since the methods by which unemployment can be overcome are the same whether the actual cause of it be technical progress or a lack of proportion in the development of the various branches of production. The special features of the process set in motion by technical progress will be discussed later.
A. Decreasing Return in a Competitive Market

*Increasing Costs Hamper the Process of Growth* 

Increasing cost under free competition acts as a brake on expansion. Production is governed by the law of increasing cost when, other things being equal, an increase in labour or capital yields diminishing returns. Thus in agriculture, with a given area of land and an increasing number of workers, the yield per head can only remain constant if the accumulation of capital proceeds faster than the growth of the population. The more closely the land is cultivated, the more fully this rule applies. This, of course, implies that it is technically possible to use a larger amount of capital per head.

We may assume, on the basis of what has already been said, that the expansion of modern economies is no longer governed by the law of diminishing return. For some years after 1900 it seemed as if the law of diminishing return was beginning to make itself felt, not only on prices but also in a downward pressure on the standard of living; but this proved to be only a short interlude. However, we are not concerned here with the changes which have taken place during the process of expansion, but only with the problem of how a sudden access of unemployment can be dealt with if, as long as the quantity of the other factors of production remains constant, the employment of additional workers involves a diminishing return. However the system of distribution may be regarded — whether from the standpoint of marginal utility or from that of the law of cost — the income of each unit of one of the factors of production (i.e. labour) must fall if, in such a situation, *ceteris paribus*, its quantity increases. (Similarly interest rates would decrease if there were a sudden increase in the quantity of capital.) Hence, if the number of workers increases, wages cannot be maintained at their former level. The bigger the reduction in marginal productivity, brought about by the increase in the ratio of labour to the other factors, the more steeply will wages fall. This, of course, means a corresponding rise in profits. Even if these profits can be invested at once so as to enlarge the capital equip-

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ment of the economic system, it is bound to be some time before this increase in capital equipment can raise wages again to their former level.

Increasing Labour Supply and the Situation in Individual Firms

In this situation of diminishing return, the problem differs for the individual firm and for the industry as a whole. If it is a matter of determining the rate of wages at which a single firm can employ a larger number of workers, it may be assumed that the firm concerned will be able to sell the larger quantity of goods produced at the old, or very nearly the old, prices. The smaller its share in total production, the more nearly correct this assumption will be. But the product of the workers who were employed before will remain unchanged, although their wages are lower, so that profits will rise sharply. These rising profits then form extra capital which, if it can be invested at once, will again increase the efficiency of labour. In this case, the fall in wages will correspond exactly to the fall in marginal productivity but will gradually be cancelled by the restoration of marginal productivity to its former level, following the accumulation of capital. But if an increased supply of labour appears throughout a whole industry, it will only be possible to sell the larger quantity of goods produced by reducing prices, the extent of the fall in prices depending on the elasticity of demand for the product. In this case it is doubtful whether profits will rise at all and the fall in wages will therefore be permanent.

Two examples may be given to make this difference clear:

(a) Supposing that 100 workers were formerly employed at a wage of 10 and that 10 more workers could be engaged if the wage were reduced. Suppose, further, that the original output was 3,000 units of product, each sold at a price of 1. The share falling to the workers was then originally 1,000 or 33 per cent., the remaining 2,000 being allotted to other costs and

1 In this chapter unemployment is considered as the result of an increase in the workers' supply (e.g. increase in population); if, however, this additional supply may be employed while other (e.g. older) workers are discharged, the situation is very similar to unemployment, due to dismissals, i.e. to a decrease in the demand.

2 It is also assumed that production in this industry is expanded proportionately more than in others. If this is not so, the position is similar as when production is expanded in a single firm.
profits. Profits may be taken as claiming 10 per cent. of the total value of the product, i.e. 300, while raw materials cost 1,200 and depreciation 500. Now if capital equipment remains unchanged, the extra output produced after the engagement of the 10 additional workers will not be 300 but only 18.5, so that 92.5 of this will now be allotted to wages. This wage will now be paid to the former 100 workers as well, so that, if their output and the price obtainable for it remain unchanged, the entrepreneur will obtain an extra profit of 75 as a result of his wage bill on the old output having fallen from 1,000 to 925. His profits will therefore shoot up from 300 to 375. But, in addition to this, there is also the profit from the extra units of product which, given the same ratios, will amount to 18.5. Thus, total profits will rise to 393.5 — that is, by 30 per cent. This huge increase in profits depends on two conditions: first, that prices remain constant in spite of the greater quantities produced (this implies free competition) and, secondly, that the productivity of the workers originally employed is unchanged. Now if the number of workers increases and capital equipment remains unchanged, the return obtainable from the 100 workers previously employed must necessarily diminish. Our formula, however, gives only the marginal return, that is, the change in the total return which will result from increasing the number of workers, for, in considering whether and at what rates additional workers can be employed, it is only changes in the total return that are important, since the return obtained with the previous number of workers is naturally still obtainable as before. (This view agrees with that of Clark. His curves are not intended to show what share of returns should be allotted to each unit of one of the factors of production, e.g. labour or capital, in any given combination, since each unit naturally receives the same share. What the curves do try to do is to illustrate the change in return when the quantity of one of the factors of production is varied while the others remain constant.)

(b) Supposing now that additional workers have to be engaged in every firm, the increase in quantity of production cannot be neglected any more and prices will fall. In the case

1 In reality this figure would be higher because the amortisation charges for the whole undertaking are covered by the proceeds from the first 3,000 units.
we are considering, therefore, the 3,185 units would, with elasticity equal to unity, sell for 3,000 in all, and an additional outlay of about 6 per cent. on raw materials must also be allowed for. Wages will then have to fall by 17.5 per cent. in order to bring in the same return as before. Here, therefore, is no possibility of subsequently increasing the productivity of labour by a more rapid accumulation of capital and thus raising wages to their former level.

The effect of the employment of additional workers on marginal productivity will also depend on the shape of the marginal-productivity curve, and this again is mainly governed by the extent to which the firm's capacity is being used. If the firm is working to full capacity, as is usually assumed, the expansion of production will necessarily involve a relative fall in returns; in many cases indeed no expansion of output at all can be expected when capacity is being used to the full. But the cases instanced above do not explore the process we are examining in sufficient detail. The problem we have to solve is whether and to what extent a change in the income of labour will enable employment to be found for all persons seeking work, i.e. how far a simultaneous increase in the quantity of labour and in the social product can take place. Let us take the case of an increase in the supply of labour within an expanding economy. We will also assume that this economy is governed by the law of diminishing return — that is, that the application of further doses of labour or capital produces a relatively decreasing additional yield. In a dynamic economy of this kind, capital equipment improves from year to year; it rises by 3 per cent. annually and the number of workers increases by 1 per cent. Under these conditions, the supply of labour suddenly increases by 10 per cent. (e.g., as a result of a sudden withdrawal of capital supplied by short-term foreign loans or following a sudden wave of immigration or a sudden increase in the demand for work). The necessary adjustments can indeed be made to some extent by an appropriate use of the additional capital created, but, given the numbers and quantities we have postulated, only within comparatively narrow limits. In the process of adjustment several groups of pheno-

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1 It is assumed that the workers are obliged to seek work in their own industry and cannot transfer to others, as in the case of coal miners, or that unemployment appears in all industries simultaneously.
mena can arise and will react on one another, all being effects of the suddenly increased supply of labour. The immediate result of this will be a sharp fall in wages and the economy will have to adapt itself to this change.

Changing Ratio of Capital to Labour

The first result will be that the newly formed capital will be put to a different use from hitherto; that is to say, it will be used to finance firms which use a relatively large proportion of labour to capital in production. The new capital which comes into the investment market will then enable some of the unemployed to be absorbed. This will occur if the fall in wages is steep enough to make profitable the employment of more workers in relation to a given quantity of capital.

But only 3 per cent. of all the capital invested in industry is available to finance such firms, which are now using less capitalistic methods, so that the change-over can take place only on a very narrow scale. Let us, nevertheless, consider what will be the effect of such a change in the structure of production. We will assume that three-fifths of the capital invested in the firm is fixed capital and two-fifths circulating capital, spent on raw materials, subsidiary material, wages, etc. (Rieger, for instance, assumes in his *Einführung in die Privatwirtschaftslehre*, page 162, that one-third of the capital is circulating capital and two-thirds fixed capital and that the circulating capital is turned over about three times a year.)

Suppose now that, other things being equal, a capital of 100,000 units is invested as follows: fixed capital, 60,000; circulating capital, 40,000, of which 15,000 goes in wages and 25,000 in raw materials and subsidiary materials. The firm employs 30 workers, its wage bill being 60,000 or 2,000 per worker. The cost account or its total yearly output would be as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 per cent. interest on an invested capital of 100,000</td>
<td>7,000</td>
</tr>
<tr>
<td>10 per cent. amortisation on fixed capital of 60,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Fourfold turnover of circulating capital</td>
<td>160,000</td>
</tr>
<tr>
<td></td>
<td>173,000</td>
</tr>
</tbody>
</table>

It is important how we adjust the changes in this bill of costs. Suppose that new firms, organised on a lower technical level and
in which the efficiency of labour is consequently lower, are founded in competition with existing firms. The number of workers will thus rise, say, by 33 per cent., but output only by 25 per cent., 15 per cent. or 10 per cent. The question then is how far wages must fall in order to make this additional output possible.

Suppose that the number of workers increases by 33 per cent., i.e. from 30 to 40, and total output by 25 per cent. If 100 units of the product were formerly produced, output per worker was 33\frac{1}{3} units. The addition of 10 more workers, involving a technical change in capital equipment, would bring the total product up to 125 units, so that the output attributable to the extra 10 workers would be 25 and their wage would be determined accordingly. I call this wage the "marginal-productivity prime-cost wage".

If the extra 25 units produced are sold at the same price as before (price per unit = 1,730) the proceeds of the 25 units would be 43,250. The extra raw materials needed would cost 25,000, leaving 18,250, or 1,825 per worker, for wages, making the fall in wages about 9 per cent.\(^1\). This wage reduction will also apply to the 30 workers formerly employed, whose aggregate wages will now be 1,825 times 30 = 54,750. If prices remain unchanged, therefore, the result will be an extra profit of 5,250 for the firm, while the total wages will be 73,000\(^2\).

Even if the formerly employed workers are not prepared to work at the reduced wage, they will be unable to obtain a higher one, if competition among labour is free. Assuming free com-

\(^1\) This implies the assumption, strongly in the workers' favour, that the extra 25 units can be sold at their prime cost, because interest and amortisation are covered by the proceeds of the first 100 units.

\(^2\) This case can be computed in a different way: if the overhead costs (13,000) are spread over the whole production, including the 25 additional units, then the proceeds realised from the sale of these 25 units will be distributed in the following way:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 per cent. interest on 20 per cent. of capital invested</td>
<td>1,400</td>
</tr>
<tr>
<td>10 per cent. amortisation on 20 per cent. fixed capital</td>
<td>1,200</td>
</tr>
<tr>
<td>Raw materials</td>
<td>25,000</td>
</tr>
<tr>
<td>Leaving for wages</td>
<td>15,650</td>
</tr>
<tr>
<td>Total proceeds</td>
<td>43,250</td>
</tr>
</tbody>
</table>

The wage of the individual worker would drop to 1,565 or a reduction of 22 per cent.; this wage reduction, applied to the 30 workers formerly employed, would bring down the total wages bill to 62,600 or hardly more than before, for an output greater by 25 per cent. (price remaining equal). The extra profit would amount to 13,050, or 13 per cent. on the fixed capital invested. This wage is the marginal-productivity wage.
petition between the workers, therefore, the reduced wage will become the rule for the whole staff, with the result that the firm will make the extra profit mentioned above.

It is true that the saving effected on the wages of the formerly employed workers forms a fund out of which wages could be raised above the level of marginal productivity. But if competition in the labour market is really free, this will be no incentive to the entrepreneur to pay a higher wage than is justified by marginal productivity. It is just when returns are diminishing that every increase in the number of workers will, ceteris paribus, represent a chance of profit which the employer has no reason to forgo. But this chance of profit may well furnish the basis for collective action on the part of the workers. This is important because it is precisely when returns are diminishing that the well-known social factors which operate to prevent a corresponding fall in the wage level are especially strong and have some prospect of success if they aim purely and simply at preventing the making of an additional profit.

**Increasing Labour Supply and the Situation within One Industry**

(a) *Elasticity of Demand equal to Unity*

We must now turn from the individual firm which we have so far been discussing to a consideration of the industry as a whole. Supposing that the surplus workers cannot all be engaged in the new undertakings, that the change-over to a less capitalistic system of production throughout the industry is possible within a short space of time and that the formula of production is varied in accordance with our previous assumptions, and supposing further that the elasticity of demand is equal to 1, the 125 units would then sell for the same total sum as was

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2 The highest wage could be 1,956 — the total wage bill 78,250; profit unchanged 7,000. I call that: *monopoly wage of workers*; if the wage is computed on the basis of *marginal prime costs* it would be: 1,825 and the total wage bill 73,000, leaving an extra profit of 5,250. If the wage is computed on the basis of *marginal productivity*, it is 1,565, and the total wages bill 62,000, leaving an extra profit of 13,050.
3 The formula constructed below applies to firms able to adjust their structure in the manner indicated. The results likely to arise if the technical structure of the firms is rigid will be discussed later.
previously obtained for 100 units. Thus, in our previous example, the total output would sell for 173,000, which would have to be distributed among the various costs as follows:

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>7,000</td>
</tr>
<tr>
<td>Amortisation</td>
<td>6,000</td>
</tr>
<tr>
<td>Raw materials, etc.</td>
<td>125,000</td>
</tr>
<tr>
<td>Wages</td>
<td>35,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>173,000</strong></td>
</tr>
</tbody>
</table>

With 125 units of product the price per unit would thus be 1,384. The average wage would then be 875 instead of 2,000—that is, it would have to be reduced by 56 per cent.; and the purchasing power of the wage as regards the products of the industry concerned would fall from 1.15 to 0.63, i.e. by 45 per cent.

But at the same time the number of workers employed in producing the raw materials would also have risen, the increase being 25 per cent. if wages remained unchanged. Supposing that 25 workers were formerly employed in the production of raw materials at a wage of 2,000, wages representing a share of 50 per cent. of the cost of production of raw materials (all these assumptions being highly favourable to the labour factor), in future 31½ workers would be employed in producing raw materials at an aggregate wage of 62,500 (provided that wage rates remained unchanged). The total wage bill for the industry, including the production of its raw materials, will thus be reduced from 110,000 to 97,500, and the average wage (also the monopoly wage) from 2,000 to 1,373, i.e. by 31 per cent. The total number of workers, however, will have risen by 33 per cent. (The total demand for labour is here almost equal to unity.)

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1 This formula describes the end of a long process, in which producers are forced into expanding production by competition, though the final result is the same level of profits as before, while wages are reduced to a fraction of what they were before. The process begins with changes in single firms, as they were outlined on page 97, and leads in case of elasticity equal to unity to the result given above. The wage is then, in spite of its low level, the monopoly wage of workers, as in fact the marginal-productivity wage would be below zero: the production of further units cannot increase total receipts at all and as it entails additional expenditures on raw materials and so on, negative wages (or subsidies) will result. This example shows that under competition, an expansion of production will take place with wages above the marginal-productivity level, eliminating the excess profit, which otherwise would be the result of decreasing returns. At marginal-productivity wages the excess profits would be excessively high.
(b) Elasticity of Demand Greater than Unity

If the elasticity of demand for the products of this industry is equal to 2, an expansion of 25 per cent. in output will cause the price to fall to 1,550. In order to enable the product to be sold at this price, total costs (including interest, etc.) would have to be reduced to 194,625. Hence, the wage bill in the undertaking would be 56,625, or 1,415 per worker, representing a reduction of 30 per cent. as compared with 56 per cent. if the elasticity of demand is equal to 1. Expressed in terms of purchasing power (so far as the product manufactured by the workers themselves is concerned), the fall in wages is even less than this. Whereas the wage would formerly buy 1.15 units of the product (2,000 : 1,730), it now buys 0.9 (1,415 : 1,557), this represents a wage reduction of 21.7 per cent. But the actual fall in real wages is only as small as this if the price of the essential commodities consumed by the workers is also reduced in an equal measure. If we again compare the wage bill before and after the reduction for the whole industry, including the production of its raw materials, maintaining the previous technical assumptions, the following results are obtained: The wage bill, which before unemployment arose was 110,000, has now risen to 119,125; the number of workers from 55 to 71.25; while the average wage has fallen from 2,000 to 1,672, i.e. by 16 per cent. The total number of workers employed in the industry, including the production of raw materials, has increased by 33 per cent., and their average wage fallen by 16 per cent. The wage bill has risen by about 9 per cent. (The demand for labour here is greater than unity. But the contraction of other markets, due to the greater expenditure on this commodity, is not taken into account.)

(c) Inclusion of the Earlier Stages of Production

In these examples we have assumed that unemployment affects only the final stage of production and that the preliminary stages (raw materials, etc.) can be expanded to a corresponding extent without any change in the return per worker employed, so that unemployment occurring simultaneously in the preliminary stages does not involve a reduction in wages there. If, on the contrary, we assume that the preliminary stages of production too can only be expanded at the cost of diminishing returns, a
reduction of wages is inevitable here also, and the average fall in wages throughout all stages of production will then approximate more nearly to the figures calculated for the last stage of production alone. The total result for the workers as a whole will then be very much less favourable than that shown above.

Moreover, in these examples the average productivity of labour or the monopoly wage for workers has been taken as the basis for the determination of wages instead of the marginal productivity. But given our previous assumptions, if elasticity of demand for the product is equal to 1 and the 10 additional workers engaged produce an extra 25 per cent. of the former output, their wage will be only 700, which, applied to all the workers employed, gives a total wage bill of 28,000, with the result that the employer obtains an extra profit of 7,000. The calculation is as follows: with 10 workers added, 25 new units of product will be produced. With a total output of 125 and elasticity equal to 1, these 25 units are sold for 34,600. The costs are as follows:

<table>
<thead>
<tr>
<th>Interest and amortisation (20 per cent. of)</th>
<th>2,600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>25,000</td>
</tr>
<tr>
<td>Available for wages</td>
<td>7,000</td>
</tr>
<tr>
<td></td>
<td>34,600</td>
</tr>
</tbody>
</table>

If elasticity is equal to 2, the price per unit as calculated above will be 1,557 and the proceeds of the sale of 25 units will be 38,925, distributed as follows:

<table>
<thead>
<tr>
<th>Interest and amortisation</th>
<th>2,600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>25,000</td>
</tr>
<tr>
<td>Available for wages</td>
<td>11,325</td>
</tr>
<tr>
<td></td>
<td>38,925</td>
</tr>
</tbody>
</table>

The wage is then 1,132, that is, there has been a reduction of 43.6 per cent.

Here the reduction in wages is much larger, both because marginal productivity is now taken as the basis for their determination and because, even with greater elasticity of demand, it

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1 If this method of computation is applied, the entrepreneur does not compare the new total profit with the old (as in note on page 103); he is supposed to compare the changes in output due to the change in the number of workers.
is assumed that a fall in prices will result from the increased output. This second feature is due to the unequal distribution of the unemployed over the different branches of production. (An increase in the quantity of money is also assumed to accompany the increase in production if prices remain unchanged; whereas if the elasticity of demand is equal to 1 or 2 the quantity of money is assumed to remain constant.)

(d) Repercussions on other Industries

It might be thought that if elasticity is greater than 1 there would be a switch over of purchasing power to our industry, which would restrict the demand for other products and therefore reduce employment in other industries, so that the final result would be more unfavourable than is here assumed. But this relative shrinkage in the production of other goods when the elasticity of demand for a specified product is greater than 1 will not invariably occur. If the elasticity of demand is equal to 2, for instance, and the consumption of our product accounts for 5 per cent. of the total expenditure of the community, and if the price then falls by 10 per cent. with the result that consumption rises to a proportion of 5.4 per cent. of the community's income, only 94.6 per cent. of that income would appear to be available for all other expenditure. This would mean that the total purchasing power which can reach the market cannot be increased at all. This is not the case, however. It must not be forgotten that the purchasing power which is transferred to the producers of these goods and to the workers they employ has increased from 5 to 5.4 per cent. of the community's income, i.e. by 8 per cent. This purchasing power comes on the market and makes good the diminution of purchasing power on the part of displaced workers. Hence, although the consumers of the products of our industry may have to restrict their consumption of other commodities because of the extra amount they have spent on the former, this shifting of demand is nevertheless accompanied by an increase in production which is also expressed in terms of money and thus creates additional purchasing power on the market, provided that the velocity of circulation and/or quantity of credit money rises to a corresponding extent. And this means that the increased demand for workers in our industry will not be accompanied by a lower rate of employment in industry in general. We have here an
example of the shifting of wants which may lead to industrial growth (see above, Chapter I, page 39).

Thus, general conditions are more favourable to the effects of a reduction in wages when the elasticity of demand is greater than 1 and when, owing to a speeding up of the velocity of circulation, or an increase in the quantity of money, there is a rise in general purchasing power. This example then shows, that an additional number of workers may be absorbed under the conditions assumed. Here the workers' total income may even increase. If however the unemployed are workers, formerly employed but now displaced, say by technical progress, the new total income of the workers' class, compared with their former income will necessarily be smaller. This case is dealt with on page 204.

(e) How Works a Monopoly of Labour?

A paradoxical situation arises if labour is controlled by an organised or tacit monopoly which enables the workers to insist that profits shall not increase. It follows from our previous premises (pp. 102-103) that the less the new workers then add to the total output, the higher the wage will be. Suppose, for instance, that the number of workers increases by 33 per cent. and output only by 5 per cent. At the old rates costs will then be 198,437. The 105 units of which output now consists will be sold for the same total sum as before, i.e. 173,000, which, if the previous figures hold good for the other costs, will make available a sum of 63,213 for the wages of 40 workers. In this firm, therefore, the wage per worker will fall by 31 per cent. Consequently, 33 per cent. more workers can be employed at a wage 31 per cent. lower than before, whereas in our previous example the reduction in wages was 56 per cent. (p. 103). The explanation is that the cost of raw materials does not rise as steeply as in the previous example, so that with elasticity equal to 1 the share available for wages to all the workers may even increase slightly.

A still more curious feature is that, given the same premises, the number of workers can be raised from 30 to 40 with practically no change in the wage bill, if these extra workers add nothing at all to the total output. In this case it will be possible to pay a wage of 1,500 per worker — that is to say, wages will fall by 25 per cent. and the number of workers employed will rise by 33 per cent. Here, therefore, it is merely a case of spread-
ing the previous sum available for wages over a larger number of workers, just as when hours of work are reduced in order to enable more workers to be employed.

All these examples, however, are based on the monopoly wage of labour leaving profits unchanged and not on marginal productivity. They therefore imply strong organisation among the workers or spontaneous common action as though such organisation existed. On the basis of marginal productivity a rise of 5 per cent. in output due to the engagement of the extra 10 workers, with elasticity equal to 1, would, under our previous assumptions, cause wages to fall to 259; whereas if output remained unchanged the marginal-productivity wage would fall to zero. Assuming that the facts do not exactly correspond to either of these hypotheses, namely, free competition or organisation, the actual wage will lie somewhere between the marginal productivity and the monopoly wage.

(f) Increasing Labour Supply in Individual Firms with fully Utilised Capacity

There remains to consider the case of individual firms which are working to full capacity and are totally unable to engage additional workers. Such firms will benefit by the reduction in wages applying to the whole industry without increasing their own output; but their profits will not increase by the amount of the fall in wages unless prices remain unchanged. If prices are reduced, the increase in their profits will be determined by the difference between total savings in wages on the one hand and total reduction in receipts on the other hand; as prices will drop less than wages, profits will increase.

(g) Special Cases

If, as in the examples examined on page 107, the reduction in wages in the industry concerned is as small as it can possibly be under the given conditions — that is, if labour is controlled by a monopoly — profits will neither rise nor fall, and accordingly no fund will be formed which will permit of the permanent employment of more workers. In this case therefore the reduction in wages will be permanent unless more capital is formed from other sources. In practice, however, the problem seldom arises in exactly the form postulated in our first example (page 97), for it is very seldom that a given number of workers accruing to the
labour supply have to be reabsorbed in the same enterprise. The process is different where a whole industry is concerned. In this case immigration, or an unusually large influx of young workers on the labour market, may lead to a sudden surplus of labour seeking employment which has to be absorbed by the industry. As a rule, however, a certain proportion of the unemployed are disposed of by being distributed over different industries. In this case, of course, wages need not fall so far even if returns are diminishing. But supposing that unemployment arises simultaneously in several industries, owing to a sudden rush for employment following a change in the mode of life of the population, the fall in wages is bound to be a very steep one under the operation of the law of diminishing return.

The same conclusions are reached if the examples above are varied in a specified direction. Equilibrium theory assumes that a fall in wages will involve a change in organic structure. In the foregoing examples this organic structure has indeed also been supposed to vary to a certain extent, in so far as it is assumed that when the number of workers increases while the quantity of capital remains constant; but this can also be interpreted as a fuller utilisation of capacity. We will now consider how a really substantial change in organic structure will affect costs. Suppose, for instance, that fixed capital falls from 60,000 to 30,000. What will be the effect on output of this reduction in capital? Suppose that the permanently invested capital falls from 60,000 to 30,000, and that with a much higher labour-capital ratio 60 workers are now employed instead of 30 (the amount of fixed capital per worker thus falling from 2,000 to 500), and suppose further that output can be expanded by 50 per cent. — all these assumptions being highly favourable to the efficiency of labour — then if prices remain unchanged the following result will be obtained (some of the 30,000 which is no longer invested is now used as extra working capital).

Total capital will now consist of 30,000 fixed capital and 62,000 circulating capital (velocity of circulation = 4).

1 It is assumed, as before, that the production of raw materials, etc., can be expanded to the extent required by the increase in output without fresh investment and with the same costs as before.
The wage per worker is now 1,666, and the reduction in wages 16 per cent., always assuming that labour can obtain monopoly wages and that the cost of amortisation and price of raw materials and product are unchanged. But this assumption does not accord with the facts, as will be shown below.

(h) *Competition between Capital-Intensive and Labour-Intensive Firms*

In assuming as a general rule that wage reductions lead to a less capitalistic system of production it is frequently forgotten that the reduction of wages will also affect the older undertakings, in which capital is the more important factor, in the form of a lowering of costs. It is only by comparing the reduction in costs in these two groups of firms that we can determine how far wage reductions really encourage the change-over to more labour-intensive methods. A few further examples will be given to illustrate this point. But if the wage cut does not bring about a decisive reduction in the costs of the labour-intensive firms as compared with those of the capital-intensive ones, the organic structure of industry in a given country or industry will hardly be affected by a lowering of the wage level, unless the capital-intensive undertakings are not working to full capacity. And if the technically superior firms are working to full capacity, they will still maintain their superiority even after a very steep fall in the wage level.

In order to prove this thesis, the effect of wage reductions on costs must be compared as between labour-intensive and capital-intensive firms. We will take a set of circumstances in which a reduction in wages is most likely to be effective. Suppose that the share distributed in wages is 33 per cent. in the capital-intensive firm and 58.4 per cent. in the labour-intensive firm, that 20 per cent. yearly goes in interest and amortisation on capital, and that the cost account of the two firms is as follows:

```
<table>
<thead>
<tr>
<th>Cost of raw materials</th>
<th>150,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>100,000</td>
</tr>
<tr>
<td>6 per cent. of total capital (30,000 + 62,500 = 92,500) instead of 100,000 as before)</td>
<td>5,550</td>
</tr>
<tr>
<td>10 per cent. amortisation on fixed capital</td>
<td>3,000</td>
</tr>
<tr>
<td>Total cost</td>
<td>258,550</td>
</tr>
</tbody>
</table>

150 units at 1,730 | 259,500 |
```
It is clear that with the high wage of 2,000 the capital-intensive firm has the advantage.

But now suppose that wages fall, and consider how this affects the competitive position of the labour-intensive firms. In order that unit costs in firm B can fall below those in firm A, costs for the 50 units of firm B must be reduced from 3,433 to 3,000; in other words, wages must be reduced from 2,000 to 1,577, or by 21 per cent. But if this 21 per cent. fall in wages takes place, it will also apply to firm A, so that the latter's unit costs will be reduced to 56. In order that firm B may be able to remain in competition, its costs must now also be brought down to 56 per unit, which implies a further reduction in wages to 1,380. But with wages at 1,380 the unit costs in firm A will fall again to 54. Not until wages are reduced to 1,200, i.e. by 40 per cent., will unit costs in firms A and B be practically equal at about 52. Thus, although the original difference in costs was only 13 per cent., a wage cut of 40 per cent. is necessary to eliminate it.

1 A still more drastic result is obtained if the example on page 100 is taken as a basis. The application of the wage reduction (example on page 110) to the capital-intensive firm reduces the latter's costs (including amortisation and interest at the former rates) to 1,630 per unit. To maintain its competitive position the labour-intensive firm must reduce its wages to 1,433 or by 30 per cent. But, if the capital-intensive firm also pays this wage, its unit costs will fall to 1,560, so that in order to be able to produce at the same cost the labour-intensive firm must cut down its wages to 1,250. Thus under the law of competition one reduction in price involves another. These considerations also help to show how much truth lies in the theory that economic laws will automatically operate to fix a wage at which all the workers can be employed. Here the unwillingness of workers to accept wage cuts of this order will undoubtedly put a stop to any further fall in prices and wages. But in that case the capital-intensive firms will remain superior to the others and some of the workers will be unable to find employment. If they nevertheless succeed in forcing their way into production, the result will be very high extra profits, which may soon cause wages to rise again by creating new openings for employment. Thus, under the free play of economic forces, fluctuations in wages would be very great indeed.

The position is different if the reduction in wages is confined to the labour-intensive undertakings. The workers in these undertakings are-
The reason why in practice much smaller reductions in wages than these are often effective, and that sometimes it is not even necessary to reduce wages in order to make the older labour-intensive firms profitable again, is that the capital-intensive firms are not working to their full capacity. If, for instance, firm A (page 111) is working up to 75 per cent. of its capacity, its unit costs will rise to 70. If the utilisation of capacity then falls to 60 per cent., unit costs will rise to 80 and firm B will automatically become able to compete again even without a reduction in wages.

Even assuming that firm B is also unable to make full use of its plant, its relative position will still be improved because costs will rise more sharply in firm A. With 75 per cent. of capacity in use, costs in firm A will rise from 60 to 70 and in firm B from 68.4 to 74.4, and if only 60 per cent of capacity is used costs in firm A will rise to 80 and in firm B to 80.6. If wages are now reduced by 20 per cent., costs in firm A will fall from 80 to 78 and in firm B from 80.6 to 76.6. This in itself gives an appreciable advantage to firm B. Moreover, as the capital-intensive firms usually employ more borrowed capital and are therefore obliged to provide the interest on it in any case, the labour-intensive firm will increase its lead if it is able temporarily to omit the item of interest on capital from its cost account.

It follows from this that it is not only lower capital equipment and freedom from the burden of high fixed costs which give the labour-intensive undertakings an advantage over the others, and particularly in the event of wage reductions, but also the fact that plant is being used below its full capacity. The part played by variations in the capital-labour ratio in determining costs is discussed in *Kosten und Kostenrechnung* by Dr. Konrad Mellerowitch, whose examples afford a good illustration of our present line of argument. He quotes the cost accounts of actual firms, which show that plant is often a heavier charge on small firms than on big ones. This may be due to special circum-

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*often prepared to make sacrifices in order that production may be set going again, while the capital-intensive undertakings do not reap the benefits of a reduction in wages. Moreover, labour-intensive undertakings (e.g. handicrafts) may sometimes be given the preference in distributing orders although the capital-intensive ones could fill them at the same or even at lower prices, especially if the wage reduction applied to them also.*
stances; but wherever it is the case the profitability of small firms can obviously not be restored by wage reductions.

This writer also gives special data for the automobile industry. The production of passenger cars in medium-sized undertakings, for instance, is 81 per cent. dearer than in mass production. In the case of motor-vans production is 20 per cent. dearer in medium-sized undertakings and 61 per cent. dearer in small undertakings than in mass production. These percentages are too big to be bridged by wage reductions. If we take a relatively small difference of 27 per cent., for example, assuming that the share of wages is 25 per cent. in mass-production firms and 50 per cent. in medium-sized firms, the following result is obtained:

<table>
<thead>
<tr>
<th></th>
<th>Mass-production firms</th>
<th>Medium-sized firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs</td>
<td>100</td>
<td>127</td>
</tr>
<tr>
<td>Share of wages</td>
<td>25</td>
<td>64</td>
</tr>
<tr>
<td>25 per cent.</td>
<td>50 per cent.</td>
<td></td>
</tr>
</tbody>
</table>

A reduction of 50 per cent. in wages would bring costs down to 95. But even this would not enable the medium-sized undertaking to compete because costs in the bigger firm would also fall to 87½.

In the example given the respective costs of the two types of firm would not be balanced until wages had been reduced by 61 per cent. — that is to say, to 39 per cent. of their former amount.

In this case too it can, of course, be shown that the competitive position of the medium-sized firm would be improved if the big firm were not working to full capacity.

The fact that wage reductions may stimulate less capitalistic methods of production also has a subsidiary effect which calls for mention here. If handicrafts, for instance, again become profitable, the average efficiency of labour will diminish. If at the same time the development of the capital-intensive firms is restricted or retarded, there need be no expansion at all in production, and in this case the total product will not be increased. This is the same result as would be obtained if hours of work were reduced; work is spread over a larger number of workers without increasing the social product so that the per capita return is bound to fall proportionately as employment rises. The working hours, or in other words the burden of work for the indivi-
dual worker does not decrease, as the work is now done in shops with less capital. It is clear, therefore, that if firms are not using their capacity to the full, the change-over to less capitalistic forms of production can only have disadvantages.

A further drawback is that still more of the capacity of the capital-intensive firms will remain unused with the result that their profits will decline. The revival of old-fashioned methods of production therefore seems to be inadvisable both on economic and on social grounds.

Whether it is possible to employ additional workers in production by lowering wages thus depends on the probable output of the extra workers and the elasticity of demand for the product. The smaller the likelihood that the efficiency of the additional workers will diminish (i.e. the lower the cost of producing a larger quantity of goods) and the greater the elasticity of demand, the easier it will be for the firms to absorb additional workers without any considerable fall in wages if production expands harmoniously. But it must be remembered that wages will not be able to fall without limit, because in every country there is a standard of wages below which workers will not accept employment, even at the risk of remaining out of work. This standard is determined by historical and social factors. Not only the worker's refusal to accept employment below a certain standard but his apprehension that the reduced wage will tend to become permanent, and above all his fear of incurring the enmity of his fellow-workers, will prevent wages from falling below a certain level. Hence, in spite of lasting unemployment the market will be unable to reabsorb more than a certain fraction of the unemployed by wage reductions. This position may also arise in static theory, which also assumes that not all the workers will be able to find employment if marginal productivity falls below the subsistence standard. If we substitute the idea of a social minimum standard of subsistence for a physical one we shall not be very far from the truth. It is true that static theory assumes that the superfluous workers will die off and disappear and will thus be permanently eliminated, whereas in our humaner practice society carries them along with it as a dead weight and they remain on the labour market as a living argument against the optimistic concept of a natural equilibrium.
Certain other conditions must be mentioned which are not only important factors in the process of expansion but are also necessary to enable wage reductions to lead to increased employment.

**Distribution of Income as affecting the Results of Wage Cuts**

In the first place, the ratio of the workers' average income to that of the other sections of the community must be lowered. If all or most incomes fall, as occurs in a protracted and severe depression, and if the fixed incomes of public servants, rentiers, etc., are also drawn into the downward movement, total purchasing power in terms of money will be reduced, even if the total purchasing power of the workers as a class does not diminish. This, however, will restrict the elasticity of demand, and the reduction of wages will not be able to produce its full effect of making the price-cost ratio more favourable. Even so, relatively more workers will be able to find employment if wages are low than if they are high. But, under these circumstances, protracted unemployment will continue unless nominal wages are very drastically reduced (the possibility of a rise in the value of money cannot be discussed in detail here).

Let us assume that the income of the workers stands to that of non-workers roughly in a ratio of 60 to 40, and that a 10 per cent. reduction in wages throughout the economy would involve a 10 per cent. fall in prices (assuming that capital values are adjusted to the altered costs) and the employment of an additional 10 per cent. of the former number of workers. Provided that there were no change in habits of consumption, the workers would then consume 66 per cent. of the previous output and the other classes 44 per cent., making a total of 110, which exactly corresponds to the increase in output. But if the income of the other classes were also to fall by 10 per cent., a 10 per cent. fall in prices would only enable them to consume the same quantity of manufactured goods as before, i.e. 40 per cent. Thus only 106 units would be consumed instead of 110 and 4 per cent. of the workers would remain unemployed in spite of the 10 per cent. fall in wages. In other words, a 10 per cent. fall in wages would leave 4 per cent. of unemployment in existence because the income of the other consumers was reduced without any increase in their numbers. Moreover, this calculation entirely leaves out
of account the fact that the unemployment produced in this way still further restricts the workers' consumption, thus creating a secondary wave of unemployment. According to this reasoning, therefore, a uniform lowering of all incomes would lead to further reductions in wages 1.

It may be argued that the fall in "other" incomes, e.g. the incomes of public servants, merely represents a change in distribution and therefore has no effect on total purchasing power. The salaries of public servants are paid out of taxation and a reduction in these salaries therefore means that more income is left in the hands of the taxpayers. Similarly, a reduction in the salaries of employees is equivalent to an increase in profits, and an increase in profits may directly or indirectly increase consumption and thus lead to the reintegration of the unemployed.

But the argument relating to the maintenance of purchasing power, according to which a fall in the purchasing power of one class implies a corresponding increase in the purchasing power of other classes, is not always applicable. A distinction has to be made between a partial and a universal reduction of income. In the former case a transfer of purchasing power may take place, particularly in the course of normal development — that is to say, within a dynamic system. But even in this case the extra profits made by the entrepreneurs will not necessarily come on the market in the form of purchasing power. They may, for instance, be used to pay off loans from the banks, and if the banks are unable or unwilling to lend out the money again (for instance, if they wish to improve their liquidity) there will be an absolute shrinkage in total purchasing power. If, on the other hand, income is merely transferred from one class to another and used as purchasing power in any case, it would seem that there need be no fall in the total active income 2.

1 In this connection, cf. my own study: Wirkungen des Lohnabbaus.
2 The position differs according as the elasticity of the demand for the product concerned is greater or less than unity. If it is less than unity, the velocity of circulation and total purchasing power will fall; if it is greater than unity they may even rise. These variations in the effects of price and wage reductions, which at first sight do not seem very plausible, belong to the group of problems relating to variations in the velocity of circulation which have been repeatedly referred to in the course of this study. The maintenance of total nominal purchasing power is admittedly impossible if all incomes fall. If, for instance, all incomes from wages and salaries are reduced under a systematic scheme of deflationary policy, and if prices also fall so that the saving in wage costs cannot be transformed into an increase in profits, we are obviously confronted — if the reductions
The effect of a reduction in wages, whether it takes the form of a fall in prices or of a rise in profits, also depends on the effect of a change in the labour-capital ratio in the industry concerned. In the long run, and with normal profits, the effects of a general reduction of wages are more or less similar for all branches of production but they may involve a considerable time lag. If the reduction in wages brings about a fall in prices, this will apply soonest to consumers' goods, and its advantages can even be anticipated in this branch of production. But even in the consumers' goods industries the reduction in wages will affect only a fraction of total output, large though this may be, and not always to an equal extent. In the case of capital goods it can only take effect as new capital goods are created. The existing means of production will stand in the firms' books at their cost price, and this error can only be corrected by writing down capital. Hence the larger the direct share of wages in the product, the quicker will the effects of a reduction in wages appear. If these effects do not appear, profits will increase and, if competition is free, new capital will flow into the industry, production will increase and prices will eventually decrease. In any case, however, the fall in prices will be proportionately smaller than that in wages because, owing to the fact that capital goods also play a part in production, wages represent only a fraction of total costs. It is only if the reduction in wages is absolutely general that the fall in prices can correspond at all closely to the fall in wages, and even then the equivalent adjustment in the rates of interest and amortisation will take some considerable time.

in wages, salaries and prices correspond exactly to each other — with an increase in the value of money which leaves the former position unchanged, and which accordingly cannot bring about the re-engagement of unemployed workers. In other words, a lowering of the whole price level and income level has taken place without producing any other change at all. At the most the saving in wages might lead to a surplus of working capital, and so enable additional workers to be engaged; but if all incomes are reduced this is hardly to be expected. Conversely, if the lowering of the price level were able to increase employment, output and sales, the same result could have been achieved at the old price level, given the necessary monetary conditions. Hence a reduction in wages accompanied by a corresponding reduction in prices will only bring about a frictionless expansion of production if the nominal purchasing power of the market remains unchanged and the latter can therefore react immediately to a fall in prices by an increase in demand.
Special Influence of Wage Cuts on Housing

Yet another point arises in this connection. The wage level does not only affect investment — and hence the relative proportions in which capital and labour are used in industry as a whole — but also the distribution of savings over the various fields of investment. Savings are not used solely to finance manufacturing firms, but also to produce durable consumption goods, especially houses. If the rate of interest does not rise — and under our assumptions there is no reason why it should do so — the cost of building houses will fall more quickly than other costs because the proportion of labour to other factors used in this industry is especially high. Hence house building will obtain a start on the other branches of production if a wage reduction takes place, and as it represents a very high proportion of total production this feature will be of considerable importance. So far as the labour market is concerned, it is immaterial in what branch the demand for extra labour first arises, but it is important for subsequent developments that this additional demand should lead to a permanent expansion of production. In the case of an extension of building this is, of course, not the case, apart from the increased need for repairs which is a factor common to all investments. House building will therefore only temporarily increase the openings for employment. In so far as a wage reduction in the building industry leads to a reduction in rents, it may also slightly raise the level of real wages.

Special Influence of Wage Cuts on the Psychology of Consumers

Lastly, we must also consider the effects of wage reductions from the standpoint of the distribution of the social product. We have already seen that under the law of diminishing return a reduction in wages will frequently involve a decline in the total income of the workers. A fall in money incomes is to be expected as an inevitable result of a reduction in wages if elasticity is not

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1 It may also be assumed that under the free play of competition wages in the building industry will fall rapidly because this industry will be the first to be affected by cyclical depressions on the labour market. On the other hand, however, the close organisation of labour in the building industry, which is a sheltered industry, will tend to prevent rapid wage cuts.
much greater than 1, even if the firms are not working to full capacity. But prices will also fall, and in so far as they do so there will again be a slight rise in the real income of the individual worker as contrasted with the decline in his nominal income. The fall in prices will not, however, go as far as the fall in wages because wages represent only a fraction of total costs and the marginal productivity of labour diminishes as the number of workers increases. Moreover, the fall in prices will benefit the actual workers whose wages were reduced only to a limited extent. As they are never applied simultaneously to all industries, and indeed as a rule never become general at all, wage reductions accompanied by price reductions also represent a redistribution of the income of labour which may give rise to a lengthy process of readjustment. The workers who were not affected by the wage reductions may, for instance, benefit by an increase in their purchasing power. These theoretical examples cannot, of course, exhaust all the possible combinations of facts, which also depend on the mood of the consumers. As the reactions of the consumers to price reductions cannot be forecast with any certainty because they can transfer their demand to another field at any moment, the demand curve is not known. Such a shifting of demand will occur if the consumers are expecting a further drop in prices and therefore buy still less than when prices are rising, or if, as a result of the bad state of business and the fear of a coming reduction in their incomes, they restrict all their expenditure and buy less of everything than before in order to put something by. This will apply to the groups of consumers who are threatened with a reduction in their money incomes (e.g. reduction of public servants' salaries, decline in landlords' rents, etc.). All these reactions represent shifts in the demand curves which in fact cannot be carried over unchanged from the period prior to the wage reductions and unemployment to the subsequent period, as the ceteris paribus formula implies. Both unemployment and, still more, wage reductions have an unfavourable moral effect on the general situation which cancels some of the potentially favourable effects of a reduction in wages and prevents that rise in the volume of employment which might otherwise have been expected.
Wage Cuts and Personal Services

Finally, two more possible ways of doing away with a sudden access of unemployment without interfering with the structure of production must also be discussed.

In the first place, the unemployed may be diverted into the field of personal services. The characteristic feature of this branch of employment is that it requires no fixed capital. Supposing that the elasticity of demand for personal services is equal to 1, the unemployed workers can obtain work as well as those formerly employed in the branch for the same total sum without any disturbance of equilibrium. There may perhaps be some shifting of consumption, but even this is not likely to take place on any considerable scale because the unemployed were being maintained before and the sums spent on their maintenance are now saved and can be applied to other productive uses. Equilibrium can therefore be restored by transferring the income of a given group of persons to the unemployed without involving any change in the sphere of production.

If the elasticity of demand for personal services is equal to 2, for instance, a reduction of 3 per cent. in the remuneration of workers in this branch would lead to a 6 per cent. increase in demand. There would now be a demand for 106 units instead of 100, and these would be sold for 103. The income of the persons formerly employed in the personal services would consequently fall from 100 to 97, while the consumers of personal services would now transfer 3 more units of their total purchasing power to the new workers offering their services. Provided that these 3 extra units also come on to the market, this would involve a change in the distribution of production but no fall in total demand. In this case, therefore, the total income of the community will rise in consequence of the fact that the supply of and demand for personal services has increased by 6 per cent. The greater the elasticity of demand for personal services, the larger the decline in unemployment. It is true that this increase in employment capacity and the transfer of the unemployed to the personal services can only take place without a decrease in the demand for consumers' goods if there is a slight rise in the velocity of circulation of money, but this does not create any practical
difficulties. This process is identical with that of the shifts in the scale of wants described in an earlier chapter (p. 39).

Real Wage Cuts and Commerce

As a rule, however, there will be no such increase in the demand for personal services; the unemployed are much more likely to be absorbed by commerce. In this case the personal services are not expanded, but the employment they provide is simply spread over a larger number of workers. The real income of the community is not increased, nor is a larger share of the social product applied to the remuneration of personal services in commerce; all that happens is that the income of the commerce sector, while remaining constant, is now spread over a larger number of persons. This relative decline in income in the sector of commerce will not divert labour into the sector of production because the latter’s employment capacity is already saturated. The case is essentially the same as when the same amount of employment in production is spread over more workers (short time). The latter occurs very frequently in practice, especially in connection with seasonal unemployment.

Summary

Reviewing the possibilities of absorbing the unemployed — who are here considered as accruing to the labour market — by means of wage reductions under the law of diminishing return, it is clear that such possibilities do exist, but that they demand very heavy sacrifices from some sections of the workers even if unemployment itself is only slight. They imply a return to less efficient, i.e. obsolete forms of production, or, where this is possible, to less capitalistic methods in existing firms. The lower efficiency resulting from these obsolete methods will then tend to become the basis on which wages are fixed in all firms. If the reduction in wages is accompanied by a fall in prices, favourable effects may result, but only provided that the circumstances themselves are favourable. If the wage reduction is not accompanied by a fall in prices, it becomes impossible to find a market for the additional output. The only exceptions will occur if there is an increase in the output of one firm only, which under the system of free competition cannot influence prices; and if part
of production is carried on by less efficient manual methods, so that in spite of the increase in the number of workers output does not expand. In practice, the actual course of events — e.g. whether or not there is a change over to less highly capitalised firms, what saving on interest it will involve, and to what extent it will be possible — depends on circumstances. From the standpoint of a national economy this method of solving the problem of unemployment is only inevitable if returns in the industry concerned are really diminishing — that is, if the fall in returns is not due to the disproportionate expansion of the different branches of production, but is actually attributable to the fact that capital is lacking to promote the expansion of production by improved methods; and if, further, it is also impossible to extend production in existing firms because they are already using their plant to its full capacity. In these circumstances the return to less efficient methods of production is clearly an emergency measure running directly counter to the dynamic process, in which capital increases faster than the population. It is not a stage on the road to swifter progress, but a setback which must be overcome as quickly as possible if a higher level of economic development is to be attained.

B. Decreasing Return under Monopoly and Cartels

We now have to consider whether a sudden access of unemployment, given the law of increasing cost and monopoly conditions, can be done away with by wage reductions which will bring about an expansion of production even under a monopoly. If unemployment occurs, the effect of diminishing returns, assuming free competition on the labour market, will be to cause wages to fall because the efficiency of the newly engaged workers is reduced.

If the greater output is to be sold, prices must fall, which will depress the wage below the level at which it would be fixed if prices remained unchanged. Now it will depend upon the relation of the decrease in wages and thus in average costs to the decrease in prices due to the increasing quantity of output whether the new and greater production causes the profits to rise. The point at which profits will be maximised will decide how many workers can be absorbed at the lower wages. The monopo-
list is then in the same position as any other producer with decreasing unit costs.

If for any reason costs are lowered, e.g. as a result of a reduction in an existing tax on turnover, the volume of output in the monopoly industry will rise. For if unit costs fall by the same amount irrespective of the number of units produced, the increase in profits will be relatively larger in the case of a larger output, because the bigger the output, the smaller the share of overheads in total costs. Hence it will be to the firms' advantage to expand their output, provided, of course, that the reduction in prices necessary to permit of the marketing of the increased output does not entirely cancel out the prospects of profit resulting from the lowered costs.

The monopolistic industry will then engage as many workers as are necessary to expand production to the point where its sale will produce a new and higher maximum profit now that unit costs have been reduced. This point may very possibly be reached before all the unemployed have been reabsorbed. If this happens some of the unemployed will be squeezed out of the industry and will be unable to find employment in any of the monopoly firms. The only possibility open to them will be to transfer to other industries, which may not always be easy where skilled or long-settled workers are concerned.

Something must also be said of the situation under a cartel system. A cartel often covers firms which are already operating under the law of diminishing returns (e.g. in coal mining). What would be the effects of a reduction in wages in this case? The fact that prices are fixed by a cartel shows that under free competition they would be lower. But price-fixing is only one item in the functions of a cartel. From the standpoint of the individual firm a more important feature is the quota allotted to it, or its share in total output. This is usually fixed on the basis of the capacity of the individual firm, as calculated by an agreed method, in proportion to total output as estimated by the cartel. The fact that there is usually a good deal of quarrelling over the fixing of the quotas points to the conclusion that the quota allotted to each firm does not always enable it to work to full capacity.

As a result of the difference in the costs of production in

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1 Cf. MARSHALL, op. cit., p. 482 and footnote to p. 483.
different mines, it may happen that the transfer of quotas from a mine with high costs to one with low costs is advantageous to both. Sometimes indeed a company only claims the right to a quota for the purpose of farming it out. Now it may happen that as a result of a wage reduction an improvement takes place in the competitive position of such a company, thus causing it to produce its quota itself. As a rule it will have to employ more workers to produce the same amount of coal than the more efficient firms which had previously bought the quotas, first, because it is obliged to increase its costs for non-extractive services, whereas the other firms cannot reduce theirs; secondly, because its transport costs will be higher than those of other firms; and, thirdly, because its labour will probably be less efficient. If a reduction in wages were to have this effect therefore the volume of employment would in fact be increased without increasing the volume of production, and accordingly there would be no change in prices but profits would simply be transformed into wages. In such cases the wage reduction will not lead to a general expansion of production, but to some increase in the demand for labour. How far this increase in the number of workers employed (the quantity of money remaining unchanged) will involve a decline in employment elsewhere in the economy depends on whether the transformation of profits into wages which here takes place is accompanied by an increase in the velocity of circulation, or whether the newly engaged unemployed can fill the gaps in demand created by the decline in profits without delay — a process of which the increase in the velocity of circulation is the monetary expression. Where this proves possible, the circulation of money and employment are expanded without an accompanying shrinkage in another part of the economy.

Suppose now that as a result of unemployment a wage reduction takes place, bringing with it a lowering of costs in all the undertakings which previously supplied coal. The first result of this will be a rise in the profits of all undertakings, although it will be proportionately smaller in the good, i.e. the more highly capitalised, mines than in the bad ones. The position will differ according to whether an increase in sales can

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1 This is not very probable because the reduction in wages will also benefit the firm with the lower costs. Cf. supra, pp. 110 et seq.
be expected as a result of the fall in prices following the wage reduction or not. The demand for coal for industrial purposes, for instance, will not respond readily to considerable variation in price: But this may not be true of household coal, and a fall in prices may also enable exports to be expanded. In the case of export coal the quantity marketed will obviously expand much more quickly as a result of a fall in prices than the demand on the home market. If such an increase in total sales takes place, any extra profits made will be relatively smaller in the capital-intensive mines than in the labour-intensive mines. As a result, where the rules of the cartel and, in particular, the relative strength of the members allow, the good undertakings will demand and probably obtain a larger quota. But in this case the extension of production will not be reflected in a correspondingly larger demand for labour.

Where the wage reductions do not lead directly to an increased demand for labour, they will do so indirectly only by increasing profits, and so involving investment in other economic branches with a consequent increase in the demand for labour. Theoretically therefore, if this investment really takes place, employment will be extended by the heightened demand for labour for the production of capital goods. The ultimate effects will depend on the extent to which the new investments provide lasting employment for the extra workers.

C. INCREASING RETURN IN A COMPETITIVE MARKET

The Situation of Diminishing Costs described

Let us now consider how sudden unemployment will affect a dynamic system in which production is carried on under free competition and with increasing returns.

Though many economists believe that such a case is impossible, it is much more commonly found in practice than that of diminishing returns, particularly in the modern industrial system but even in agriculture as well. A few preliminary assumptions are necessary before embarking on a study of the question.

A country's production is ruled by the law of increasing returns if it has reserves of productive capacity the full use of which would increase the efficiency of its total production. We will therefore assume that unused capacity exists in all or most
industries, or at least in a sufficient number of firms in each branch of industry to enable the workers accruing to the labour market to be engaged without reducing (physical) marginal productivity.

We deal with both cases, namely prime costs of additional production either decreasing or remaining equal; in both cases average costs will decrease, though slower in the latter case, due only to the spreading of overheads over a larger output.

We will also assume that in our system production is expanding harmoniously, so that a suitable proportion of the community's labour is applied to extending the system of production at all times. If this continues uninterruptedly, before the theoretical capacity of the existing undertakings is entirely used up, all firms will be operating with reserves in hand, except at the height of the boom, and production will be able to advance without fresh investment.

The whole system of production is assumed to be dynamic; that is to say, that not only are the data changing, but progress to more efficient methods through technical inventions, improved organisation, improved division of labour and better management, is the normal process. That implies their increasing returns within the economic process as a whole apart from single enterprises and their unused capacities.

In this dynamic system the limits of output in the individual firms are never reached. New possibilities of expanding production are constantly being explored and every firm tries persistently to improve its own position, so that equilibrium in the sense of a condition of rest is never attained. If the whole system is working under conditions of increasing return, i.e. if there is still a margin of unused capacity in every industry, all the factors of production should find employment. No unemployment could exist in a system of this kind. The expansion of output could only be brought to a standstill by the exhaustion of the available means of production. Nevertheless there are certain limits beyond which production will cease to expand even if all the factors of production have not yet been

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1 This condition of disequilibrium does not necessarily lead to a monopoly; cf. Allyn Young: "Increasing Returns and Economic Progress" in the Economic Journal, December 1928, pp. 531-534. Young deals mainly with increasing return due to internal and to a lesser degree to the external economies of an expanding system, i.e. of expanding markets.
employed. For instance, at all times the producer must keep prospective market conditions in view. If he thinks that the increased demand will not last he will sell from stock, if stocks are available; in this case the existence of reserves of stock will at least retard the utilisation of the firm's full capacity. But apart from such times of uncertainty, the disproportionate expansion of the various branches of production is the principal factor which prevents all the available factors of production from finding employment. If production expands unharmoniously the expansion of every branch will, from a certain point onwards, entail falling prices and therefore lower money returns, which has the same effect as diminishing physical returns with prices unchanged. Hence the fact that production is not expanding is not in itself a conclusive proof that it is no longer governed by the law of increasing return. The operation of increasing returns may even be assumed when the separate firms are actually working to different average costs. If there is unused capacity in all the firms in a given industry to enable as much additional output to be produced at lower costs as could be absorbed by a permanent expansion of the market, that industry can also be said to be working under the law of diminishing cost. In a severe depression this may be assumed to be the case in all industries.

**Optimum Output under Increasing Return**

What is the optimum output in a dynamic system of this kind operating with reserves and building up the reserves of the future in the course of its development? Clearly it is a volume of production which is not only the optimum output for current conditions, but is also designed to maintain this optimum in the more distant future if the producers' expectations are fulfilled. Hence in every firm and every industry production should be planned ahead for a fairly long period on the basis of definite forecasts.

Suppose now that in a system of this kind the number of workers seeking employment suddenly increases while the other factors of production, in particular capital equipment, remain

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1 Young (loc. cit., p. 537) also points out that in the planning of industrial undertakings potential demand has to be balanced against potential economies in costs. Cf. Piers Sraffa: "The Law of Returns under Competitive Conditions" in the *Economic Journal*, December 1926, p. 543.
unchanged or, if a long process is under observation, only expand at the normal tempo. (We are not here considering the gradual absorption of additional workers in the normal course of development.) This will lead to pressure on the labour market; more workers will offer their labour but will not be able to find a market for it under the current wages. If, however, wages were reduced, production could be expanded, and this expansion could not have taken place, in spite of the existence of constant or increasing returns, without a reduction in wages, if it were followed or expected to be followed by a reduction in prices. A wage reduction would very greatly increase the margin of profit because it would apply to all workers, whose remuneration would thus fall below the previous level. Here, however, the reduction in wages is not due to a decline in marginal productivity, but to the special conditions obtaining on the commodity market. Strictly speaking, if the whole of the industrial system expanded harmoniously, all the additional workers could be reabsorbed without friction and without a fall in wages by distributing them properly over all branches of production. But if the rate of growth is not uniform and if the unemployed are absorbed into unsuitable occupations it will be impossible to integrate the additional workers in the process of production without friction, although physical output is still rising.

Monetary Aspect of Increasing Return

It may be noted in parenthesis that this whole question of the expansion of production has also a monetary aspect, both as regards the whole economy and the separate industries, since means must be found to finance the expansion of production. We have tacitly assumed that no expansion of credit is necessary to finance the extra output, over and above the normal increase in the quantity of money. But if this is so, either prices must sink, or the firms must use some of the purchasing power which would otherwise be available to them for investment as working capital. This applies to the finished goods industries just as much as to the capital goods industries. As a result of a relative increase in working capital, investment both in the finished goods and in the capital goods industries will decline and the output of finished goods and capital goods will rise. But this prepares the way for a twofold disturbance. The finished goods industries will not
be able to absorb the additional means of production because they have turned some of their investment funds into working capital, and the capital goods industries, tempted by the fall in wages, will have enlarged their output and will thereby have come to another deadlock when this output comes into the market. A decline in employment may therefore be expected throughout the capital goods industries, because, taken as a whole, investments in the finished goods industries and output in the capital goods industries must decline to the same extent, whereas direct production in the finished goods industries is expanded by having recourse to the reserves of capital equipment. But as a result of this, investments in the finished goods industries soon become too small and those in the capital goods industries relatively too large, so that disproportionality develops which is further aggravated by the fact that the demand for finished goods by the workers employed in the capital goods industries also contracts. The decline in the output of capital goods means more unemployment. Thus an inelastic supply of money is a handicap, since unless the general price level is lowered equilibrium is bound to be upset. The supply of money must therefore be increased by an expansion of credit in order to raise the rate of employment without depressing prices. The same result could be produced by increasing the velocity of circulation. But it is difficult to see how this could be varied merely by the entrepreneurs' desire to produce a larger output.

Process of Adjustment under Decreasing Costs

To return now to our main line of argument: if, as a result of the reduction in wages, output increases at least proportionately with the increase in employment, through recourse, first, to the utilisation of unused capacity and secondly to the extra capital created by a simultaneous and proportionate expansion of credit, real incomes would not only soon return to their former level, but would rapidly rise above it, as a result of increasing returns. This development depends on the rapidity with which the necessary adjustment can be made, i.e. the lowering of prices (costs having already diminished as a result of the reduction in wages), and the rapid absorption of the necessary workers in the capital goods industries in order to provide the future equipment for a permanent growth in the economic system which will
maintain the right proportions between the different industries. (These will seldom remain unchanged.) The problem is therefore a problem of growth, in the course of which the more rapid and jerky increase in the number of workers as compared with the growth of capital is only temporary. The difficulty lies in the fact that, given our present premises, this process has to take place while prices are falling, a situation which is not in itself favourable to expansion. It is only by means of a suitable expansion of credit that the reduction in prices can be limited to the extent justified by the lowering of average costs involved by the operation of increasing returns. Their fall in costs will be small, because the increasing productivity of the additional workers will not have much effect on average costs.

The position thus differs fundamentally from that obtaining when diminishing returns operate, in the following respects:

(a) The *per capita* efficiency of labour does not diminish but increases. Hence the integration of the unemployed in the process of production depends on an immediate or ultimate fall in prices. This applies particularly when the supply of money remains unchanged.

(b) Even if the supply of money is enlarged in proportion to the newly employed factors of production, the price of the commodities now produced at a lower cost must still fall to some extent, in order to prevent a dangerous disturbance of equilibrium.

(c) Save in exceptional cases the question of a change-over to firms using less highly capitalised methods of production does not arise at all, and a reduction in real wages cannot accordingly be justified even partly on the ground of a declining physical return.

(d) If the process proceeds without friction, the overcrowding of the labour market will speed up the rate of development, and not check it as in the case of diminishing returns (e.g. immigration in rapidly expanding economic systems).

(e) If the increased supply of labour creates dislocation, this can only be because there has been a disproportionate development of the various factors, a situation which usually arises when

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1 The effect of the absorption of unemployed workers under increasing returns in raising efficiency and reducing prices is relatively small as compared with that of technical improvements.
prices do not fall simultaneously with the lowering of costs. The usual explanation of this phenomenon is that production has expanded too rapidly and has outstripped the capacities of the system of distribution. This is the same phenomenon expressed in different terms, for it is obviously impossible that the technical organisation of the distribution system should have lagged behind in our modern dynamic economies with their growing efficiency. What has not developed proportionately with the rest of the system is the purchasing power available to absorb the output of commodities. This is the situation that arises if prices do not fall sufficiently quickly.

If, owing to the fact that all the labour available is organised, wages do not fall and the surplus workers cannot be absorbed, equilibrium is upset and those engaged in production have no incentive of any kind to restore the unemployed to employment. Under certain circumstances it may even be to the advantage of the employed workers, at least temporarily, to support their unemployed comrades as a dead weight in order to prevent a lowering of wages. (This may also be to the interests of the trade unions when returns are diminishing.)

The absorption of unemployed workers can accordingly only take place if real wages rise rapidly to their former level, and even beyond it in the case of increasing returns. Only for a very short time, before the final product of the increased number of workers is available, can real wages fall without creating a disturbance; but the quicker the increasing returns appear, the shorter will this interval be if fairly large reserves of capital equipment and stocks of consumption goods are in hand. The synchronisation of all the stages of production, and in particular the utilisation of reserves of equipment and stocks, enables the output of commodities to be enlarged at least by an amount corresponding to the additional workers employed. Under the premises of the old theory that production was governed by the law of diminishing return and that all the means of production were fully employed, it was necessary to assume that a sudden increase in the supply of labour would inevitably be followed by a period of declining real wages. If we correct this assumption, it is clear that the number of workers employed can increase very con-

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1 This point has a much more important bearing on the question of technical progress than in the present connection.
siderably without any fall in real wages. Disturbances can only arise if maldistribution over the separate industries and stages of production and the rigidity of prices check development and a lasting contraction of output ensues. Given our present assumptions, the only useful purpose of a reduction in real wages is to tide over a brief interval. If it persists beyond this interval it will lead to serious disturbances when the law of increasing return applies.

D. INCREASING RETURN UNDER A MONOPOLY

If diminishing costs are operating in a monopoly industry and there is a sudden appreciable increase in the supply of labour, recourse may be had to a reduction of wages. This will increase profits, provided that the demand for the products of the industry is not simultaneously cut down by the reduction in wages. We may, however, neglect this secondary effect here. The characteristic feature of the market for goods produced under a monopoly is that a monopoly can choose the price-quantity relation which yields the largest profit.

Under the operation of diminishing cost the optimum output may be larger than that produced before the supply of labour was increased. Though with diminishing cost sales will begin to decline from a given point onwards too, it is quite possible that the economy in costs will more than counterbalance the contraction of the market. It is also possible that where diminishing costs operate equilibrium may be reached at several different points; i.e. profits with very high prices and a small output may be as high as with a larger output, because in the latter case, in spite of the lower prices, the fall in costs is a compensating factor, and may be as high or even higher in the case of mass production with very greatly reduced costs ¹. We will not pursue these questions further here, but merely note that owing to its command and knowledge of the market and its power of deciding

¹ On this point, cf. Marshall, op. cit., p. 806. The curves show that under free competition there are several points of equilibrium. This position may arise in the case of a monopoly. The choice of the optimum output depends on a thorough knowledge of the different forms of technical structure, of market conditions, and of current and prospective market conditions.
freely and with full knowledge of the circumstances on the tech­
nique to be adopted, a monopoly will be better able to transfer
its operations to a lower level of costs and prices than one operat­
ing under free competition. Even assuming that under free
competition too firms can react immediately to every opportunity
of reducing their costs, monopoly undertakings are still more
likely to make the change when it involves heavy investment
(and therefore a greater need for capital) and a very large expan­
sion of output, as in the case of mass production. Under free
competition with a large number of producing units it is by no
means certain that this lowering of costs would be carried out.¹

In this connection it is important to note that the discussion
in this field has been dominated far too long by the question of
primary production.

In fact, primary production, e.g. mining, operated under
the law of rising costs during the decisive years of industrial
progress, so that the effects of a monopoly in increasing prices or
restricting production have received undue prominence owing to
the inelasticity of the demand for these products. This restrictive
effect of monopolies will indeed always exist, but the argument
applies only in comparing the volume of output produced by the
same technical methods in both cases. The effects of an improve­
ment in technical methods are not confined to the home market
and home prices; they also tend to enlarge the export market
open to the product concerned over a wider field. This is particu­
larly true of new industries, such as the automobile, artificial silk
and wireless industries but it also applies to technical improve­
ments in the heavy industries. In these cases again it is diffi­
cult to distinguish the operation of diminishing costs in the true
sense of the term, i.e. the alteration in receipts when one of the
factors of production is varied while everything else remains
unchanged, from the dynamic process, in which the volume of
all the factors of production alters.

It is a clear case of diminishing cost when a monopoly is
able to expand its output without further investment. If this can
be done at a new point of equilibrium, leaving profits as high as

¹ The producers may fear that the competitors will follow suit quickly
and that the price will decrease with profits even smaller than before.
before, there need be no reduction in wages, because a fuller employment of capacity enables the same profit to be made from a larger output while wages remain unchanged. If, as a result of sudden unemployment, there is also a lowering of wages, the expansion of output will in all probability be facilitated.
CHAPTER V

EFFECTS OF TECHNICAL PROGRESS ON THE ECONOMIC SYSTEM IN GENERAL AND ON THE LABOUR AND CAPITAL MARKETS IN PARTICULAR

I. Various Effects of Technical Changes

The effects of technical progress may be classified as follows:

1. Inventions (page 22) lead to an expansion of the whole system of production and a parallel increase in the total purchasing power of the community, through the creation of money or a rise in the velocity of circulation. These effects cannot be regarded as disturbances but must be recognised as one of the fundamental forms of the growth of the industrial system.

2. Changes in technique which alter costs in existing industries, and therefore create competition with firms operating with older technical methods, fall into the following categories:

   A. The introduction of a new technique enabling output to be expanded by a change in organisation, an improved use of raw materials, a better distribution of work, etc. The existing firms will then be able to produce more goods than before without any rise in investment or in the number of workers employed; the latter may even decline. Economically speaking, this category includes all those cases in which efficiency is improved by changes in technical equipment not involving the investment of fresh capital, e.g. improvements financed out of the amortisation fund.

   B. Technical improvements which enable the same product to be produced at lower cost by one of the following methods: (a) Reduction of labour costs accompanied by a relatively smaller increase in capital costs.
(b) Reduction of capital costs with labour costs remaining unchanged.

(a) A reduction in labour costs is usually accompanied by a change in capital costs. It is true that even a minor improvement in equipment may sometimes bring about a reduction in labour costs. Examples of this are improvements to automatic looms, which reduce the amount of labour required by enabling each worker to attend to a larger number of machines; the speeding up of spindles so that fewer workers are needed to produce the same output; and the increase in the average speed of motor transport resulting from the improvement of roads and engines. Nevertheless, the most important forms of technical progress usually involve heavy investment. In all these cases there will be a reduction in the number of workers required, if output does not at first expand, or alternatively a very big increase in total output will be necessary to provide employment for the former number of workers. This is the type of technical improvement which especially concerns us here.

(b) Examples of this type are the introduction of more efficient methods in the production of capital goods and machinery and in building. If the cost of building a factory or transport undertaking or of working a pit is reduced as a result of mechanisation, the effect of technical progress in such cases is an economy of capital.

II. Effects of Technical Improvements

A. Technical Improvements which do not involve Capital Investments

Various Types of such Technical Improvements

Under this head we will discuss the effects of those technical improvements which permit of an expansion of output without any fresh investment. Improvements of this type are constantly being introduced, in the form of a better division of labour, more careful work in the production of raw materials, improvement of plant without any increase in costs, etc. If the technical improvements were carried out simultaneously in all fields of produc-
tion, every unit of product would involve a smaller expenditure of labour, and the efficiency of national labour in all its forms would increase without the necessity for any investment at all. To this group belong all cases in which the amortisation quotas are applied to the acquisition of more efficient machinery. Both the static and the dynamic theories recognise this type of technical improvement. In a static system they must lead to increased consumption, for otherwise an accumulation of capital would occur and the whole complicated mechanism of development will be set in motion. In a dynamic system they may lead to a greater or lesser degree of accumulation unless consumption increases conformably with the decrease in prices. If consumption does not expand correspondingly with the increase in efficiency, a displacement of labour will at first occur.

Far-reaching technical improvements of the kind just described are usually found in isolation. Let us take the case of an improvement in technique which enables some producers to produce a larger output with the same factors of production as before. This might occur in agriculture through a better observation of natural processes or in industry through a better arrangement of work, enabling improved production results to be obtained.

Technical Improvements throughout the Whole Industry

Let us suppose, in the first place, that in a given industry all firms are able to raise their output by a simultaneous improvement in operation, and that accordingly the supply of a particular product increases. The effects of this change will depend on the elasticity of demand.

(a) If the elasticity of demand is equal to unity, i.e. if the consumers are prepared to spend a given amount of the medium of exchange on acquiring these goods, this amount being invariable whatever the upward or downward variation in price, the producers will be forced by the operation of free competition to sell more cheaply. Prices will fall approximately in the same measure as output rises: if, for instance, output rises from 100 to 120, each unit of product will sell at 83.33 per cent. of the former price.

(b) If the elasticity of demand is greater than unity, i.e. if consumption rises more rapidly than prices fall, the proceeds from
the total output after expansion will also rise, although not as steeply as the output itself. Supposing that every increase of 12.5 per cent. in production, and therefore in supply, reduces prices by 10 per cent., the following result will be obtained:

<table>
<thead>
<tr>
<th>Amount produced</th>
<th>Price per unit</th>
<th>Proceeds from total output</th>
</tr>
</thead>
<tbody>
<tr>
<td>supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>1,000</td>
</tr>
<tr>
<td>112.5</td>
<td>9</td>
<td>1,012.5</td>
</tr>
<tr>
<td>126.56</td>
<td>8.1</td>
<td>1,025.13</td>
</tr>
<tr>
<td>142.38</td>
<td>7.3</td>
<td>1,039.37</td>
</tr>
</tbody>
</table>

1 As costs within the industry differ, it must be assumed that output increases uniformly in all firms as a result of technical improvements of the kind described.

(c) If elasticity of demand is less than unity, so that every increase of 8 per cent. in output involves a fall of 10 per cent. in prices, we obtain the following results:

<table>
<thead>
<tr>
<th>Amount produced</th>
<th>Price per unit</th>
<th>Proceeds from total output</th>
</tr>
</thead>
<tbody>
<tr>
<td>supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>1,000</td>
</tr>
<tr>
<td>108</td>
<td>9</td>
<td>972</td>
</tr>
<tr>
<td>116.64</td>
<td>8.1</td>
<td>944.78</td>
</tr>
</tbody>
</table>

These series can, of course, be interpolated to obtain the ratio between the different outputs, prices and total proceeds.

Thus the effects of such increases in output vary according to the elasticity of demand. With unity elasticity, the sole effect of the rise in output is to increase consumption. As the consumers expend the same fraction of their income on the goods concerned as before, their purchasing power on other markets remains unchanged. The producers for their part have not increased their costs but merely improved their efficiency, so that their returns from their output are unchanged. Hence they have no cause to change their arrangements. The only result in this case is to increase the benefit obtained by all consumers from the purchasing power they control. Any advantage which the producers might have obtained from an all-round improvement in efficiency is cancelled by the action of competition.

We are assuming that the fall in prices is confined to those goods the cost of producing which has been reduced. At the most, other goods can be said to have become dearer relatively to the cheapened product, e.g. cloth, but all other price ratios remain unchanged. The general price level will fall slightly, but only in so far as the price of one commodity has fallen. Here the
cause of the lowering of the price-level obviously lies in the field of production.

If elasticity is greater than unity, important shiftings will take place. Suppose, for instance, that output is increased by 26.5 per cent. by the introduction of improved technique, the price per unit of product will fall from 10 to 8.1, but the total proceeds will rise from 1,000 to 1,025.13, i.e., by 2.5 per cent. One might be inclined to suppose that the total money income would not be altered by the introduction of more efficient production methods in a single industry with the quantity of money remaining unchanged, and that accordingly the money available to purchase all other goods would fall by 25 units. This is not the case, however, because the producers of the cheapened goods now obtain an extra 25 units of purchasing power which they place on the market. Suppose that groups I-X represent the producers of all goods except that which has fallen in price, e.g. cloth, while group XI represents cloth manufacturers. Group XI will now obtain 1,025 instead of 1,000 for its total output, its costs remaining unchanged, while the producers of groups I-X will now have 25 units less with which to purchase all other products except cloth. That is to say, their purchasing power as regards the majority of goods has been reduced. But the price of these goods will not fall, because the amount by which the purchasing power of the producers of groups I-X has diminished accrues to the producers of cloth. If the demand for the products of groups I-X increases to the same extent as the consumption of the producers in this group has dwindled, the market for these goods will be perfectly balanced, and accordingly their price will not fall. Here again, as in the first case, the general price level will have fallen because of the fall in the price of the goods of group XI, but the price of the products of groups I-X will have risen only relatively to those of group XI.

In this example we have implied some increase in the velocity of circulation of money, since the 25.5 money units previously applied to purchasing the goods in groups I-X will now be transferred to the producers of group XI and will there be transformed into income, which will subsequently flow back into the sphere of the producers of groups I-X. Thus the 25.5 units of purchasing power will have to be turned into income twice within the period considered. But it can safely be assumed that the elasticity of our monetary system is sufficient to permit
of this slight increase in the velocity of circulation\(^1\). If the velocity of circulation does \textit{not} rise, i.e. if the producers of group XI hoard some of their income, the price of the other commodities is bound to fall slightly. If the demand of the producers in group XI is transferred to other products, there will be a change of price ratios without any change in the total proceeds from prices. Even if this process takes place with the least possible friction, equilibrium is bound to be upset, because the producers of group XI earn extra profits and other producers will therefore be attracted into this branch of industry. Moreover, some of the surplus profits may also be used to expand production in group XI, and this will require a transfer of labour from other branches of production. For our present purpose it will suffice to indicate the limits up to which the production of group XI can expand.

The limit for the expansion of output in group XI is reached when, as a result of the increased supply, prices have to be lowered to a point where in spite of the reduction of costs the average profit can only be secured. If the factors of production are mobile, two circumstances may accelerate the reaching of this limit. In the first place, the entry of new producers into the industry may speed up the expansion of output. If the original output was 1,000 units and the former producers in the group can now produce 1,200 units at the same cost, and if one new producer enters the industry who could have produced 50 units with the old technique and can now produce 60, the total supply will rise to 1,260. The price obtainable for one of these 1,260 units will be lower than when total output was 1,200. Thus in this case surplus profits may be whittled down to nothing, so that the development of group XI comes to a standstill. Secondly, the flow of capital and labour to group XI involves a restriction of production in groups I-X, leading to a rise in prices which will rapidly create a new equilibrium.

As costs and wages in groups I-X remain constant, however, these groups will begin to make surplus profits which will increase with every further shrinkage in these branches of production until equilibrium is secured in all branches. The

\(^1\) We have to assume, however, that the producers of group XI spend the addition to their incomes at the same moment when the other producers and their workers would have spent it.
ultimate result will be that average profits will increase and will only begin to diminish again later as capital begins to accumulate.

In static theory elasticity can only be assumed to be greater than unity occasionally and over short periods. If this situation is found in practice, it is usually because the existing system is a dynamic one in which the purchasing power of the various classes of consumers gradually increases. But in this case we are dealing with a statistical demand curve and not a theoretical one.

If the elasticity of demand is less than 1, prices will fall more rapidly than supply increases. In this case if output is controlled by a monopoly there will be no expansion of production. Under free competition the effects of increased efficiency of production will vary.

If, for instance, output increases by 8 per cent. as a result of an improvement in production methods without any rise in total costs, while prices fall by 10 per cent., all producers are bound to operate at a loss (or at least with lower profits). Under free competition this is inevitable, and the result is the same whether the individual entrepreneur assumes that only a few producers will apply the new methods, or that all of them will do so. Every producer will be bound to increase his output, even if all the others do the same, in order to try to reduce his losses by cutting down costs. Not until the weaker competitors are driven off the market by their heavy losses will equilibrium be restored.

Any one of the three degrees of elasticity considered here may be found in practice, but we may assume unit-elasticity for most products over short periods, particularly when incomes are comparatively stable. The habits of consumption of each consumer will then be fixed along definite traditional lines, and he will allot a specific fraction of his purchasing power to buying each product. This will apply only within narrow limits, however; beyond these limits, i.e. wherever there is a substantial increase in supply, elasticity will fall below 1, because this particular want will be satisfied more fully than others and the increased utility resulting from a further expansion of consumption will decline very sharply. This is especially true as regards all the

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1 We assume as before that the velocity of circulation of money is easily adjustable, i.e. that the incomes earned in one economic period are spent in the same period, as before.
necessaries of life; in their case we may safely assume that elasticity will fall below 1. The degree of elasticity also depends on whether the lowering of prices enlarges the market to cover new classes of consumers, and on the extent of competition from substitute products.

*Technical Improvements in One Part of the Industry with Elasticity equal to Unity*

Our next task is to examine the further consequences of an increase in production without any alteration in costs in one part of the production group which we have designated as XI. We will examine these consequences in detail only under the assumption of elasticity equal to 1 and under static conditions.

Let us take as example an industry in which there are 100 producers. Each producer manufactures 10 units of product during the period of production considered, so that output is 1,000 and the proceeds of its sale also 1,000. 5 of the producers now find themselves able to increase their output by 20 per cent. They will therefore now produce 60 units instead of 50 and the total output will rise to 1,010. These 1,010 units will be sold for 1,000. The returns of the 5 privileged producers will therefore be 59,405, i.e. each producer will obtain 11,881 instead of 10. The other 95 producers will obtain 940.6 in all, or in other words 9.9 each.

(a) *Great Changes of Incomes of Dynamic Producers*

Supposing now that out of every 10 units of returns 3 have to be set aside for replacements of plant, the following changes will occur in the income available to the producer for the satisfaction of his wants. The income of the producers who continue to use the old technique (referred to henceforth as the “static” producers) will fall from 7 to 6.9, while that of the “dynamic” producers will rise from 7 to 8.8, or by 27 per cent. Here therefore, even with a very small change, the differences are extremely wide. In consequence of this situation, each of the 95 static producers must cut down his consumption by 1.4 per cent.; the dynamic producers will increase their consumption by 27 per cent., and the total consumption of the product concerned will increase by 1 per cent. No attempt will be made here to compare the profits and losses of all economic subjects, since any such
attempt implies the assumption that a specific utility quota attaches to every given sum of money, irrespective of the size of the income from which it is derived or to which it is added. We will therefore confine ourselves to the observations made above. If a shifting of demand takes place as a result of this process, a whole host of deviations may occur, which are nevertheless of a minor order of importance and therefore cannot be examined here.

Let us now suppose that the 5 dynamic producers decide to use the extra profits they have earned to enlarge their output. If the construction costs of one producing unit are 30, a new unit could be constructed out of the surplus profits earned in about 3 years, or alternatively the 5 dynamic producers could enlarge their plant so as to increase their joint capacity to an amount equal to the capacity of a new producing unit. The annual capacity of each producing unit operating under the new technique is 12, so that total output now rises from 1,010 to 1,022. As the total amount earned is still 1,000, the share of the static firms will now fall to 9.78 and the income of the static producers to 6.78, i.e. by 7.5 per cent. The takings of the dynamic firms will rise to 14.09, and each of the dynamic producers will be left with an income of 10.49, after deducting the necessary allowance for depreciation. Thus each of the dynamic producers will be able, in the fourth year following the introduction of the improved technique, to consume 50 per cent. more than before, and to maintain his increased consumption provided that he keeps up his output and that no other changes supervene.

This example shows how quickly even small changes in conditions of production can create wide variations in individual incomes, provided that they are confined to a narrow sphere. The incentive to make such changes and the driving force of technical progress are all the greater on this account.

(b) The Redistribution of Income

The effects of this redistribution of purchasing power are as follows: if production is sufficiently flexible, there will be a shift in the direction of production in groups I-X. Fewer consumption goods will be manufactured and more capital goods, because the 95 static producers in group XI will have to restrict their consumption in order to keep their productive capacity up to the former level. The 5 dynamic producers will indeed be able-
to consume more, but will not wish to do so (any minor increase in consumption which may occur is left out of account here), and will at first apply their additional purchasing power to acquiring capital goods. The necessary producers are available, as stated above, and there need be no change in prices if the change in the direction of production takes place quickly enough. Here therefore the development of production can be speeded up by the restriction of consumption in group XI.

The operation of the sixth dynamic producing unit will now of course mean an additional demand for labour. This would lead us on to the problems of a dynamic system. But setting these particular problems aside for the time being, the only change which takes place is in the direction of production in certain branches. Even changes in the circulation of money are confined to the minor variations mentioned above. The effect of these investments does not become apparent until later when the products reach the market and give rise to growing disturbances.

(c) Velocity of Circulation affected

Our analysis of this process shows that under the assumptions of a rapid change in the direction of production, an adjustment of the velocity of circulation, and a sufficient fall in prices, the introduction of a new technique need not involve a displacement of labour. It also shows that technical improvements benefit the great majority of producers and that only 95 producers in group XI suffer from disadvantages which can in fact be removed if some of the producers begin to produce different kinds of goods. This of course implies sufficient mobility in the means of production to enable them to be transferred quickly enough from one branch to another or to be rapidly transformed. This condition cannot be too strongly emphasised. If we assume that the changes in the nature of the process of production can take place without difficulty, that is to say without loss, we obtain quite a different picture and one which does not resemble more

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1 The increased demand for labour will cause wages to rise. The static producers, however, are not in a position to pay a higher rate, so that if costs within the industry differ, the border-line undertakings will have to close down. But as we are considering the expansion of only one firm in the whole economic system, with a capacity representing only 0.6 per cent. of the total capacity of one industry, we can safely ignore this particular effect of the change in production in group XI.
closely the situation which actually exists under our dynamic system.

If the elasticity of demand is greater than 1, and if only part of the producers in group XI adopt the improved technique, the profits earned by the dynamic producers will be higher and losses of the static producers lower because prices will not fall as rapidly as in the previous example. If the elasticity of demand is less than 1, the dynamic producers will still make a profit, but it will be smaller because prices will fall lower. For the same reason the losses of the static producers will also be larger. This will rapidly drive some producers out of business and thus restore equilibrium with a lower price level.

(d) The Premises for Smooth Adjustment further Examined

The reason why no greater dislocation occurs in all the cases discussed is that no investment takes place and that the means of production are supposed easily and automatically transferred and interchanged. Hence the whole system is elastic and can adapt itself without difficulty to the changed circumstances. Nevertheless, disturbances do occur in many cases, and the closing down of the weaker firms in particular may involve displacements. It may then be some time before all the displaced workers can be reabsorbed into the process of production. Moreover, it must not be forgotten that the establishment of a new equilibrium is conditional on the possibility of adjusting prices easily to the altered output in order that the market can always absorb the whole supply. If prices are rigid, part of the output would be unsaleable, and subsequent developments would depend on how many firms were obliged to close down owing to their inability to sell their products. But in spite of all these difficulties there remains the great advantage that if technical improvements are generally adopted, competition enables prices to be adjusted without friction to the altered output. If, on the contrary, the increase in efficiency involves investment and consequently a rise in costs, the problem of the employment capacity of the industry, which is not involved in the simple cases we have just been discussing, immediately arises. The writing off of the existing capital will also lead to complications. And finally, in the case of capital-saving inventions which render superfluous capital that was or might have been invested, the question of investment will not always find an automatic solution. It is clear, therefore, that the
problem of displacement must arise when changes take place in the capital structure of production.

B. TECHNICAL IMPROVEMENTS INVOLVING INVESTMENT

*Technical Improvements do not reduce Purchasing Power in the Industry itself*

Technical improvements involving investment have one feature in common with those previously discussed in that they do not bring about a contraction of purchasing power in the industry concerned. If labour costs fall, some workers will indeed be displaced directly, but their purchasing power, i.e. the sum represented by their wages, does not disappear; it simply takes the new form of profits for the entrepreneur or economies for the consumer, provided that output is kept up at least to its former level. If the entrepreneur economises on his capital costs, he will be left with a surplus of purchasing power which he can use to enlarge his own undertaking or for investment in other branches of industry. We will discuss later whether total purchasing power remains unchanged.

This second form of capital-saving improvements has not yet been examined in detail from the theoretical standpoint. It has striking parallels with the first form, and the compensation theory would doubtless assume a smooth and automatic reabsorption of the displaced capital in this case also. This did indeed take place during the nineteenth century even more rapidly and easily than the reabsorption of the displaced workers. But it cannot be denied that under certain circumstances the displacement of capital too may give rise to difficulties, especially if it takes place too rapidly.

*Displacement of Labour limited to a Certain Period*

The effects of displacements of labour and of capital are naturally intertwined with each other, since every displacement of capital involves a fall in the demand for labour in the production of capital goods. Hence it is hardly possible to disentangle the effects of these two processes at all clearly. So far as possible, however, we will try in this section to deal only with the problem
of the displacement of labour, leaving that of the displacement of capital for subsequent consideration.

Before turning to this problem, however, it must be noted that in discussing technical progress we are not, as already stated, concerned with changes which lead to a permanent displacement of labour. In the long run, all influences which have a disturbing effect on the economic system are ultimately assimilated; that is to say, the other factors adjust themselves to the change. What we are discussing are the medium-period effects with which economic theory has to deal when analysing the process of economic development.

Effects of this kind, which may extend over 5, 10 or even 20 years, cannot be lightly dismissed as short-period disturbances. This is especially true in that a secondary series usually arises while the first are being overcome, or even before, so that a certain type of disturbance may appear to be chronic although the effect of each individual disturbance is operative over a limited period only. It is for this reason that economists often admit that technical progress may involve dislocation, although their logical arguments point to the opposite conclusion. They explain this by saying that the dislocation is only temporary. But is that a valid argument? Human life itself is also temporary, and in matters of economics, interest will accordingly always be centred in changes which are of vital importance to any one generation, even if they will ultimately be assimilated to the general process. Indeed, these temporary influences are the factors which determine the historical course of decisive long-period developments. The only point on which opinions on our problem can differ is, therefore, whether technical progress leads to medium-period unemployment. This question can only be elucidated by theoretical arguments, and not by direct observation. The argument adduced to disprove the existence of technological unemployment is in fact also a theoretical one.

It may be added that in discussing the displacement of labour we are considering technical improvements which lead to a reduction in the direct as well as in the total labour costs of a product through a change in the equipment necessary for production. The extent to which hours of work can be reduced at the last stage of production is illustrated by the investigations of the United States Department of Labor. From the standpoint of the profitability of an improved technique, and therefore of
the extent to which it is economically practicable, it is only the total reduction of costs which is important, so that the interest and amortisation quotas for the extra capital invested should also be taken into account. This total reduction of costs is unfortunately not shown in the United States statistics mentioned above.

The Compensation Theory discussed; its Shortcomings

The thesis of the compensation theory is that technical progress does indeed involve an initial displacement of labour, but that at the same time it sets in motion various primary and secondary effects which ultimately lead, after certain difficulties have been overcome, to the reabsorption of the workers temporarily excluded from the process of production. Technical progress is thus regarded as a disturbance of equilibrium which can easily be readjusted in the normal course of development when its indirect effects, especially the displacement of labour, have begun to operate on the other economic factors. The compensation theory takes two forms. In the first form, it maintains that workers are indeed displaced by the introduction of machinery, but that these workers will be needed to produce the machinery. But this argument contains several fallacies. In the first place, the actual workers who formerly operated the less efficient machinery and have now been displaced will not be employed in producing the actual machines which have deprived them of their livelihood. Secondly, investment derived from savings can never create an extra demand for labour, because in a balanced system savings are fractions of income which must lead to a demand for goods on pain of dislocating the whole process of production. That is to say, that if the savings were not invested, this would not only mean a failure to expand the process of production, but also a contraction of the economic circle which must necessarily involve unemployment. If, therefore, investments are financed by savings, this simply means that the demand for labour at the current wage will not decline, but

not that it will rise. Only when the capital goods created by means of these new investments have come into operation and have begun to employ workers can a rise in employment be expected, always on the condition that the resultant extra output does not lead to unemployment in other firms.

Nevertheless, this argument of the compensation theory has a germ of truth. The economic process could be so constructed as to ensure a constant improvement and extension of the machinery of production to an extent enabling not only the annual contingents of new workers to be absorbed, but the displaced workers also. But this process is conditional on an accelerating expansion of capital accumulation and investment, the tempo depending on the growth of the population and the extent of the displacement of workers.

Suppose, for instance, that 1,000 workers are displaced by machinery and that these displaced workers are employed in producing other machines which in turn will displace 100 workers. In the second year 1,100 workers will have to be employed in the production of the machines, which will subsequently displace 110 workers. The series would then run: 1,210, 1,331, 1,464, and so forth. The increase in production must be calculated by the formula of compound interest, because the number of displaced workers who, according to this theory, must be employed on the production of machinery will increase progressively. After twenty years, six times as many workers would have to be employed in the production of machinery in the example taken as at the beginning of the series. Clearly no such structure of the system of production is to be found in reality. In cases in which the engineering industry has actually expanded as rapidly as this over a short term of years, export to other economic territories has played a very considerable part in providing the necessary market.

The thesis stated above that the investment of savings cannot in itself increase employment nevertheless requires qualification in one respect. It applies only when a volume of savings and investment recurs regularly in the course of economic development and forms the pivot of the whole process. If the volume of investment rises while workers are displaced, employment in general can remain stable. Similarly, employment will, of course, fall if the volume of investment dwindles. (On this point the reader is referred to our previous discussion of the dynamic
process of economic development.) Thus, under given conditions, tendencies towards displacement can be counterbalanced for a certain time by speeding up the process of development. When the old tempo is resumed, a setback will be inevitable.

In its most generally accepted form, however, the compensation theory tries to carry the analysis of the process set in motion by the introduction of labour-saving methods a step further. The starting point of the argument is that in such cases total purchasing power remains unchanged.²

This indeed is true, at least within the industry concerned, since if labour-saving machinery is introduced the cost of production will fall. This fall in costs represents either higher profits for the producer or lower prices for the consumer, or possibly both at once. The purchasing power which was formerly in the hands of the displaced workers is now brought on to the market by the producers or by the other consumers, and the total demand for the commodities, in so far as it originates in this industry, expressed in terms of money, remains unchanged. Hence it is assumed that this extra purchasing power accruing to the producers or consumers will enable the displaced workers to be re-employed, thus restoring equilibrium. Even if the problem is considered without regard to the connection between employment and capital equipment — that is to say, as a disturbance in the circuit of a single-stage process of commodity production — this argument of the compensation theory is not compelling. All that it says is that total purchasing power is not reduced; but this does not mean that the same amount of purchasing power is spread over the same number of persons. The effect of labour-saving technical improvements is precisely to enable the same amount of product to be produced by fewer workers, so that the real income of particular classes — whether of the entrepreneurs, the consumers, or the workers who are still employed in the reorganised industry — is bound to rise. As the displaced workers will encumber the labour market, there will be no rise in the real wages of the workers whose efficiency has improved, so that the spare purchasing power will be transferred to the

² Cf. McCulloch: Principles of Political Economy, Part II, section 4, and in particular p. 102, where the author points out the importance of the example given by Ricardo. Cf. also John Baptiste Say and Nassau W. Senior. A bibliography will be found in Dr. Alfred Kähler: Die Theorie der Arbeitsfreisetzung durch die Maschine, Leipzig, 1933.
entrepreneurs or the consumers. These groups of consumers will now increase their demand for goods to the same extent as the purchasing power of the dismissed workers was reduced or lost. But the economic system is already organised to produce these goods. With slight adjustments, the workers who were formerly employed in supplying the demand of the displaced workers will now be able to work for those who have "inherited" their purchasing power. Thus the circle is closed, and the displaced workers are at first shut out of the economic process, so that another line of development will have to be started before they can again find employment. The fatal gap in this argument is the assumption that because purchasing power remains unchanged, so does the volume of employment. Even if the lowering of the cost of production leads to increased demand, full compensation cannot be expected to occur automatically for reasons which will be explained later. In any case, the displaced workers cannot be reabsorbed directly and unfailingly through the effects of technical progress itself. On the other hand, however, as already stated, an immediate transfer of purchasing power can check the cumulative disturbing effects of displacement by intercepting the purchasing power lost by the displaced workers and bringing it back on to the market. In order that this may happen, it is important that the velocity of circulation of money shall not be reduced to a greater extent than is required by the contraction of the economic circle.

But this is only likely in very rare cases, and accordingly it is probably inevitable that there should be a period during which the effects of displacement will be felt. Here we see clearly the difference between this type of technical change and inventions, in which the economic process is so arranged as automatically to involve the adjustment of the velocity of circulation or the quantity of money to the increased output.

Owing to the international ramifications of production, the

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1 Only if it is assumed that the retarding of the velocity of circulation, due to the fact that money has to pass through less hands than before, will automatically correct itself, can this secondary monetary result of the process be expected to afford compensation. But if this view is upheld, it must also be proved that even such very small changes in the velocity of circulation are strong enough to give the impetus to those developments of production which alone can restore the former velocity.

2 The compensation theory argument here described further assumes that the total purchasing power of the community remains unchanged. For reasons to be explained later, this is not the case.
effects of technical progress may sometimes be still more unfavourable. Suppose, for instance, that as a result of technical improvements there is a fall in the price of copper, rubber or cotton, accompanied by a considerable displacement of labour in the production of these raw materials. At first the European consumers or producers will reap the benefit of this change.

If, for instance, the price of cotton to the English textile producer falls from 100 to 50, and the cost of raw material represents 20 per cent. of all costs, the producer’s bill of costs will be as follows, assuming a 50 per cent. fall in the price of cotton and a 10 per cent. increase in output:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Interest and amortisation</th>
<th>Wages</th>
<th>Raw materials</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>25</td>
<td>55</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>110</td>
<td>25</td>
<td>60.5</td>
<td>11</td>
<td>96.5</td>
</tr>
</tbody>
</table>

Unit costs will thus fall from 1 to 0.87, or by 13 per cent. This reduction is greater than might be expected from the reduction in the cost of raw materials if the firm was not working to full capacity, because the unchanged fixed costs are then spread over a larger output. If elasticity is equal to 1, the 110 units of product will sell for 100 and an extra profit of 3.5 will be earned. The extent to which the remuneration of capital will rise depends on the amount of the capital. If 12 of the 25 units of fixed cost represent interest and the previous rate of interest was 6 per cent., it will now rise to more than 7.5 per cent. This increase in profits prepares the way for an expansion of the total output, which will be possible without contraction in any other branch because it can be brought about by having recourse to the reserves of unused capacity. The increase in output shown in the table also implies the employment of more workers in the cotton manufacturing industries. To this extent the effect of the fall in the price of raw materials is beneficial. If the transfer of labour from country to country and from occupation to occupation were quite unrestricted, some of the workers displaced from the cotton growing industry could be given employment in the manufacture of cotton goods. But the fact that these two branches are carried on at places widely distant from each other

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1 If, under the play of free competition, profits are levelled down at once to the previous rate, this extra profit will not be obtained. In practice, however, we may assume that it will be earned, at least for an appreciable period of time.
prevents this from happening. The knowledge that employment will increase (though maybe on a very small scale) somewhere in the world as a result of the fall in the price of a raw material is cold comfort for the raw material producing countries.

We still have to discuss the further consequences of unemployment in cotton growing. As a result of the reduction in the number of workers employed in cotton growing and of the fall in the price of raw cotton, consequent on the lowering of costs, the purchasing power of the country concerned in foreign markets will dwindle. It can no longer afford to import as much as before. Directly or indirectly, therefore, imports from England will also fall, and workers in England will be thrown out of employment because of the reduction in consumption there. This fall in employment offsets any additional employment created in the cotton manufacturing industry (if the capital-labour ratio remains unchanged). In the example taken, the cost of raw material fell by 10. Of these 10 units of purchasing power, part were spent on wages, coal, etc., and the remainder represents extra profits. But exports also now fall by 10 units of purchasing power. Hence, if no change in organic structure takes place to weaken or aggravate this effect, the volume of employment in England will not expand. All that will happen is that the unemployment which would have arisen in consequence of the falling off in exports will be offset by the effects of the fall in prices. (There can only be an absolute increase in employment if England grants credits to the cotton-producing countries in order to finance her own exports, and this again will be merely temporary.) Even taking the whole world as a single economic unit, therefore, no compensation will occur in this way. It can only occur if the workers displaced from the cotton-growing industry can ultimately be reabsorbed into the economic system of the raw material producing country by a process which will be described below. But this is very difficult, especially in countries producing a single staple crop. The imposition of high or increased tariffs, which is to be expected in the cotton-producing country under these circumstances, will only aggravate the position, because it will prevent the possibility of a larger quantity of cheaper products entering the cotton-growing country and thus stimulating the export of other goods on the manufacture of which the displaced workers could be employed. The fact that technical progress affects different markets far distant from each
other, between which communication is not entirely free, thus prolongs the duration of technological unemployment.

The compensation theory, which applies the principle of communicating vessels to the economic process, is therefore too simple and shows only one side of the complicated process set in motion by labour-saving inventions. In the following section we will try to throw some light on these complex reactions by linking them up with the main considerations set forth in the previous chapters.

Technical Improvements and Changing Capital-Labour Ratio
("Lengthening the Period of Production")

Except in the cases discussed above, technical improvements of a labour-saving kind are usually accompanied by an increase in the capital-intensity of production. Capital equipment per worker then rises because the increase in the worker's efficiency involves higher expenditure on machinery, premises, etc.

Economic theory began to concern itself with this change in the capital-labour ratio at an early date. Ricardo, in his well-known chapter on the effects of machinery, discussed the possibility of the transformation of circulating capital into fixed capital and expressed the fear that the economic system might settle down to a new equilibrium with higher profits and a smaller wage bill, leaving some of the workers outside the system. Ricardo also assumed that the capital-labour ratio might change for a long period with a consequent displacement of labour. Marx also devoted considerable attention to the problem of the organic structure of production, and echoes of Ricardo's views on the subject are to be found in the writings of L. V. Birck 1.

Many economists reject the view that technical improvements may lead to the absorption of too large a fraction of accumulated capital, so that workers are displaced without any new openings for employment being immediately available. They

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1 Cf. "Theories of Over-production", in the Economic Journal, March 1927, especially pages 28, 29 and 31. In this paper Birck stresses the variations which take place in the tempo of technical progress and the accumulation of capital. He points out dangers latent in the difficulty of finding new fields for investment (p. 29). Cf. also his lecture on Technical Progress and Over-production (Kiel Lectures, 1927), especially pages 16 and 18.
hold that the automatic forces which operate in an economy can prevent any such displacement.

This question of the establishment or re-establishment of the right capital-labour ratio, in the form of Böhm-Bawerk's theory of the introduction of more roundabout methods of production, has been much discussed in recent years in connection with Wicksell's theory of the "natural" rate of interest.

According to Böhm-Bawerk, capitalist production is a roundabout method of production which takes a considerable time. Both technically and economically, this roundabout method is only possible for the producer because he possesses means of subsistence enabling him, without immediately producing consumption goods, to apply himself in the first place to the production of capital goods, which will lead to the production of consumption goods in the future. This method of production involves a period of waiting, but ensures the future production of a larger quantity of finished goods. Böhm-Bawerk assumes that every lengthening of the period of production increases the future output of finished goods, although in a diminishing measure. The larger the "subsistence fund" which the entrepreneur has in hand, the longer can the period of production be. Its duration also bears some relation to the level of wages, for the lower the wage the longer can the process of production be extended with the same amount of capital. Conversely, the more the period of production is lengthened when an increased supply of capital is available, the higher wages will later rise, but at a decreasing rate because the increase in productivity slows down with the lengthening of the production period. The fact that the introduction of more roundabout methods of production involves diminishing returns also explains why the rate of interest falls in the case of intensive saving. (In my own opinion, this idea of the increased productivity of more roundabout methods of production is the fundamental factor in the general structure of Böhm-Bawerk's theory of the fixing of the rate of interest, whereas the argument of the discounted value of future consumption goods is not essential.)

This concept of the lengthening of the period of production is essentially nothing more than the idea of a change-over to more capitalistic forms of production. It is true that as compared with primitive forms of production modern industry has lengthened the time which elapses between the beginning and
end of the production process. But even this does not apply in every case (e.g. the chemical tanning of leather). Even in some typically modern industries production has not always been made more roundabout. It does not necessarily take longer to build a railway than to build a road, and the modern rationalisation of industry does not represent an extension of the production period as compared with the older methods. What actually happens is that the amount of capital is increased relatively to the number of workers employed, leading to a temporary or lasting employment of more labour in the capital goods industries. Even if the total process of production actually becomes more roundabout, the fact that many of the operations involved are performed simultaneously robs this of all significance. Thus, for instance, while the road bed is being prepared, the rails may be manufactured, the station buildings constructed, and the coaches and locomotives built. Moreover, these operations are often carried out more quickly than by the old, more direct methods, because mechanical methods of manufacture are also applied to the construction of capital goods. And, lastly, methods of production in labour-intensive firms are very often just as roundabout as in capital-intensive ones. If the period of production is defined as the time elapsing between the beginning of the manufacture of capital goods and the production of the last products which can be derived from the same capital, the length of the period may be taken as practically the same in all firms, because the life of the factors of production will be the same, provided that no revolutionary changes take place. The only difference between different industries is that the separate stages of production may not require an equal number of workers. If the period of production is construed to mean the lapse of time between the beginning of the manufacture of all capital goods and the manufacture of the last product within the undertaking concerned, i.e. the entire lifetime of the original combination of the factors of production, the concept becomes wholly inapplicable to the production of durable consumption goods (e.g. dwelling houses) and if we include the time necessary to produce the preceding capital goods, the concept loses its meaning altogether. So far as the present writer can judge, Böhm-Bawerk himself

merely interprets the notion of the lengthening of the production period in the simple sense of the lapse of time between the beginning of the first preparatory operations and the turning out of the finished product. Böhm-Bawerk himself has repeatedly emphasised the fact that the problem of the lengthening or shortening of the period of production is the same as that of a higher or lower capital-labour ratio. Personally, however, I think that the concept of the capital-labour ratio is a useful one, because this ratio can be increased or lowered both in an individual firm and throughout the whole economy without altering the length of the period of production. What is constantly changing is the quota of capital per worker employed. Böhm-Bawerk’s assumption that whenever the proportion of capital rises there is a corresponding and often proportionately greater extension of the average period of production bears no relation at all to the facts.

It will therefore be wiser not to attach undue importance to the fact that the period of production may possibly be lengthened. Hence, the idea that where more capitalistic methods of production are used it is necessary to wait longer for the finished product — an idea which clearly lies at the root of the roundabout production theory — is also incorrect. The products of a technically up-to-date plant are usually available after the same lapse of time as those of an older plant. The change-over to a more capitalistic form of production merely signifies that a larger amount of purchasing power is tied up — that is, until the first finished product is ready — but not that the investment period is lengthened.

It follows from what has been said that progress in capitalistic production does not involve a longer period of abstention from current consumption. In most cases, the means to finance the period of production are derived from savings, which would have been made independently of any movement in the rate of interest. Hence the rate of interest is determined solely by the prospects of profit, and as a rule savers will not respond to a lowering in this rate by saving less. And, lastly, it must again

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1 Op. cit., ed. 1921, pages 111 et seq., and passim, e.g. page 146.
2 Cf. for instance, op. cit., Vol. 2, pages 29 et seq.
3 Cf. op. cit., pages 30-31, 38 and 101, where the following passage occurs: “It is obviously extremely probable, and in fact almost mathematically certain, that the larger the accumulation of work done in the past, the further back must some of this work date.”
be remembered that production is often expanded by temporarily calling unused capacity into play without any necessity for waiting for fresh investment. In boom periods the production of consumption goods and capital goods alike increases. Once this phase is over, normal conditions are restored and reserves are built up anew.

Even if credit expansion is regarded as the normal method of financing the development of longer production processes, this argument still holds good. Additional credits mobilise reserves and give economic activity the necessary impetus for a rapid increase in the volume of production. Only if inflation takes place will the volume of consumption goods be directly reduced, although it must of course be assumed that there will be a relative decline in the output of consumption goods during boom periods.

The inference to be drawn from these remarks is that unemployment cannot be regarded as the consequence of a process of expansion in which the period of production is prolonged to a greater extent than would naturally correspond to the savings involved. The most that can be said is that technical improvements usually involve a rise in the capital-labour ratio throughout production, which may lead to the adoption of methods which will diminish the employment capacity of the dynamic industries. If the new methods require the investment of a large fraction of the available savings, so that the other economic branches cannot expand at their normal tempo, these two circumstances may lead to medium-period unemployment, even if the natural rate of interest, in Wicksell’s sense, actually obtains on the market. Equilibrium can then only be restored if a reduction in wages takes place enabling the labour-intensive undertakings to catch up with the start obtained by the capital-intensive ones, so that the employment capacity of these industries again rises.

1 This view is implicit in Böhm-Bawerk’s theory. See, for instance, Schumpeter’s remarks on this subject: “The solution is easy to state. The right wage rate is that under which the production period most profitable for the entrepreneur is precisely that which requires the employment of all the labour available in the community and the expenditure of the whole of the subsistence fund on wages. In practice, when a wage rate is fixed experimentally on the market, there will be only one production period which is the most profitable for the entrepreneur under a given scale of increasing productivity. This will therefore be the period chosen, and a specific rate of interest will be fixed in accordance with the objective relationship discovered by Böhm-Bawerk. If under this arrangement the supply of labour and the subsistence fund should happen to balance each other exactly, equilibrium is secured and the condition
This assumption of Böhm-Bawerk is based on the fact that he defines the whole capital equipment of the economic system and all half or quarter manufactured products, together with durable capital goods, as a "subsistence fund", which can of course be used as desired to employ more workers at lower wages. In practice, however, there will be no technical transformation of existing undertakings, but at the most only a stimulation of older firms or an expansion of the personal services. Schumpeter obviously realised this difficulty when he pointed out that these "means of subsistence" are not all immediately available, but that the intermediate products for the most part represent future consumption goods. Consequently, it is also impossible to increase available employment automatically by reducing wages. In other words, it is not the size of the wages fund, in the more elaborate sense of the term, which sets the limits to the number of workers employed, since in the case of technical improvements involving heavy investment, the wages fund is not at first reduced, but the difficulty of ensuring the expansion of the industries which are now unable to obtain the capital they require while their capital-structure remains unchanged, quite apart from the question of the accumulation of capital necessary to provide fresh employment for the displaced workers.

**The Effects of Displacement and their Complexity in a Dynamic System**

So far we have been discussing the problem of increased capital intensity of production, which brings about an increase mentioned above does not apply. If not, however, the unemployed labour and means of subsistence will exercise a downward pressure on wages or on the rate of interest until a production period of a different length becomes profitable and equilibrium is reached in that way" (Das wissenschaftliche Lebenswerk Eugen von Böhm-Bawerks: Zeitschrift für Volkswirtschaft und Sozialpolitik, Vol. 23).

If this is intended as a method of solving practical difficulties, it implies that any wage rate which is theoretically correct in this sense is also practically possible. But this would involve wage reductions which are not possible in practice, apart from the fact that it also implies sufficient flexibility in capital to permit of the rapid lowering of the capital-intensity of production.

1 Cf. on this point Alfred Kähler's interesting criticism of Böhm-Bawerk's theory in: Die Theorie der Arbeiterfreisetzung durch die Maschinen, page 73.

in real capital. The fundamental problem is the disproportionately faster growth of capital equipment to labour and the reduction of employment capacity which it implies.

The difficulty attaching to a scientific analysis of the effects of technical improvements is that the results of disturbances within a given dynamic system are always complex. In the first place, the economic subjects do not all react to changes in the same way, since they are actuated by different motives and expectations. We have already noted the uncertainty arising out of the fact that in some cases extra profits are used for consumption, and in others for investment, a fact which has an important bearing on the extent of the permanent demand for labour. Secondly, the same set of facts may have quite a different significance under different circumstances. Suppose, for instance, that a cotton manufacturing industry is driven off the market by a newly founded artificial silk factory, and that the workers from the undertaking which has closed down find employment in the new firm. The effects of this change will differ according to whether the savings accumulated in the course of the economic process would otherwise still have found a field for investment or not. If so, the creation of this firm will mean a relative fall in the permanent demand for labour, both because it will prevent the extra demand for labour which would otherwise have resulted from the materialisation of the investment and because the profits of the firm which has closed down will also disappear. But if the capital which is built up anew every year out of savings would not otherwise have found employment, the fact that these savings have nevertheless been invested then means that additional workers will be employed in the production of capital goods during the period when the new undertaking is being built. Whether a given investment is beneficial or not thus depends on the current phase of the business cycle. The prospects of profit from the new investment will afford no reliable indication on this point.

1 The concept "employment capacity" refers to the reduction in the demand for labour, which shrinks when an increasing ratio of capital to labour is used in production. I think that this concept is important in modern economic development and is necessitated by the rigidity of technical structure; it is, however, obviously at variance with the views of J. B. Clark who assumes that any combination of capital equipment and labour is possible. This view of Clark leads furthermore to the assumption that, given flexibility in the prices of all factors, capacity will always be fully utilised.
Let us now consider the case of a change in the organic structure of capital resulting from the introduction of labour-saving methods. The value of the machinery of production rises, while the number of workers employed diminishes, at least relatively and often absolutely as well, simultaneously with the increase in the efficiency of production. The investment of the profits regularly earned in a dynamic system involves a process of this kind on a wide scale. It implies that the purchasing power of other economic subjects is mobile and can easily be diverted into such investments.

Basic Features of the Dynamic System

We are here taking the dynamic system in the sense of capitalistic production, i.e. the production of goods for profit. The profits are re-invested and thus expand the total volume of production. This expansion is not a disturbance, but a deliberate consequence of the economic process. On the contrary, if the volume of production were to remain stationary over a fairly long period of time, this would represent a disturbance in the operation of the law of progress by which the process is governed.

In analysing the dynamic process we cannot wholly neglect the social aspect, which gives its definite form to the concept of the capitalistic process, the only one with which we are familiar. But it will be enough for our present purpose to recall that capitalistic production demands the concentration of the means of production in the hands of a group of producers and the employment of a large number of wage-earners whose characteristic as a class is that they own no property. These factors in the situation are extremely important from the standpoint of the effects of technical progress, especially in the case of an economic system in which all producers are independent. Our argument also assumes the existence of a modern monetary system with credit banks, international trade and an international capital market; but these factors, which greatly complicate the situation, will be analysed later, and only in so far as is necessary for our purpose.

What we have before us in practice is merely a progressive system in which the effects of the most varied technical improvements at present in progress are interwoven with other changes, some of which date back far into the past. Consequently, we cannot base our analysis directly on the observed facts. Just as
the intensity of a light cannot be measured if it is among a group of others the intensity of which is also unknown, so it is impossible to trace the effects of technical improvements when they occur in a set of circumstances, the changes in which cannot be said with any certainty to be due to these particular improvements. Here again therefore we must use the method of isolation and try to study the effects of technical progress in an atmosphere of economic calm. We cannot indeed make pure statics our starting point, but must assume a steadily progressive economy in which no disturbances take place and which may be said to be in a state of "dynamic equilibrium" or growth. In accordance with this concept, we must also assume that our system is organised to ensure a uniform expansion of the process of production (e.g. by 1 per cent. yearly), accompanied by a parallel increase in the number of workers employed. The social dividend per head will thus remain constant, so will the ratio of profits on invested capital, the real value of wages, the share of wages in the social dividend, etc. In this system boom and depression are alike unknown. As the technical features of production remain unchanged, there is no necessity for the premature writing off of capital values. The wealth of the community grows simultaneously with and parallel to the growth of the population. In a system of this kind no disproportionalities will arise, and profits cannot be eliminated by competition, because the population is increasing and because, under our assumptions, a decline in profits at any point in the process would be a disturbance which would call corrective influences into play. There can be no question of one undertaking increasing its production with a view to earning larger profits because no means are available to enable given production units to develop more quickly. Unless he were to cut down his consumption, the only possibility open to

1 The possibility that under free competition profits will be destroyed by competition and a situation be established in which no interest is obtainable can only arise if investment is financed out of profits and the ceteris paribus formula applies, i.e. if both technical methods and the supply of labour remain unchanged. For if capital is accumulated and there is no change in the number of workers or in technique, there will be such competition for labour that profits will be whittled down to nothing. Competition between producers does not in itself necessarily mean the elimination of profits. It might just as reasonably be assumed that competition between the workers must cause wages to fall below the subsistence level; this, too, could only occur if the number of workers increased and other conditions remained unchanged.
the entrepreneur would be to borrow from other producers, who would then have to restrict their own demand on the market. Such a redistribution of productive forces could therefore alter the share of the factors of production falling to each economic subject, but could have no effect on the structure of the system as here assumed. The fact that there is no change in technique is of great importance in the present context. It alone can ensure the maintenance of an appropriate scale of values, and also of that steady forward movement, which is perhaps the best definition of a "progressive static economy".

In this system too a distinction must be made between fixed capital and circulating capital. Fixed capital is represented by the existing capital equipment. It stands in the firm's books on the liabilities side opposite the value of plant on the assets side. Circulating capital is a quantity of purchasing power enabling the producer to pay for his labour, raw materials, power, etc. The circulating capital is turned over comparatively quickly. If the process of production is continuous and the products are regularly sold, so that the producers do not accumulate stocks, the circulating capital may be expected to turn over several times in one business period, for instance four times a year. In this case circulating capital need be less than one-quarter of the total annual turnover, because both profits and the amortisation of fixed capital have to be taken into account. In a steadily progressive economy circulating capital must increase simultaneously with the expansion of production, and consequently the quantity of money must increase in the same measure if the velocity of circulation remains unchanged.

*Monetary Aspects of the Dynamic System*

Given this construction of the process of circulation, the total value of one year's production also includes the amortisation quotas and the profits which will subsequently be invested. Hence the producer does not need any additional purchasing power beyond his working capital. By sale and subsequent purchase he transforms some of his production into the capital equipment which is worn out during the period of production, and some of it into additional capital goods. The third fraction represents consumption goods for his workers and himself and raw materials and subsidiary materials. As a result of the divi-
sion of labour within the community, one group of producers produces capital goods only and another consumption goods only, so that the producer of capital goods must also produce subsistence goods for his workers and himself in producing machines, buildings, etc., while the producer of consumption goods has at first to produce the equivalent of his capital goods in the form of goods for rapid consumption such as cigarettes. As all firms are working to a profit, each producer produces in every period increasing quantities of goods which are sold on the market at constant prices and therefore yield a larger money return than in the preceding period. This implies that the quantity of money in the community also grows.

It follows from what has been said that not all the social dividend is income in the form of consumable goods, but part of it is produced right at the outset in the form of capital goods. These too are exchanged for money and accumulate in production like a sediment in the form of fixed capital. But the money which was paid for them continues to circulate as working capital, fulfilling its three purposes of income, the equivalent of written-off capital, and new investments. (An immobilisation of circulating capital would only take place if the equivalent of income, in the sense of the stream of purchasing power which flows into consumption, were to be invested. In this case capital goods would be produced instead of consumption goods, and the consumption goods industries would contract as a result of falling prices, or would not expand as rapidly as they would otherwise have done.) One fraction of the new capital goods merely represents replacements of worn-out machinery, premises, etc.; to this extent its money equivalent is allotted neither to the purchase of consumption goods for the producers nor to profits. In every firm part of the available purchasing power must be reserved to pay for the replacement of plant, and the total net income of the community is therefore smaller than its total production. This can also be expressed by saying that the sum of incomes is smaller than the total selling price of all the products placed on the market.

The money in circulation will therefore include the amortisation quotas, profits, and the income from wages. It will also have to be adjusted to take account of the fact that many products have to pass through several undertakings in the process of manufacture. The problem of how the income of the entrepre-
neurs as a whole can be larger than their expenditure, and how it is possible for them to realise profits at each other's expense, arises out of a wrong view of the whole process. In an industry with a constant output profits result from the fact that the total costs which the entrepreneur has to cover are lower than the proceeds of his production. This balance is transformed into consumption goods, and if it is always spent on consumption it can always be secured. But if producers were to exchange their profits for capital goods there would be later a rise in their output, which could then only be sold at the former price provided that the quantity of money also increased.

The quantity of money can be increased to correspond to the increase in output either by producing more of the precious metal used for currency or by issuing more token coins. The latter method, as contrasted with the former, signifies an expansion of credit. In both cases the quantity of money in circulation can be increased to the exact extent required to prevent any change in prices and to ensure that profits, calculated both on capital and on turnover, remain unchanged. The circulation of the newly granted credits in the form of purchasing power will then finance the newly created circle of production, so that there will be no downward pressure of prices so far as the monetary system is concerned. In this sense money can be described as "neutral" in a progressive economy of this kind. In the course of industrial expansion an ever-growing fraction of the money in circulation will thus be created ad hoc, and this will be necessary to enable the whole process to function smoothly. In actual practice, of course, the production of precious metals, technical improvements in the money and credit system, changes in the velocity of circulation will sometimes cause the expansion of the supply of money to lag behind, sometimes to go beyond, the "normal".

*Effects of Labour-saving Devices considered in a Scheme of Dynamics*

How will an improvement in technique which substantially changes the organic structure of production in one particular branch only affect a system of this kind? We are not at present discussing technical changes which can be assimilated by applying amortisation quotas to a different purpose, but those changes
which require a larger capital investment than is available from amortisation quotas and the firms' own profits, and which can accordingly only be financed by diverting purchasing power from the products of other producers or by creating additional credit. Only the first of these two possibilities will be discussed in the present section.

The obvious course would seem to be to begin by examining the effects of technical changes only in the industry in which they occur. But this will not relieve us from the necessity of analysing the results from the standpoint of the whole economy as well. We will therefore begin by describing the whole process, although in an artificially simplified form. We will take ten industries in which the invested capital increases in quantity and value from year to year by the same percentage. Working capital and the number of workers also increase, but at a slower rate. Thus a new ring of undertakings is gradually built up year by year around the old producing units. As the invested capital increases in quantity and value faster than the working capital and the number of workers, minor changes in technique can be assimilated without friction in the normal course of development. But suppose now that within such a system it suddenly becomes possible in one important industry — e.g. mining — to raise the efficiency of production by a revolutionary technical change in the process of production involving heavy capital investment. What will be the effects of this change in the situation?

At the beginning of our business period invested capital was 50 milliards, distributed over ten industries. This amount was not equally distributed, however, 9 milliards being invested in one industry — e.g. mining — and 41 milliards in the remaining industries, I-IX.

Average profits represent 6 per cent. of the invested capital, of which 2 per cent. are used by the entrepreneurs for consumption and 4 per cent. are re-invested. The workers number 5,000,000, 500,000 in each industry. The number of workers rises from year to year by $\frac{1}{2}$ per cent., that is to say from 5,000,000 to 5,075,000 within the period under consideration. The annual wage is 3,000 per head.

With the assumptions of an annual increase of $\frac{1}{2}$ per cent.

\[ ^1 \text{This scheme is more realistic than the system of a progressive static economy (see above, page 162).} \]
in the number of workers, and a 4 per cent. re-investment of capital every year, this example illustrates the gradual rise in the capital-labour ratio referred to above, and therefore the improvement in efficiency. As we are not assuming that compensation occurs in the separate industries through diminishing returns, prices should gradually fall. This is not shown in our example, in order not to complicate it unduly.\(^1\)

There are still two more assumptions in which we depart to some extent from the actual facts. First, we have not included expenditure on raw materials, semi-manufactured goods, etc., which of course represent a fraction of working capital. Variations in these costs are parallel to those in the number of workers, and hence in wages. Secondly, we have calculated profits on invested capital only, leaving those earned on working capital out of account. The amount of the working capital is in any case only a fraction of turnover, and depends on the rapidity of the turnover of goods. Even if we assume that working capital is turned over only four times a year, its quantity will be small relatively to the invested capital. And even if it were more considerable, its omission from our calculations would not falsify our example, because we are concerned with shifts in the field of invested capital and in the labour market, and these are unaffected by the fact that money is also spent on raw materials, etc., and that these factors also increase proportionately with the expansion of production. Moreover, the example also makes allowance for a normal increase in working capital, provided that the output of gold is elastic.

Let us suppose that the process develops as follows during the period considered, setting aside the effect of technical progress which will be discussed later.

\(^1\) To make our scheme correct, we have to assume that the supply of money increases exactly to the extent which will enable prices to remain unchanged. In the case of a metal currency, this will occur under the following conditions: in the first place, an increase in the original factors of production (workers, land, capital) must necessarily expand not only the production of goods, but also that of gold, since otherwise profits in the gold-mining industry will rise and will attract more labour and capital. Secondly, we have to assume that a slow rise in the capital intensity of production will lead to an improvement in efficiency in the finished goods industries. This process will take place in the gold-mining industry as well if there is free communication between all markets, so that the prices of commodities will also remain unchanged when efficiency increases.
We will confine our analysis to a given year and consider what changes a far-reaching improvement in technique in one branch of production will involve.

(a) The Case of Technical Improvements in Part of One Industry (Coal)

Let us suppose that a sudden improvement in methods of coal-getting in the coal-mining industry — that is to say, an improvement which can be introduced within the space of a year — takes place in one-fifth of the firms considered. This improvement requires a large investment of capital, say 600,000,000. The total capital in this fifth part of the mining industry will thus increase from 1,800 to 2,400 million, instead of from 1,800 to 1,872 million, as under normal conditions. This capital is not created by means of additional credit, but primarily by diversion from other uses. This will only be possible if the mine owners are prepared to remunerate this capital at a higher rate than the average one of 6 per cent. paid by the other firms. They will be in a position to do so because, thanks to the new technique, they will be able to produce the same amount of coal as before with one-third more capital and about half the former number of
workers. The diversion of capital — that is, of profits earned in the previous production period — into mining will involve a decline in the growth of other industries. This diversion of capital formed by savings into the dynamic firms in the mining industry will require only a small increase in the rate of interest in a state of equilibrium. As the growth of production in the other industries is only relatively slower, and as this slowing down is, as we shall see, in itself very slow, it will involve only a very slight error if we assume that there will be no change in the technical structure and relative efficiency of the invested capital and the labour employed. The situation under these simplified assumptions is described below.

If no improvement in technique had been introduced, the bill of costs for the fraction of the mining industry under consideration would have been as follows:

<table>
<thead>
<tr>
<th></th>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>2,400</td>
</tr>
<tr>
<td>Wage bill (number of workers, 101,500)</td>
<td>304.5</td>
</tr>
<tr>
<td>Amortisation</td>
<td>240</td>
</tr>
<tr>
<td>6 per cent. dividend on 2,400</td>
<td>144</td>
</tr>
<tr>
<td>Extra profits</td>
<td>54</td>
</tr>
<tr>
<td>Total value of production</td>
<td>604.02</td>
</tr>
</tbody>
</table>

The change in capital structure involved by the introduction of the new technique alters these figures as follows:

<table>
<thead>
<tr>
<th></th>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original capital</td>
<td>1,872</td>
</tr>
<tr>
<td>Wage bill (number of workers, 55,340)</td>
<td>166.02</td>
</tr>
<tr>
<td>Amortisation</td>
<td>187.2</td>
</tr>
<tr>
<td>6 per cent. dividend</td>
<td>112.32</td>
</tr>
<tr>
<td>Total value of production</td>
<td>604.02</td>
</tr>
</tbody>
</table>

The volume of output is the same as in the first case. The same quantity of coal is thus produced with 33 per cent. more capital than before, and 45 per cent. fewer workers, the result being an extra profit of 54,000,000 for the dynamic firms, or slightly over 2 per cent. if reckoned on the total capital. We are assuming that the demand for and price of coal will not change to any greater extent than it would have done without the change in technique. This is not quite the case in our example, but the variations resulting from the decline in the relative growth of the other industries is inconsiderable, and may be ignored.
(b) The Effects on the other Industries

The diversion of a capital of 600,000,000 into coal mining naturally affects the growth of the other industries. Supposing that no technical changes supervene, i.e. that all firms expand uniformly, but slightly more slowly than they would have done at the normal rate of investment, and that accordingly the volume of output is slowly enlarged, we obtain the results given below. The data apply to industries I to IX and to the four-fifths of the coal-mining industry in which technique has remained unchanged. The first of the following schemes for the "static" industries shows how the process of growth would normally proceed at an investment rate of 4 per cent. of fixed capital, whereas the subsequent one is constructed on the assumption that the investment due to technical improvements in the dynamic section of the coal-mining industry has restricted investment in the other industries.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>1,928</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original capital</td>
<td></td>
<td>48,200</td>
</tr>
<tr>
<td>New investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total capital</td>
<td></td>
<td>50,128</td>
</tr>
<tr>
<td>Wage bill (number of workers, 4,973,500)</td>
<td>14,920.5</td>
<td></td>
</tr>
<tr>
<td>Amortisation</td>
<td></td>
<td>5,012.8</td>
</tr>
<tr>
<td>6 per cent. interest on fixed capital</td>
<td>3,007.68</td>
<td></td>
</tr>
<tr>
<td>Total value of production</td>
<td>22,940.98</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>1,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original capital</td>
<td></td>
<td>48,200</td>
</tr>
<tr>
<td>New investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total capital</td>
<td></td>
<td>49,600</td>
</tr>
<tr>
<td>Wage bill (number of workers, 4,953,371)</td>
<td>14,860.113</td>
<td></td>
</tr>
<tr>
<td>Amortisation</td>
<td></td>
<td>4,960</td>
</tr>
<tr>
<td>6 per cent. interest on fixed capital</td>
<td>2,976</td>
<td></td>
</tr>
<tr>
<td>Total value of production</td>
<td>22,796.1</td>
<td></td>
</tr>
</tbody>
</table>

Thus the total value of production is 144.88 million less in the second example than in the first, but still about 384 million higher than in the previous year.

We are assuming that in both cases the old (static) under-
takings bring their former equipment of capital and labour over from the previous period to that under consideration here, and can continue to operate at the same rate of profit. On the other hand, the decline in the growth of capital has involved a corresponding reduction in the capacity to offer employment; 20,129 fewer new workers have been engaged than under the normal rate of investment of 4 per cent. of fixed capital.

Comparing these two examples, we see that as a result of the decline in investment due to the flow of capital into the more profitable sector of industry in group X, production and the number of workers are reduced, although only relatively. The scheme of production in the previous year was as follows:

<table>
<thead>
<tr>
<th></th>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original capital</td>
<td>46,346</td>
</tr>
<tr>
<td>Investment</td>
<td>1,853.84</td>
</tr>
<tr>
<td>Total capital</td>
<td>48,200</td>
</tr>
<tr>
<td>Wage bill (number of workers, 4,900,000)</td>
<td>14,700</td>
</tr>
<tr>
<td>Amortisation</td>
<td>4,820</td>
</tr>
<tr>
<td>6 per cent. interest on invested capital</td>
<td>2,892</td>
</tr>
<tr>
<td><strong>Total value of production</strong></td>
<td><strong>22,412</strong></td>
</tr>
</tbody>
</table>

Thus at the normal rate of development the value of the total product would have risen from 22,412 to 22,940.98 million, i.e. by 2.33 per cent.; but owing to the transfer of capital to the other branch it actually rose only by 1.7 per cent. The normal growth of production has therefore declined by about 25 per cent.; only 75 per cent. of the usual expansion has taken place, with the result that only about 70 per cent. of the normal number of additional workers can find employment.

A closer scrutiny of the changes in these spheres shows that the decline in turnover is constituted as follows:

<table>
<thead>
<tr>
<th></th>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative decline in wage bill</td>
<td>60.4</td>
</tr>
<tr>
<td>Relative decline in amortisation</td>
<td>52.8</td>
</tr>
<tr>
<td>Relative decline in profits</td>
<td>31.68</td>
</tr>
<tr>
<td><strong>144.88</strong></td>
<td></td>
</tr>
</tbody>
</table>

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1 It might be supposed that this would lead to the adoption of less highly capitalised methods of production, but as a rule the existing technique will be so productive that such a course will be impracticable. In so far as it is followed, however (e.g. by overtime, which is only possible within specific limits), secondary unemployment can be averted to some extent.
From the standpoint of the economy as a whole, as fewer workers are now employed than in our first example (though still more than in the previous year), there is a falling off of the wage bill by 60.4 million in the second normal year as compared with the first example. On the other hand, however, the reduction in amortisation quotas resulting in this section from the relative decline in investment will be made up in the dynamic section of the mining industry owing to the increased investment which has taken place there, while the amount of the profits earned in the latter section will be at least as high as those lost by the static firms. Thus these two items do not disappear, but are merely transferred from one sphere of production to another (they will appear in the books of the dynamic mines as a result of the increased efficiency of their labour and at the expense of their wage bill). In the static industries there will now be a relative shrinkage in production due to the dwindling stream of inflowing capital and the decline in the progressive increase in employment.

As the output of the dynamic mines remains the same in volume and value as it would have been in the normal course of development (with an abnormally big change in the relative shares of capital and wages), there will be no decline in the product of the community on this account either. But in practice the product of the community will in fact usually increase in volume in consequence of improvements in technique (see below, p. 177).

Organic structure is slightly lower in our second example than in the first, because owing to the partial withdrawal of capital the growth of capital, which implies a higher organic structure, is less marked. To some extent this also falsifies the measurement of the reduction in amortisation quotas and profits relatively to those in the first example, but the quantities are so small that they may safely be ignored. If we were to assume that total efficiency was lowered by the slowing down of the rate of increase of capital, the result would be a relatively steeper fall in output and, if prices remained unchanged, in its value — a result which would merely serve to confirm our argument. But this point is left out of consideration here, like that of the possibility of a further evolution towards less capitalistic forms of production by employing the now superfluous workers in the static industries. The reduction in output will not lead here to a rise in prices, and hence to additional profits and keener competition for capital, because there will be a decline in the demand for the product corresponding to the reduction in the wage bill and in profits.
C. THE COMPOSITE EFFECT OF THE LABOUR-SAVING DEVICES

But although the volume of output remains constant extensive changes take place within this subsection. Out of a total turnover of 604 million, 52.8 million more than before are claimed by amortisation. Supposing that profit on the newly invested capital of 600 million is 15 per cent., profits in this industry will rise by 85.68 million as compared with the normal increase as a result of the investment of a larger capital. These two figures correspond exactly to the reduction in the wage bill in this subsection of the industry.

As a result, the number of workers who would have been employed in the dynamic firms in the normal course of development is now reduced to 55,340.

Considering the national economy as a whole, this means a reduction of 199 million in total wages, or a fall in employment of 66,289 as compared with the normal, represented by the second normal year. The total number of workers nevertheless rises from 5 million to 5,008,711. Thus 1.3 per cent. of unemployment arises out of the fact that about 66,000 of the older or less efficient workers lose their jobs, while in all probability all the 75,000 extra workers engaged are new or young workers. The decline in the national dividend is, however, smaller than the decline in the wage bill. This is due to a number of changes as compared with the second normal year, which may be summarised as follows:

<table>
<thead>
<tr>
<th>Groups I-X</th>
<th>Group X</th>
<th>All Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decline in wages</td>
<td>-60.4</td>
<td>-138.48</td>
</tr>
<tr>
<td>Amortisation</td>
<td>-52.8</td>
<td>+52.8</td>
</tr>
<tr>
<td>Interest and profits</td>
<td>-31.68</td>
<td>+85.68</td>
</tr>
<tr>
<td><strong>Total decline</strong></td>
<td>-144.88</td>
<td></td>
</tr>
</tbody>
</table>

Thus output in the whole economy is 23,400.12, whereas in the second normal year it would have been 23,545, making a difference of 144.88. This result can also be expressed by saying that technical progress prevents the creation of some firms which would otherwise have come into being. These groups then expand more slowly than before. In the dynamic firms, on the other hand, the efficiency of labour rises steeply, so that a much
smaller number of workers is required to produce an output the proceeds of which will be sufficient to cover both the amortisation of a larger capital and also a higher profit on the newly invested capital, whereas in our example the values created in the dynamic firms do not increase. An important factor in the whole situation is that the total income also dwindles because the extra amortisation allowances required in the dynamic firms, and that part of the profits of these firms which corresponds to normal profits, would otherwise have figured in the books of the static firms. Hence, from the standpoint of the whole economy, there is no increase in output to correspond to this fraction of the turnover of the dynamic firms, and this fraction of their returns can only be obtained if, and in so far as, the wage bill of the dynamic firms is reduced. There is thus a decline in the national dividend to this extent because if no diversion of capital had taken place not only would these amortisation allowances and profits have been earned in the static firms, but the wages in what are now the dynamic firms would also have been earned.

The loss of wages throughout the economy is greater than the decline in the national income, the difference corresponding exactly to the rise in the profits earned by the dynamic firms of group X as a result of their technical improvements. This example shows what important effects can be produced in an economic system by relatively small initial variations (in this case an increase of 54 millions in profits within a national dividend of over 22 milliards). Conversely, it also shows how little is needed to prevent comparatively serious disturbances. For we can also express our data by saying that the wage bill has fallen relatively by 199 million, that 66,239 workers can no longer find employment, and that a big transfer of capital has taken place "in order" to enable an extra profit of 54 million to be earned in the economic system. This is only 1.8 per cent. of the total interest obtained in the previous year, and only a little over 0.1 per cent. calculated on the national capital.

From the entrepreneur's standpoint, the same effect can be obtained through a very small reduction in all wages, amounting to only 0.36 per cent. But the wage cut would have been applied to the dynamic firms alone and would therefore have amounted to 46 per cent. of wages, which is clearly impracticable. Thus in the case of important technical improvements, wage reductions can never act as an effective check. If we again refer
to the previous tables, we shall see that the output of coal per worker rises very steeply indeed in the dynamic firms, from 6,000 to 11,000 per head (from 6,000 to about 6,600 if calculated over the whole coal-mining industry). Such a rise in *per capita* output is by no means unprecedented in the history of industrialisation, for instance in the textile industry. But as in this case there has been a very substantial increase in capital, the increase in efficiency is very largely claimed for amortisation. When technical progress is rapid and requires a large capital outlay, amortisation becomes a very heavy charge, quite apart from the fact that the "moral" wear and tear is much greater.

As already stated, the situation described here differs from reality in two respects. Wages remain unchanged, and prices also. Any reduction in wages must be a *consequence* of the changes we have been considering. Any change in prices would be on a very small scale, because the output also declines, thus the possibility of a fall in prices can safely be disregarded. Nor have any great changes taken place in the relative size of the different industries. The slowing down of the rate of expansion in the coal-mining industry in our example is practically the same as in the other branches of production. As the rate of investment has fallen in four-fifths of the coal-mining industry as well as in the other branches of production, the increase in output in only 20 per cent. of coalmines is practically "normal". If the average increase in total production were 3 per cent., for instance, the effect of technical improvements in a section of the coal-mining industry, under our assumptions, would be to reduce expansion by 0.75 per cent. in all industries, i.e. from 3 per cent. to 2.25 per cent., while leaving the rate of expansion in the coal-mining industry at 2.4 per cent. We may safely neglect the effects of these variations in relative rates of expansion on prices.

It may seem improbable to some readers that output does not expand in the dynamic firms, and that the only result of technical improvements is to substitute machines for workers without enlarging the quantity of the product. We will therefore also discuss the possibility of an increase in output (p. 177). Nevertheless cases of the kind just considered do actually occur, and some of the facts are covered by our example. It may be recalled, for instance, that self-acting spindles were introduced before the invention of mechanical looms, so that the number of new spindles installed depended on the number of hand
weavers available, and the production of yarn could only be expanded proportionately to the efficiency of hand looms or to the supply of skilled weavers. Hence the introduction of self-acting mules led to the displacement of spinners rather than to an increase in output, which only began to expand appreciably with the introduction of mechanical looms.

The question arises whether, under these circumstances, a new equilibrium will be created, or whether it will again be upset by further changes. If the dynamic firms in group X resume their progress at the normal rate, expansion in all branches will remain approximately the same and the sole lasting consequence will be a displacement of workers (more accurately described as a failure to absorb the major part of one year's contingent of new workers) on the one side, and increased profits for the dynamic firms on the other. The rise in profits in the mining industry will then lead to their investment in the other industries. But the sums involved are small relatively to the total profits in the separate industries. Under our assumptions, therefore, technical progress would have as its result unemployment of long duration, caused on the one hand by the displacement of labour in the dynamic mining undertakings which have adopted more capitalistic methods of production, and on the other by the relative decline in the employment capacity of all other industries. The assumption that wages will remain unchanged only applies when the workers affected by the labour-saving improvements are skilled workers and labour is strongly enough organised to be able to maintain wages at their former rate. If competition between the workers is free, a reduction in wages will be inevitable. The effects of this will be discussed later.

The Case of Increasing Output considered

As a rule the introduction of labour-saving technical improvements will be coupled with an increase in the output of the dynamic firms. Where this is the case it will be impossible to maintain the former prices, and other disturbances will arise over and above those already considered.

Let us suppose that the dynamic producers increase their output by 20 per cent. above the rate shown by our scheme of normal development, with a slightly larger number of workers
but with the same amount of new capital. As compared with our previous example, and under the same assumptions, the data for the second year in the dynamic firms will be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Previous assumptions</th>
<th>Present assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invested capital</td>
<td>2,400</td>
<td>2,400</td>
</tr>
<tr>
<td>Amortisation</td>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td>6 per cent. interest on invested capital</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Wage bill</td>
<td>166.02</td>
<td>199.52</td>
</tr>
<tr>
<td>(Number of workers</td>
<td>55,340</td>
<td>66,508</td>
</tr>
<tr>
<td>Extra profit</td>
<td>54</td>
<td>141.60</td>
</tr>
<tr>
<td>Total value of production</td>
<td>604.02</td>
<td>725.12</td>
</tr>
</tbody>
</table>

In this new scheme the capital-labour ratio is slightly lower, and with prices remaining unchanged the economic yield of the new investments will be very much higher, the extra profit amounting to about 25 per cent. on the new capital. Moreover, the number of workers in the dynamic firms will not fall so sharply. On the other hand, however, the competitive position of the static firms will be worsened. The assumption made in our example that the price of coal will remain unchanged cannot be maintained; prices will now have to fall, because the production of coal has expanded relatively faster than that of other products, and because the sharp fall in costs in the dynamic firms has made a reduction in prices possible. This fall in prices will necessarily lead to a restriction of production in the static firms.

The increase in the output of the dynamic firms assumed above represents 20 per cent. above the normal rate of development, and as the dynamic firms account for 20 per cent. of the whole output of coal the expansion in total output is 4 per cent. Hence, with unit elasticity (which is too favourable in the case of coal) the price of coal must fall by about 4 per cent.

The total value of the production of the dynamic firms will then be about 696 million. The extra profit will be 113 million instead of 141 million.

In the static firms prices will also fall by 4 per cent. The result of this will depend on the way in which production is organised. If costs of production vary the result would be the elimination of firms which produce 4 per cent. of the total output.

Strictly speaking, with unit elasticity and a 4 per cent. rise
in output, prices would have to fall by 3.9 per cent. This would reduce the returns of the static firms (2,416) by 94, and those of the dynamic firms (725) by 28, so that the total yield would be $3,141 - 122 = 3,019$, or the same as if output had remained unchanged.

But this fall in prices is bound to affect output also. The marginal mines of the static producers will now only be able to work at a loss, and will therefore close down. Under the assumption of varying costs made above, output will decline by 4 per cent., and consequently the returns of the static firms (prices remaining unchanged) will fall from 2,322 to 2,229; while if the dynamic firms receive the same price for their products their returns will remain unchanged at 697, and the total yield will now be 2,926, or 96 less than with unit elasticity. Prices will therefore have to rise again by 3.2 per cent. This process will repeat itself, and equilibrium will ultimately be restored by a fall of 2.15 per cent. in both output and prices in the static firms, making the returns of the static firms about 2,312, those of the dynamic firms 709, and total returns 3,021, as before.

It is true that there will now be a fraction, amounting here to 2 per cent., of the total capital lying dead in the static firms, a position which would not arise if total output remained the same. Moreover, about 2 per cent. of the workers, or 8,000, will be left without employment, or probably even more, because the marginal firms are those in which the proportion of labour employed is highest.

Thus the amount of displacement in this new example is about the same as under our previous assumptions, because we have assumed a slower decline in the number of workers in the dynamic firms. In the static firms less money is now available for amortisation and the remuneration of capital, and consequently more marginal undertakings will be forced off the market. Our example is so constructed, however, that there is no loss of purchasing power. The reduction in the sums allotted to wages, amortisation and profits in the static firms, which amounts to about 104 million as compared with the second year of normal development, is offset by the fact that wages have risen by about 33 million and profits by about 71 million, as compared with the first example, in the dynamic firms. This sum of 104 million, which now appears in the dynamic firms, would otherwise have appeared in the static firms in the second year of
development at the normal rate, 47 million in the form of wages, 46 million as amortisation, and 27 million as profits.

This change can also be expressed by saying that in this second case the profits of the dynamic firms, due to the transfer of profits and amortisation allowances from the static firms, have risen very steeply. Here, therefore, purchasing power is fully maintained in spite of a reduced wage bill with a corresponding amount of unemployment.

The position of production as a whole is also somewhat more favourable than in the first case. The sum of 1,400 million available for investment in the static undertakings in all industries is now invested wholly in industries I to IX, because the static firms in group X are unable to expand. In the first example 230 million went to the static firms in the mining industry, so that the capital equipment of the firms in groups I to IX is now improved by this amount without, however, reaching the normal investment rate of 1,640 millions. The total result will thus be approximately the same as in the first case.

The Destruction of Capital

But the chief difference between the second example and the first lies not in any substantial change in the volume of unemployment, but in the destruction of capital and the consequent decline in the profits of the static firms. If the demand of the dynamic producers, financed out of their profits, reaches the market at once, and immediately replaces that of the static producers, no further disturbance will arise. If not, the position will be different. The size of the profits must not blind us to the fact that the reduction in employment capacity can only be made good through the later effects of these investments, because a part of the extra profits has replaced the profits and amortisation allowances of the static firms. To this extent the extra demand for capital goods, due to the higher profits being earned by the dynamic producers is merely substituted for a similar demand for capital which would have arisen from the static firms. In so far as the extra demand for capital from the dynamic firms arises from their wage reductions the effect on the labour market depends on how the labour required as a result of this extra investment is recruited (on this point see p. 181, below). But in any case it is important to remember that a part of the extra profits
made by the dynamic firms cannot lead to an extra demand for labour.

It may perhaps be objected that the value of the new firms has, in fact, increased proportionately. But this added value, which, estimating the extra profits at a total of 127 million and the rate of interest at 6 per cent., will amount to 2,100 million, i.e. considerably more than the capital destroyed in the static firms producing coal (this will be only about 150 million, or 2 per cent. of their total capital, as compared with the second normal year, but the decline in accumulation in the other industries, amounting to 528 million, has also to be taken into account, making a total of 680 million), is not capital in the sense of accumulated and invested purchasing power, but capitalised profits, which do not represent additional employment capacity because they are merely the corollary of a more capitalistic structure of production. Hence these new values afford no compensation for the destruction of other capital values so far as the consequent loss of employment capacity is concerned. It is true that they can be, and often are, used as security for obtaining credit. But this will lead, under our assumptions, to a process of credit expansion which may indeed rapidly absorb the temporary unemployment created, but only at the cost of laying up another store of unemployment for subsequent years through an over-rapid expansion of the productive system.

D. THE PROCESS OF COMPENSATION

Various Possibilities

The process of compensation is set in motion by changes in the sphere of production, the results of which are invariably complex. We will therefore discuss in the following pages only the possibilities of compensation which may arise in connection with displacement due to technical improvements.

In so far as the total purchasing power of the community remains unchanged\(^1\) and purchasing power is merely transferred from certain income groups to others, the following possibilities arise:

\(^1\) That, however, is not the case under the above conditions (p. 174).
(1) The groups that now receive this new income, who in our example were also in receipt of income previously, may spend the extra amount on exactly those goods on which it was previously spent. In this case the demand for goods will be unchanged, and only the person of the consumer will alter. Equilibrium is immediately restored by eliminating the former consumers of these goods, who in the process we have described are also ejected from the labour market. The same amount of real income is thus concentrated in a smaller number of hands, with a slight fall in the velocity of circulation.

(2) The groups that receive the extra income spend it on consumption goods, but not immediately, so that there is a temporary falling off in consumption. If this interval is not too long, it can be bridged by producing for stock, but in any case there will be a corresponding decline in employment if the falling off in consumption is not offset by a later increase in consumption. There will then be a further slowing down in the velocity of circulation which will involve more unemployment over and above the original displacement.

(3) The groups that receive the extra income and do not spend it on consumption goods, but invest it, thus create sooner or later a demand for extra capital goods. This will usually mean a shift in demand as compared with the situation under (1) and (2). Here the ultimate result will largely depend on which workers are employed in producing the new capital goods. If the displaced workers are so employed, compensation will occur to this extent. This assumes, however, that the extra profits are accumulated simultaneously with the displacement of the workers, and are immediately transformed into an additional demand for capital goods. In practice, of course, some time will elapse before the new investments become effective, so that even in the most favourable hypothesis temporary unemployment is inevitable. If workers other than the displaced workers are employed on the production of the capital goods, e.g. those who were thrown out of employment as the result of the disappearance of the demand of the displaced workers, there will be no compensation. These various possibilities correspond to different velocities of circulation.

(4) The saving in wages may also be turned into extra income for the consumers by means of a reduction in prices, and may then be used in any of the ways described under (1), (2)
and (3), the most probable being (1). In the case of price reductions, however, an expansion of demand has also to be taken into account. In practice it will usually be impossible to ascertain anything more precise than that the economy in costs has led to an increase in profits or to a lowering of prices.

1. Compensation by Investing Profits
   (Wages Remaining Unchanged)

(a) Increasing Profits

We will begin by considering only the first step, i.e. displacement and the possibility of compensation, *ceteris paribus* — that is to say, with wages remaining unchanged. The effect of wage reductions will be considered later, in pursuance of our previous lines of argument.

We will now consider one by one the various possibilities of reabsorbing the unemployed which may arise as a result of displacement.

It may be recalled in the first place that the new investments necessary for the introduction of labour-saving methods do not in themselves involve any change in the volume of employment if they are assumed to be financed by genuine savings. Hence we have here only to consider the utilisation of the extra profits due to the technical improvements.

If the rationalised methods are successful, there will be a saving in wages amounting to more than the sum necessary for the remuneration and amortisation of the newly invested capital. What was formerly labour income will therefore become capital income and profits. As the average income from capital would have been earned in other firms had there been no rationalisation, there will be a decline in the national dividend, as already stated above. The theory that the total quantity of purchasing power is indestructible therefore applies only within the industry concerned, and not to the whole economy. But, apart from this, we now have to examine how the rise in profits affects the volume of employment.

The part of the economy in wages which is transformed into additional profit can also be determined quantitatively. In our first example the wage bill fell by 201 millions. 63 millions of this disappear from industries I to IX. In our scheme these 63 millions do not represent an actual loss, but a decline in
expansion, since the wage bill for the second year is less than that for the second year of normal development by this amount. Part of the new working capital which has been formed meanwhile during the progressive expansion of all the other data is now set free, amounting to about 16 millions under the assumption of a fourfold annual turnover\(^1\). This working capital can now be invested, a point which will be considered later (p. 188). The second fraction of the 201 million consists of about 85 millions in profits and amortisation allowances, transferred from groups I-IX to group X. These 85 millions would have been earned in the "static" industries if production had not been deflected into the dynamic enterprises. Therefore the total purchasing power of the economic system is reduced by about 85 millions although the purchasing power in the dynamic industries did not shrink. But this sum of 85 millions is used to buy products which are already on the market, having been produced in the normal course of development during the previous production period. As a rule these will be capital goods. Hence only the third fraction of the saving in wages, amounting to 54 millions, passes out of the hands of the workers into those of the entrepreneurs or consumers. In other words, only a quarter of the amount by which the wage bill is reduced appears on the market to offset the saving in wages (always remembering that this reduction is only relative).

It is therefore an illusion to suppose that there is absolutely no decline in purchasing power throughout the economic system. This mistaken view arises out of the fact that in the dynamic industry, and under our assumptions, total purchasing power remains unchanged; but this in no way proves that total purchasing power within the whole system must also be unaffected\(^2\). If the decline in the growth of capital in groups I-IX leads to a loss of wages, the national dividend will be reduced to this extent. A secondary displacement of workers will only be avoided if production in groups I-IX can be expanded at the normal tempo through the utilisation of unused capacity, but this

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\(^1\) If the normal rate of expansion can be maintained by having recourse to unused capacity, the wage bill in industries I-IX can also rise at the normal rate, and in this case the reduction of 63 millions in the wage bill need not take place. But under our assumptions expansion by recourse to unused capacity will only be possible within narrow limits.

\(^2\) It is for this reason that we have constantly emphasised the fact that purchasing power within the industry concerned remains constant.
is only possible to a restricted extent. Sooner or later, under our assumptions, the relative decline in the accumulation of capital will be bound to lead to secondary unemployment. When this takes place, working capital will be released in groups I-IX, most of which will be invested in order to make good the loss of capital. Assuming a fourfold turnover of working capital, about a quarter of the saving in wages will then be available for investment. The compensatory effect will depend on the way in which this released capital is used (see below), but in any case it cannot benefit more than a quarter of the workers displaced by the secondary unemployment.

In the dynamic firms the extra investments will be formed by the capital withdrawn from the static industries, and as the interest and amortisation on this capital would otherwise have been paid by the static firms, they do not represent additional income from the standpoint of the whole economy. As the sums necessary for interest and amortisation can only be obtained by means of a corresponding reduction in the wage bill, if output and prices remain unchanged the national dividend must necessarily fall to this extent. The entrepreneurs' income will be substituted for the workers' income in the economic system as a whole only in so far as extra profits are earned. In the dynamic firms, however, in contrast to the static firms, these changes will not release working capital, because the saving in wages corresponds to the other items (interest, amortisation, and extra profits), and accordingly cannot also take the form of purchasing power which would be available to the entrepreneur as released working capital. If the saving in wages leads to investment, the velocity of circulation will be somewhat reduced.

Under our assumptions, which include rigidity of wages, the position at the end of the investment period would be as follows:

<table>
<thead>
<tr>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage economy in dynamic firms</td>
</tr>
<tr>
<td>Amount allotted to interest and amortisation</td>
</tr>
<tr>
<td>Extra profits forming compensation fund</td>
</tr>
</tbody>
</table>

If secondary unemployment supervenes and there is a loss of wages amounting to 63 millions, the decline in income will be 147 millions, whereas only 54 millions are available for compensation.

Only if the static undertakings can expand their output at
the normal rate by having recourse to their reserves of capacity will this sum of 63 millions continue to be paid as wages in the static industries. In this case, even the equivalent of the share of interest and amortisation on the capital which has not been invested will also be obtained, the 84 millions which would have appeared in the normal process of expansion as interest and amortisation on investments will then also accrue to the entrepreneur and may lead to compensation. But the expansion of production in the static firms without investment is confined within narrow limits.

(b) *The Spending of Profits and its Compensating Effects*

We must now examine the ways in which the entrepreneurs can spend their extra profits. They may either hoard them, consume them, or invest them, or, finally, use them to reduce prices.

(a) If the entrepreneurs hoard their extra profits, no compensation will be possible. This is indisputable, and it may even be safely assumed that in this case the absence of investment will lead to a further secondary wave of unemployment.

(b) If the entrepreneurs consume their extra profits, a good deal will depend on the nature of their consumption. If they buy the same products as were previously bought by their former workers, the consumers' demand represented by the extra profits will simply replace that of the discharged workers, and they will force these workers out of the circle of exchange without upsetting the equilibrium.

Supposing that the entrepreneurs spend the whole amount they have saved on wages on securing extra personal services, and that they could employ the dismissed workers as servants, gardeners, chauffeurs, cooks, etc., a corresponding number of the displaced workers could be reabsorbed at once, in contrast to the case discussed above. This is an alternative method of providing the greatest possible compensation for the permanent displacement of workers. But even under these very favourable circumstances, only 25 per cent. of the displaced workers would be re-employed in our example (if wages remained unchanged).

There is also the question of what will happen if the entrepreneurs consume products other than those formerly consumed by their workers. Here we may return to our previous line of argument and follow it a step further. In order to manufacture
the products now required by the entrepreneurs, different
workers must, of course, be employed from those who were
actually displaced. The extent to which this demand can offset
the unemployment due to the labour-saving inventions will
depend on whence this labour comes.

If unemployed workers belonging to any other occupation
are engaged, e.g. unemployed building workers, this will merely
shift unemployment from one industry to another to the extent
of the transfer. As there is no reason to suppose that the newly
engaged workers will buy different products from the displaced
workers, secondary unemployment will also be averted. In so
far as this is the case, therefore, the unemployment due to tech-
nical progress on the one hand will be offset by a reduction in
unemployment on the other — that is to say, compensation will
take place.

As we have already seen, however, this form of compensa-
tion can only bring about the reabsorption of a fraction of the
unemployed. A further restrictive factor will intervene, because
not all the sum saved on wages will again be transferred into
wages. That part of the money stream which flows into profits,
amortisation and productive materials, part of the price of which
again becomes profit and amortisation, will only later be trans-
formed into wages. The time-lag will be short if these profits
and amortisation allowances are reinvested at once, and much
longer if, for instance, they are used to pay off debts and the
granting of fresh credits is delayed. But even in the most favour-
able hypothesis only part of the saving in wages will be turned
into wages again immediately, and will thus be able to exercise
its compensatory effects.

These compensatory effects will be still slighter if the further
consequences of displacement have already led to a secondary
wave of unemployment, and if only the workers displaced by
this secondary process are reabsorbed. Suppose, for instance,
that building workers were employed on building dwellings for
the workers who are now displaced, or textile workers, and that
these are now able to resume work for the entrepreneurs, this
will offset the secondary unemployment. The workers who are
now re-employed will indeed also form part of an economic
circle, which will thus be re-established, but this will not pro-
vide fresh employment for the workers who were originally
displaced. For the re-employed workers were also employed
before, so that it is only the secondary and tertiary unemployment which is compensated in this way. It may be argued that if the secondary unemployment is compensated in all its phases, primary employment too must disappear, because directly or indirectly these are the categories of workers who formerly consumed the products of the displaced workers. But this argument ignores the fact that, although these secondarily unemployed workers who have now found employment again will indeed buy goods which were previously produced by the primarily displaced workers, these goods are now produced by a smaller number of workers. Hence, if prices, and therefore demand, remain unchanged\(^1\), the compensatory process will not make room for the displaced workers, because the goods they produce are already on the market and there is no fresh demand for their services. Here again, therefore, the economic circle is closed and the workers originally displaced are left outside.

The difference between this situation and the change in demand which follows a shift in the scale of wants lies in the fact that, in this case, displacement cuts out a whole series of exchanges without leading to any increased demand for the products of the displaced workers, in spite of the transfer of their former purchasing power to other persons. Inventions, on the other hand, provided that they meet a need of the consumers, do not make a breach in the chain of demand; on the contrary, the demand of the employees and workers who produce the new product is already present on the market even before any shrinkage takes place in the demand for other goods of the subsequent purchasers of the new product. The difference between the two processes is also expressed by the fact that in the second case the velocity of circulation of money rises whereas in the first case it falls\(^2\).

If technical improvements lead to displacement in a number of industries at the same time and practically to the same extent, the position of the displaced workers will merely become still

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\(^1\) This is a necessary condition for the existence of the returns, the utilisation of which is here under discussion.

\(^2\) A rise in the number of workers employed will only fail to result from inventions if there are no unemployed workers at all within the whole system, or if, owing to a shortage of labour in some categories, workers are transferred to the new industry from other employments. In this case, \textit{ceteris paribus}, production in the other industries will fall. But even this will not lead to disturbances, since there will have been no reduction in the national dividend, but merely a redistribution of labour and incomes.
more difficult. The transfer of purchasing power will then probably, only succeed in offsetting the secondary unemployment. This in itself will be a considerable achievement, because a general reduction of staffs leads to secondary unemployment on a large scale. It is true that if displacement is general the velocity of circulation of money will be very considerably reduced, but this alone will not suffice automatically to bring about a revival of employment (through the pressure of "idle" capital) because within wide bounds the velocity of circulation is rather a function of the volume of employment than the reverse.

(c) The Investment of Working Capital and its Compensating Effects

Nor will the investment of the working capital which is now released, as described above (page 183), appreciably affect the general result. Of the two fractions of working capital concerned, the smaller, amounting to 63 millions, belongs to industries I-IX. In the second year of normal development, corresponding to our assumptions, the sum necessary to increase the wage bill would also have been provided out of the returns for the first year. Even if only part of the profits earned in the static firms are now invested in the dynamic firms, the extra working capital derived from the previous year's production will still be available to the static firm, and as these now have no use for it, it will be available for investment. We must assume, however, that this working capital is derived from the sale of the products manufactured in the first year, and this will only be the case if the market for these products is not destroyed by the subsequent changes, so that they can still be sold at the old prices. But this working capital, when invested, will by no means provide employment for as many workers as before, because working capital circulates during the business period, whereas once it has been invested it no longer returns into the hands of the entrepre-

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1 It is even doubtful whether working capital is released at all in cases where, as in the industries I-IX production does not decrease, but only increases at a diminishing rate; under our suppositions, namely, the increase in working capital is formed in the process of production and it is a part of the profit — not appearing in our scheme — used for paying the wages of additional workers and additional raw material. Owing to the slower increase in production in I-IX the part of working capital which would be necessary for the "normal" growth of production is not earned and thus it cannot be released.
neurs. Supposing that the working capital is normally turned over four times a year, only 25 per cent. of the secondary unemployment will be counterbalanced even in the most favourable hypothesis, and that only if investment takes place at once, an assumption which we are hardly justified in making.

Thus the extent to which the displaced workers can be reabsorbed into permanent employment through the investment of working capital depends on the organic structure of the separate industries. In our example working capital represents between one-tenth and one-twelfth of invested capital, so that on an average about 10 per cent. of the workers displaced by the secondary process will be able to find re-employment. (This applies to the period following the investment; during the period of investment itself the demand for labour would be considerably higher.) Thus compensation will offset only a fraction of the secondary unemployment, and what is more it will last only so long as fresh employment continues to be created by the investment of working capital. In the following year the working capital corresponding to this secondary unemployment in the normal process of expansion will of course no longer be formed, and accordingly, under our present assumptions, nine-tenths of the secondarily displaced workers will remain permanently out of work. We have already seen that no working capital will be released in the dynamic firms; it will simply be transformed into profits.

(d) The Investment of Extra Profits and its Compensating Effects

If the entrepreneurs invest their extra profits, the result will not be very different. The profits available to the economic system, which are all we are concerned with here, and which will constantly be accruing, amount to only 54 millions. The position will be most favourable if the whole of this sum can be invested at once. If idle capital is also available in the capital goods industries which will enable investment to take place at once, while the building up of reserves is postponed until later,

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1 If the investment of this capital leads to the formation of circulating capital elsewhere, e.g. in the capital goods industries, and the volume of investment thus continues to expand, a permanent expansion in the demand for labour may be assumed in these industries. But it is impossible to estimate the actual extent to which this will take place.
and if further workers displaced from the dynamic firms can be employed in the capital goods industries, a fraction of the displaced workers corresponding to the extra profits will again be reabsorbed.

If, however, the technical improvements mainly affect the finished goods industries, as in fact was largely the case during the last period of rationalisation, workers will be principally displaced from the finished goods industries, and these are precisely the workers who can least easily find alternative employment in the capital goods industries. On the other hand, it will scarcely be possible to absorb workers from the other consumption goods industries who have been thrown out of work by the secondary wave of unemployment; it is much more probable that workers in the capital goods industries will benefit by the employment created by the new investments. These workers will replace the displaced workers, and will be able to absorb the same quantity of goods as the latter consumed before. To this extent, therefore, there will be real compensation; but, as already mentioned, it will affect only part of the displaced workers, because some of the economy in wages or the lost wages have been turned into extra profits. Moreover, the extent of the possible compensation will be further restricted by the following circumstances; the demand of the displaced workers also involved the production of capital goods, and in so far as the entrepreneurs have inherited this demand, only the same amount of capital goods as before are required. Hence the workers employed on their manufacture retain their employment, and this represents a narrowing of the economic circle, ultimately involving the final exclusion of some of its links. The same applies to the raw materials used to manufacture the consumption goods formerly consumed by the displaced workers, which are now used to manufacture capital goods. In this connection it is particularly important to remember that the displacement of workers also leads to a reduction in the demand for houses. The workers who would normally be employed in the building industry can now be used to produce the capital goods for which a demand has arisen as a result of the substitution of profits for wages. But this will only stem the secondary wave of unemployment. If the economic circle is joined up in this way, there is no hope of any

1 This eventuality is discussed above, p. 187.
compensation for primary unemployment from this source. The velocity of circulation will indeed have fallen, but this is not enough in itself automatically to set in motion processes which will restore employment to its former level. Hence much depends on the direction of the stream of purchasing power. But it is at least certain that displacement can be counterbalanced only to the extent that the extra profits are invested, and not always even to this extent.

We may now try to estimate the degree of compensation which will take place under our assumptions of a given rate of saving, which determines the accumulation of capital, and of wages and prices remaining unchanged. The displacement of labour is counterbalanced by the investment of an additional 54 millions of capital. Supposing that this sum is immediately turned into wages, it would enable 40 per cent. of the workers displaced in group X to be re-employed. Account must also be taken of the 10 per cent. reduction of the secondary unemployment in industries I-IX resulting from the investment of the released working capital, so that in all, about 33 or at the most 40 per cent. of the displaced workers can be reabsorbed. The working capital can only be invested once, so that in the subsequent years, when only the extra profits of the dynamic firms are normally invested, the amount of compensation will be less. This extra investment will then only gradually be able to make any real impression on unemployment. Moreover, it will take a long time, as large investments of capital have to be planned ahead and prepared for.

2. Compensation by Reduction of Prices

So far we have been assuming that prices remain constant. Let us now take a step nearer reality and suppose that prices fall as a result of the reduction in costs. We may assume that there will be a fall in prices even if the dynamic producers have a monopoly which should theoretically enable them to maintain them unchanged, because even so they will be afraid that the high margin of profits will attract other producers who will spoil their market. Under free competition prices will fall to a level at which the extra profits will be entirely eliminated. There are two marginal cases to be distinguished where free competition

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1 Some of the effects of price lowering, which an increase in output will always involve, were discussed above, p. 177.
leads to a fall in prices. In the first place, the introduction of a labour-saving invention may merely reduce costs without increasing output. Output can then only be increased by setting up new firms (with the same organic structure as the dynamic firms). This will require additional capital, and the rate of growth in the static industries will therefore be slowed down still further. Moreover, the extra profits will be eliminated by competition. As the new firms are more highly capitalised than the static firms, their demand for labour will be smaller than the extra secondary unemployment which must result from the decline in the growth of the static industries. In this case therefore the situation would be particularly unfavourable.

There is another alternative however: the labour-saving technical invention, while reducing the amount of labour required, may also substantially increase output. There will then be an immediate fall in prices, and the extra profit will benefit the consumer. In this case no further compensation may be expected from profits because there are neither any extra profits available for investment, nor any increase in the payment for labour. If as a result of the lowering of prices some of the marginal firms are driven into bankruptcy, new firms will be set up, with the technical structure of the dynamic firms, with results which have already been described.

We will discuss the effect of a lowering of prices on the basis of the second hypothesis, namely, that the number of workers is reduced while output is increased.

The problem must be considered separately with elasticity equal to zero, equal to 1, greater than 1, and less than 1.

(a) Elasticity of Demand Zero

If the elasticity of demand is zero or practically zero, even a big reduction in price will fail to increase purchases. All that will happen in this case is that some of the purchasing power of the displaced workers will be transferred to the consumers. As this purchasing power is distributed over a wide field, the general direction of demand may be assumed to correspond

\[ This decrease in prices should, however, increase profits in other industries if the commodities reduced in price are cost-elements in another industry; if these profits are spent in the same way as those in dynamic industries then there will be no change in the situation. \]
roughly to that of the displaced workers. Thus the circle of exchange will be closed and consequently no compensation is to be expected. Only the sum of 54 millions will be available for lowering prices. It is clear therefore that where the elasticity of demand is zero price reductions will be avoided wherever possible. The situation will then be the same as that described above; that is to say, an extra profit will be earned.

(b) Elasticity of Demand equal to Unity

With elasticity equal to 1, every 10 per cent. reduction in prices will entail a corresponding 10 per cent. rise in purchases. Hence, if costs consist entirely in wages, the displaced workers can find employment again, and the case will be the same as when there is an increase in efficiency without fresh investment, as described above. But the situation is altered by the fact that labour-saving inventions involve the setting aside of very substantial sums for the remuneration and amortisation of the new capital. If, for instance, 20 per cent. of the workers are displaced and costs are thereby reduced by only 8 per cent., an 8 per cent. fall in prices would involve an 8 per cent. rise in output, and 8 per cent. of the workers, that is, 40 per cent. of those who would have been displaced by the new invention if output had remained stationary, will be able to remain in employment. Thus, even under these favourable conditions a large number of workers will be released. It may be argued that this partial compensation (which is better described as a limitation of displacement) does not, of course, exhaust the whole process, because the entrepreneurs will now use some of the saving on their wage bill to buy extra raw materials, etc., so that to the extent to which the necessary raw materials, etc., are produced nationally this represents a further outlay on wages and other costs. The same argument as before then applies as regards the fraction of costs represented by wages in the production of these raw materials. Whether the economic circle is narrowed or continues to contain as many links as before displacement occurred will now depend on the source from which the workers are obtained. But in order that more raw materials can be produced at all we must assume that unused capacity is available, and under this assumption the case becomes very similar to that of the expansion of production without fresh investment. The more closely the situation corresponds to that already described, the larger the
increase in the number of workers which the reduction of costs will permit.

Nevertheless, it will be impossible, under our assumption, to absorb all the unemployed, and this for two reasons. In the first place, at least some of the workers who are reabsorbed are those who would otherwise have been displaced by secondary unemployment, so that there is so far no re-employment of the workers who were originally displaced. Secondly, a substantial fraction of costs are imputable to the remuneration and amortisation of capital. In the example given, only 54 millions of the savings effected on wages can be used to lower prices, because 84 millions are required for interest and depreciation and therefore form part of costs. Hence, under our assumptions, the compensation which can be secured by lowering prices with unity elasticity will not be greater than that obtainable by the making and re-investment of extra profits.

The effect of a lowering of prices as compared with an increase in profits is also unfavourable from the standpoint of its action on the labour market. A rise in profits would lead to increased investment and therefore to an increased demand for labour. Price reductions, on the other hand, merely involve increased consumption without any expansion in production as a whole, so that not even that slow expansion of the permanent demand for labour can be expected which occurs when extra profits are regularly invested year by year. To the extent to which the displacement is not compensated for, it therefore becomes permanent. The only counterbalancing factor is the rise in employment in the production of raw materials, etc. (see the examples given above), but this will only offset a fraction of the secondary unemployment.

(c) Elasticity of Demand greater than Unity

The consequences described above will be modified if elasticity is greater than 1. In this case every fall in prices will involve an expansion of output proportionately greater than the price reduction. If, for instance, prices are lowered by 10 per cent., demand will probably rise by 15 or 20 per cent. Suppose that the average bill of costs in a given industry is as follows:
Thus, the newly invested capital yields an extra profit of 4, i.e. 10 per cent, while production remains the same. Under free competition output will be raised to the point where the extra profits disappear. Prices will fall to 0.96, but this will enable output to be expanded, say to 108 units. But this expansion of output requires heavy investment, so that the total bill of costs for the 108 units of product will be as follows:

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Capital</th>
<th>Interest</th>
<th>Depreciation</th>
<th>Raw materials</th>
<th>Wages</th>
<th>Costs per 100 units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>200</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Newly invested</td>
<td></td>
<td>240</td>
<td>12</td>
<td>24</td>
<td>30</td>
<td>96</td>
</tr>
<tr>
<td>capital : 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If elasticity is about equal to 2, these costs will be covered by the total returns. The extra profit will then disappear and the consumers will reap the benefit of the reduction in costs.

In this case, therefore, 24 per cent. of the displaced workers will be reabsorbed owing to the increase in output, and employment will immediately be provided for an extra 12 per cent. in the production of raw materials, etc., supposing the share of wages to be as high as 50 per cent. On the other hand, however, under our assumptions, the fact that more capital has to be invested will not exert any compensatory effect because this capital has to be transferred from other uses. Only about 36 per cent. of the displaced workers therefore will be re-employed.

But other effects of this expansion of output will also operate to prevent compensation.

In the first place, it is only the unemployment in the dynamic firms of the industry which will be reduced, whereas in the firms in which methods of production have remained unchanged, output will decline and capital will be destroyed. Displacement in static firms plays a very great rôle but does not appear in our scheme.
Secondly, if the productive capacity of the raw material producing industries is restricted, no increase will be possible in the total number of workers employed in this branch until more capital is invested.

Thirdly, the consumers will have to restrict their consumption of other goods because they now spend a larger portion of their income on the cheapened goods. The argument applied in the case of inventions holds good, to a certain extent, here also, though the results are not as favourable. The effect of inventions is actually to create a genuinely new demand; this can indeed only be satisfied at the expense of the demand for other products, but the producers of the new product immediately fill this gap so that total output and total employment are able to expand. In the present case, however, it is only the primary unemployment in the dynamic firms which is reduced. If the other consumers restrict their purchase of other goods in order to buy more of the cheapened goods, there will, under our assumptions, be no additional demand to offset the decline in the demand for the goods which have remained unchanged in price. Total wages (raw material included) will have decreased; furthermore 6 of the increase in the total turnover of the dynamic firms are for interest and amortisation on additional capital. These returns would have been earned anyway and they therefore do not constitute a new demand. That again proves the importance of sudden changes in organic composition. Consequently, the relative increase in the consumption of the products of the dynamic industry will be accompanied by a decline in demand in other industries. In the case under consideration this will offset the increase in demand in the dynamic firms. Once again, therefore, it is clear that the changes which take place in the actual firms affected do not show the full extent of the real effects of these variations. If we are prepared to grant that a fall in employment in the dynamic firms can be remedied by a rise in employment in other parts of the economic system, e.g. as a result of investment, we must also admit the possibility that under certain circumstances compensation involves unemployment in other branches. This fact is frequently overlooked, and it is assumed that compensation has been successfully achieved if there is no decline in the number of workers employed in the industry or even in the dynamic firms only. If the demand for the cheapened commodities is so elastic as to lead to a greater
number of workers being employed than before the mechanisation took place (including those employed in supplying the raw materials) there will be an increase in total consumption. But this increase in consumption will only take place in so far as total employment in the mechanised trade exceeds the former level.

It is true that this decline in employment may here and there be outweighed and counterbalanced by the expansion of production as a whole. The introduction of more capital-intensive methods of production need not necessarily involve unemployment if it is simply a factor in the general growth of production, and such changes in organic structure are also provided for in our example of normal development. In point of fact the extent of the changes is the only deciding factor. This means, however, that we cannot neglect the quantitative aspect of the changes.

(d) Elasticity of Demand less than Unity

If the elasticity of demand for the products of the dynamic industry is less than unity, a reduction of $\frac{7}{2}$ per cent. in prices will increase consumption by only 4 or 5 per cent. Consequently, the amount of re-employment in the dynamic undertakings themselves will be less than in the previous case. Over the economic system as a whole the difference will be smaller than might be expected at first glance. The consumers will now have some of their purchasing power left over for other goods, and consequently there will probably be an additional demand for other goods, on the production of which additional workers can be employed. If the share of wages is the same, and if the additional demand can be covered by having recourse to the unused capacity of existing firms, the increase in employment in these other industries can be regarded as a compensating factor. Thus the elasticity of demand plays a smaller part than is generally assumed. (All these considerations are based on the hypothesis that the supply of money increases only at the normal rate required by harmonious development and that wages remain constant.)

In discussing the effects of labour-saving technical improvements, great importance is sometimes attached to the question whether the goods cheapened by such improvements are those consumed by the workers or by persons with larger incomes. Johnson and Pigou lay great emphasis on this point, considering
that the more the goods produced at a reduced cost are consumed by the workers themselves, the more favourable the final results of the invention will be for labour as a whole. Personally, however, I think that too much importance is attached to this point. It is true that, given diminishing productivity of labour, a labour-saving device which involves a lowering of the price of a commodity consumed by the higher income classes will reduce the workers' wages without compensating them by enabling them to increase their consumption. But I agree with Marshall that, apart from the fact that labour-saving inventions which benefit the more prosperous classes alone are rare, a reduction in the price of luxury goods very often leads to a bigger demand for personal services or for goods requiring a high proportion of manual labour for their manufacture. This increases the demand for labour, and in particular delays the fall in the marginal productivity of labour.

3. Compensation through Reduction of Wages

Can wage reduction increase the compensation for unemployment and reduce the extent of displacement?

(a) Does Unemployment prove that Wages are too high?

Many economists have tried to attribute the unemployment which follows the introduction of technical improvements to the fact that wages do not adjust themselves, or do not adjust themselves quickly enough, to the level of the marginal productivity of labour. They argue that the fact that unemployment exists proves that wages are too high. More workers cannot be employed because a larger output is impossible at the existing level of wages.

This view implies that the wage level determines the number of workers employed and that the wage actually paid always corresponds exactly to marginal productivity, so that with wages at a given level the number of workers cannot increase, whereas if they were reduced it would be possible to adjust production to a lower level of marginal productivity.


The argument is obviously based on the assumption that labour is subject to diminishing returns while capital equipment remains constant, and it also tacitly implies that the disturbance on the labour market arose or, at any rate, continues from this cause and no other. Under the operation of diminishing returns every increase in employment does in fact involve a fall in wages. We must now consider labour-saving technical improvements and the displacement of labour in connection with diminishing marginal returns.

(b) Why Marginal Productivity of Labour decreases with Technical Progress

At first sight it may seem contradictory to assume that the marginal productivity of labour will fall within the economic system as a whole as a result of labour-saving technical improvements which increase the efficiency of the dynamic firms but have no effect on that of the others. But this contradiction is only apparent if it is assumed that all branches of production are operating under the law of diminishing return. This is also the case if the employment capacity of certain industries is rigid.

From the standpoint of the economic system as a whole, the decisive factor in determining marginal productivity is not the return of separate firms or industries but the marginal return of labour throughout the whole economy. Every increase in the capital intensity of production will begin by releasing a certain number of workers. The smaller their prospects of being reabsorbed in the dynamic firms or elsewhere, owing to the rigidity of employment capacity, the more they will tend to be forced into the outfields of the economic system, and to this extent the marginal productivity within the whole system will decline. It will hardly be possible to find employment for the displaced workers in other firms, especially if unemployment rises above a certain limit, and there will therefore be an oversupply of labour in the personal services. But the demand for personal services will rise only if their cost is reduced. Here prices will in fact correspond very closely to marginal utility, which can be determined more exactly for the personal services than for manufactured goods, not only because productive equipment plays no part, or at the most a very small part, in this sphere, but also because a minute adjustment of supply to demand is possible. In such a case of very heavy unemployment there-
fore the question shifts to the problem of the productivity of the labour factor in general and is no longer confined to that of whether and how the marginal productivity of labour has changed in the dynamic firms or industries. We may assume that for technical reasons the dynamic firms are not in a position to extend their demand for labour right down to the level of the marginal productivity of the whole community¹, and we shall thus still be able to speak of a fall in marginal productivity and therefore in the economically correct wage².

(c) **Lower Wages — Higher Profits. Wicksell's Views**

Under the present assumption, equilibrium cannot be restored on the labour market until wages have fallen to this level. Consequently, workers will be forced into the personal services, or into firms in which the organic structure is more elastic, and if wages are reduced sufficiently demand will expand so far as to enable all the unemployed to be reabsorbed. The lower wages fall as a result of the pressure on the labour market, the larger will be the profits made by the entrepreneurs in the dynamic

¹ The marginal utility theory, however, assumes that in every industry or firm, demand for the different factors of production will continue to expand until the limit of their marginal productivity in the whole system is reached, the only exception being under a monopoly. But this automatic adjustment of the marginal productivity of the separate factors of production in the various industries and firms will only take place on condition that the factors of production can be distributed at will, that they can be combined in every possible way, that the products can also be distributed at will, and that competition is free. If these conditions are not fulfilled, the marginal productivity of labour may be higher than the average productivity of the community under free competition in some industries and lower in others. As a result, extra profits will be made and may even continue over long periods. The existence of these extra profits, which will be the general rule in the dynamic firms because they produce with lower costs, in no way affects the principle under discussion here. But it will lead to a still further fall in wages because the efficiency of the marginal workers will be reduced by the fact that many firms will cease to engage more workers before they have reached the limit of the marginal efficiency within the total system. The situation on the labour market would be just the same with increasing real returns resulting from unavoidable maldistribution of factors, the consequence of which on employment we analysed above. See below, p. 266.

² D. H. Robertson, in *Economic Fragments: Wage Grumbles*, p. 51, assumes that where rationalised industry with a high coefficient of capital predominates some of the workers will be able to find employment at a relatively high wage, whereas it would not be possible to reabsorb any of the unemployed by means of a reduction, even a very steep reduction, in wages.
firms — larger, in fact, than those shown in our example under the assumption of constant wages.

Wicksell (Vorlesungen über Nationalökonomie, 1 Bd, p. 199) too has given some consideration to the question of a decline in the marginal productivity of labour as a consequence of technical progress. According to the marginal utility theory, it is quite correct that the displacement of workers must reduce the marginal productivity of labour if real returns are decreasing in general, even if no fresh investments are necessary to introduce the labour-saving methods. It is also true that, in spite of the decline in marginal productivity and the consequent reduction in all labour income (real incomes as well as money incomes), the national dividend must rise because total output has expanded. But the equilibrium which Wicksell assumes between the dynamic and static firms will not be established if we substitute for his example one which corresponds more closely to the facts. In the first place, Wicksell assumes that the labour-saving technical device is introduced without fresh investment. Secondly, following Ricardo, he assumes that net earnings will increase with a very steep fall in the gross yield. Thirdly, the extra profits only arise because labour costs fall much more rapidly than gross yield, so that profits are larger than under the former methods of production. And fourthly, the extra profits are very small (a total profit of 52,000 as against a profit of 50,000 earned previously and still earned in the static firms).

The adjustment between the profits of the dynamic and static firms is brought about as follows: as a result of the reduction of wages (prices remaining constant, as they are assumed to do throughout Wicksell’s example) an extra profit is earned from the workers formerly, and still, employed, whose contribution to total output remains unchanged. As the number of workers in the dynamic firm has been reduced by half and the extra profits of the dynamic firms have only risen from 50,000 to 52,000, the static firms will soon be able to earn the same profit as the dynamic firms. But if we were to assume that the extra profits could only be obtained from technical improvements after fresh investment, which would reduce the coefficient of capital in the static firms, there would be a much sharper fall in marginal productivity. If, further, the extra profit of the dynamic firms is assumed to be not 2,000 but 10,000 (i.e. if the gross yield is 85,500) the reduction of wages from 500 to 450 would still leave an extra profit for the dynamic firms. The total profit would be (85,500 + 2,400) — 24,750 = 87,900 — 24,750 = 63,150, as compared with the profit of 55,150 in the static firms. In other words, the extra profit would be 8,000 instead of 10,000. Accordingly the static firms will now also try to introduce the new methods and wages will fall even more severely, perhaps even to below the subsistence level. Wicksell contemplates this possibility when he points out (p. 203) that wages may not only be forced down below the subsistence level, but may even remain there, as happened in England in the eighteenth or nineteenth centuries when wages were fixed by the Justices of the Peace and made up out of taxation if the rate fixed was below the subsistence level. He obviously assumes that at that time the economically correct wage was below the subsistence rate, but it is probable that in many cases the Justice of the Peace fixed a differential rate for the employers in his district, leaving the balance to be made up out of general taxation. Wicksell further states that this form of regulation is advantageous to the taxpayer as well, considering that the unemployed would have to be maintained in any case. It is true that in this way they do at least contribute something to the national income, whereas they would otherwise have had to be supported entirely. On the other hand, however, under this system the difference would also have to be made up for the wages of all the workers previously employed, and there would then arise the difficulty of finding the necessary means out
This re-integration of the unemployed in the process of production differs a good deal from the process of compensation as usually depicted, depending as it does on the forces of adjustment latent in the whole economic system. It may also be noted that this method of restoring economic equilibrium leads to a paradoxical situation, because although on the one hand the output per worker increases, on the other marginal productivity declines. As, for the purposes of the theory, this decline in productivity means a decline in physical returns (apart from the personal services, which diminish in value as they expand in volume), the increase in the efficiency of production in the dynamic industries is accompanied by the transfer of labour to technically less productive uses. (If physical returns were not diminishing, money wages might fall, but not real wages under the assumption of a harmonious distribution of factors.) This means, as our general argument would lead us to expect, that the appropriation of all available savings to finance labour-saving methods during a period of rapid technical progress involves a sharp decline in efficiency on the outer fringes of the economic system. In spite of this, however, the total income of the community will increase, first, because of the expansion of output in the dynamic firms, and secondly, because of the extra output of the displaced workers.

of taxation. If prices remained constant a tax could be levied directly on the entrepreneurs, equivalent to the saving they also make on the wages of the workers who were previously in their employment; but it is doubtful whether this would be politically practicable, and if the difference were to be found out of general taxation the theory that the burden would sooner or later fall on profits would be small consolation for the classes who had to pay the extra taxes. Under Wicksell’s assumptions his inferences are correct, but they alter considerably if the example he has taken as his starting point is formulated in more realistic terms. Supposing, for instance, that the improvement in technique involves the investment of new capital and the margin of profits is larger, the restoration of equilibrium will demand a reduction in wages which will bring them far below the subsistence level. Thus Wicksell’s analysis actually shows how difficult, and often even impossible, it is for the principle of marginal productivity to operate in the case of rapid technical progress. In any case, it cannot be advanced as an argument to prove that wage reduction is an effective practicable remedy against the difficulties raised by technical progress, and one which will rapidly restore a stable equilibrium.

We will not attempt to discuss here the debatable point whether Wicksell’s assumption of diminishing physical returns actually applies in reality as rigorously as he supposes.
(d) **Total Payrolls lower than before**

**the Displacement of Workers**

The extent to which a reduction in wages will be necessary to reabsorb the unemployed cannot be deduced from examples constructed for separate industries. It must be assumed, however, that under the free operation of the law of marginal productivity total labour incomes will fall. The effect of labour-saving technical inventions is to shift the labour demand curve towards the left, and the same amount of labour as before can then only find employment at a lower total wage. In other words, after the displacement of labour by technical progress, it is a question of employing not more, but the same number of workers as before, at lower wages. Here again the total labour income must fall. The labour demand curve before the introduction of the technical improvement is represented by AB; the supply of workers available on the market by OL, and their wages (= marginal productivity) by NL. Every technical improvement displaces the demand curve in the direction of O, e.g. A'B', so that now only the workers represented by OR can be employed at the former wage NL, and full employment is only possible if wages fall to N'L. It is obvious that the total wage bill must necessarily be smaller than before. In other words, as marginal productivity has fallen to a lower level without any increase in the number of workers, the elasticity of the demand for labour during the
process of the labour-saving technical progress will be less than unity. This is not a contradiction of the general assumption or observation that the elasticity of the demand for labour is usually greater than unity. Our curve applies to the situation which is present after the displacement and it simply shows that, if wages are reduced, the total wages bill will be greater than the wages bill after the displacement: OM'NL may well be greater than OMQR (Fig. I) but it will always be smaller than OMNL or the curve would not shift and the amount of labour demanded would be the same at the old wages. Accordingly, whereas in the case here considered the wage bill would fall although the number of workers remained unchanged, it might rise if technical coefficients remained constant and the number of workers increased, provided that the marginal productivity of labour declined more slowly than employment expanded.

A fall of about two-fifths in wages corresponds to a three-fold increase in the number of workers. The total wage bill will rise from about 100 to 180, with a reduction of 40 per cent. in wages. This favourable situation would arise if the curve of the marginal productivity of labour were particularly flat. It is important to distinguish clearly between the situation under stable technical coefficients with a growing number of workers and that of improved technique with a stable coefficient of labour. In the first case the real labour income may rise, whereas in the second it is bound to fall owing to the operation of the law of marginal productivity under diminishing returns.

(e) Wage Reductions under Diminishing Returns

Let us now return to the discussion of wage reductions under diminishing returns.

The further effects of a reduction in wages cannot be foreseen with any accuracy even under free competition. All that can be said with certainty is that the national dividend will increase. If the quantity of money also expands sufficiently, prices will remain unchanged, and profits will rise to an extent corresponding to the fall in wages. Only if these profits are invested immediately will there be no impairment of purchasing power. If the extra profits are not invested, or not until later, there will be a check to the process of development which may spread to a wider field.

If the extra profits are invested at once, further disturbances
will be averted. Nevertheless, the investment of these profits will not lead to a new and additional demand for labour, because total labour incomes will be bound to shrink in consequence of the fall in wages and the total demand of the workers in general will accordingly also shrink, and with it the demand for consumption goods. The workers so displaced will then find employment in the production of capital goods. Hence, the investment of profits is the factor which determines whether the process stops with the fall in wages corresponding to the fall in marginal productivity. In other words, the expansion in gross output inferred from our previous remarks automatically implies new investments and these investments will lead to a later increase in wages. If investment does not take place at once, unemployment will again arise and will inevitably lead to a further fall in wages. This means that an imperfect economic circle will be created with further unemployment.

(f) Wage Reductions coupled with Reduction of Prices

So far in this section we have been discussing the effects of wage reductions under the assumption that prices remain constant. But if the money supply does not expand to the extent necessary to keep the price level unchanged, complications will ensue, the analysis of which involves some difficulty.

In the process considered above the total volume of production expanded, and consequently, since prices remained unchanged, total income as well.

This increase in total income can only be expected if credit expansion takes place. If not, we remain with a larger volume of output on the one hand, and an unchanged amount of income. 

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1 In our examples, in which the gross output of the dynamic firms does not decline, total production must expand more rapidly than in Wicksell’s scheme, in which there was a fall in the gross output of the dynamic firms (according to Ricardo’s example) which was not made up again until the displaced workers were again re-engaged. Moreover, it is only under our assumptions that an increase in gross returns is certain, because in Wicksell’s example the gross returns of the whole economic system would fall if marginal productivity diminished faster than he assumes. If the first of the extra workers employed produced 500 units, the second 470, the third 440, the fourth 410, and the fifth 380, the gross output of the static firm would rise by 2,200 instead of 2,400; the gross returns of the nine static firms would rise from 100,000 to 102,000 = 919,800, and the gross product of the dynamic firms would rise to 79,700. Total output would thus now be 999,500 or 500 less than before the introduction of the labour-saving improvements in the dynamic firm.
on the other. The income of labour and of entrepreneurs alike must therefore be squeezed out of the same total sum.

It will be remembered that the first step was a change in the technique of production which enabled total income in the dynamic industry to expand normally, but involved the transformation of a large fraction of the former share of wages into extra profits and amortisation quotas. The total income of the community contracted (or expanded at a slower rate than in the normal course of development) because the growth of industry as a whole was held up by the slowing down of capital development in the static industries and firms.

If now the workers who were displaced and were not reabsorbed as a result of the investment of profits, etc., are provided with employment, and if this is possible at the cost of diminishing returns although capacity is being used to the full (this being assumed in our examples), no purchasing power will be available for them. Even if some surplus circulating capital is left free here and there (and this will only happen in the static firms, not in the dynamic ones), it will not be available in the firms, which could employ extra workers. Hence credit will have to be made available.\footnote{Though the total income of the community contracted (see above, p. 172) and though the velocity of circulation slowed down correspondingly that does not provide a reserve of money for the employment of additional workers. This slower circulation of income-money fails nowhere to the filling up of liquid reserves; it only makes for slightly longer holdings of cash-reserves.}

Thus, if the supply of money does not increase proportionately to the increase in the national income due to the re-employment of the displaced workers, wages must adjust themselves to the available money supply, even if prices fall correspondingly. Accordingly, wages will now fall for two reasons: first, because marginal productivity is declining, and secondly, because the supply of money has remained unchanged. But that part of the fall in wages which is due to the rigidity of the money supply will be accompanied by an equivalent fall in prices, so that, setting aside the possibility of changes in price ratios, real wages will not fall any further than under an expanding currency.

The process may be briefly schematised as follows: in the first place, the number of workers in employment will diminish if prices remain unchanged. A part of the wages saved (ignoring
the further complications of the case) will be transformed into profits and amortisation allowances in the dynamic firms. Employment will now rise again, but with falling wages. As a result of increasing employment output will also increase, but more slowly than employment because of decreasing marginal returns. Owing to the increase in output prices will fall; wages will fall more rapidly than prices because real wages are also declining. (The reduction will not be greater than under an expanding money supply if the fall in prices is general and takes place without a time-lag.) As a result of this fall in real wages, profits now also rise and can be invested. But this will not involve an increase in the demand for labour, because the fall in real wages releases labour which was previously employed in producing consumption goods for workers. Even if the money supply remains unchanged, therefore, the whole process will proceed more or less as if it expanded correspondingly.

Throughout this analysis we have dealt only with workers and entrepreneurs, leaving out of account the other consumers, such as farmers, rentiers, public servants, etc. But the inclusion of these other classes would scarcely alter the general picture. If prices remain unchanged there will be no change in their purchasing power, and if prices are lowered, the quantity of money remaining unchanged, we must also assume a corresponding reduction in the incomes of these classes. Hence, the sole result of the reduction in wages is still to increase real profits, as expressed in terms of goods. As the increase in profits is uniform, competition between the producers will not lead to a fall in prices. This can only happen as a result of the investment of the extra profits.

The position here is different from that produced by a forced reduction in wages (with the number of workers remaining unchanged) in a single industry, which may also cause prices to fall as a result of an increase in profits and an influx of capital and producers into the industry. In the latter case some or all of the economy in wages will benefit the other consumers, and

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1 We assumed before that if prices fell profits would not rise because the benefit would accrue to the consumers (see above, p. 192). In point of fact, under the above assumptions of constant wages, the fall in prices represents a reduction in profits brought about under the pressure of free competition. In the process here described, however, the whole relation between the distributive shares of labour and capital is altered, and consequently profits increase throughout the economic system.
labour incomes will in fact be transferred to these other classes of consumers.1

Even if we suppose that most firms are operating under the law of diminishing returns, and that with free competition on the labour market there will be a corresponding fall in wages, these general compensating factors will still encounter obstacles, because even if wages fall only slightly there will still be a reduction in the total income from labour. In spite of the fall in prices, labour's share in the national dividend and also total real wages will diminish when there is a simultaneous expansion in total production. This is a paradoxical, although only temporary, result of technical progress; its duration will depend on the promptness with which the transferred fraction of income is invested. It is true that in the meanwhile this favourable action may be retarded by new technical improvements, which, in conjunction with the destruction of capital values and of possibilities of employment, may prevent any benefit being derived from the improvements for a very long time. Generally speaking, throughout the nineteenth century this kind of wage reduction led, or would have led, to a particularly rapid growth of the industrial system. To-day such rapid expansion is no longer to be expected, for the reasons already stated. If the unemployment which this measure is intended to remedy is extensive, wages will have to fall to a very low level, and the lower they fall, the less reason is there to expect prompt investment. Thus wage reductions offer only limited prospects of success.

(g) Wage Reductions while Returns increase

The assumption of diminishing returns which we have hitherto been making rests on the hypothesis that productive capacity is already being used to the full. If unused capacity is still available, physical returns will not fall when the number of workers increases, but will at the worst remain constant.2

But it cannot immediately be inferred from the assumption

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1 See my study on the "Theory of Wage Reduction".
2 The present brief digression to consider the case of constant or increasing returns, on which the extent to which capacity is being used has an important bearing, is justified by the fact that in many cases unused capacity is in practice still available, and it is important to show that even then difficulty is encountered in reabsorbing the displaced workers.
of constant or increasing returns that in practice extra workers can be employed without difficulty at an unchanged wage.

If, when extra workers are employed, productivity remains constant or even increases, it should theoretically be possible to absorb all the displaced workers at once at a wage at least as high as before. In this case the extra working capital could also be found without difficulty in a dynamic system. But as soon as capital is exhausted, it will be impossible to increase employment any further, and as in order to reabsorb the displaced workers new units of production will have to be brought into being, the problem of obtaining the necessary capital again arises. If it is solved (by the transfer of capital from other uses), the new undertakings will at first operate with very much higher costs, which will indeed gradually fall but will continue to be higher until the new capacity is being fully used.

While unused capacity is still available and output with the existing means of production could be expanded, the situation arising under constant or increasing returns can be regarded in several different lights.

(1) We may take it that the normal output involves the use of 75 or 80 per cent. of theoretical capacity. When this proportion is reached the cost curve will drop to the level of prime costs and will remain there until capacity is being used to the full. Once this point is reached, new firms will have to be set up and their cost curve will develop in the same way.

(2) If overhead costs are reckoned on the basis of theoretical capacity, the curve will develop asymptotically up to a certain point and will then break off. It will then be an average cost curve throughout its whole length.

(3) If the increase in output permits of a more thorough and better division of labour, there will be a sharper fall in the cost curve.\(^1\)

The first and second curves merely represent different methods of calculation, the situation being the same in both cases. As in reality the return from each unit of labour is larger than that of the preceding one, wages cannot be determined by the criterion of marginal productivity. This is clear whichever

\(^1\) In all these cases it is assumed that marginal costs also continue to decrease. If they increase (e.g. because obsolete equipment is called into use) we are faced with increasing marginal costs, though average costs may still decrease.
of the above two methods of calculation is applied. Hence, under the new law postulated here, all the displaced workers should immediately be able to find fresh employment at the same wage as before.

In practice, however, even where this situation obtains, i.e. if costs for the extra units fall, there will not always be an expansion of output because it will be prevented by the fall in prices. This does not in any way prove that the industries concerned are governed by the law of diminishing returns; the fall in the money return relatively to other industries is usually due to a disproportionate expansion of production in the different economic branches. This disturbance in the returns of certain industries will tend to become general. But if this happens the position on the labour market will not be very different from that which obtains under generally diminishing returns. Although a larger quantity of the product is placed on the market at a lower cost than before, prices in the industries which have expanded too rapidly will have to fall even more sharply than costs, and a reduction in wages is therefore to be expected if wages are the only factor which is not rigid.

Under increasing returns, therefore, the process of development will, in the most favourable circumstances, proceed somewhat as follows. If production expands uniformly, which it will be enabled to do by the displacement of some of the workers provided that the expansion of output does not require further investment, no disturbances need arise. But as soon as capacity is being used to the full the demand for labour is bound to cease,

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1 It should be noted that under our present assumptions of a hitherto harmonious expansion of total production and the existence of unused reserves of capacity, displaced workers could, in fact, easily find employment at the same wages (provided that there were an adequate increase in the supply of money). There is, however, no guarantee that production will expand proportionately, and disturbances in circulation are therefore inevitable. In practice, this expansion of production within a dynamic system is made possible by credit expansion only, which in itself will lead to irregular price movement and hence to a disproportionate expansion of the different industries. If the movement then sooner or later comes to a stop, it will be impossible to re-employ the displaced workers in spite of the fact that unused capacity is undoubtedly available, because owing to the general conditions obtaining the expansion of production will not be profitable at any one point. Even if wages are reduced much more than under our assumption as would be necessary under diminishing returns, production would not immediately become profitable. Hence the existence of unemployment under these circumstances is no definite proof that wages are higher than is warranted by marginal productivity.
and at this point it will no longer be expanded by a further fall in wages, because under our assumptions the extra capital required for the employment of fresh labour is not available. The unemployed will therefore be transferred into the field of personal services, this probably involving a very sharp fall in wages in this branch. If this fall in wages spreads to production, extra profits will accrue and a new wave of development will be set in motion. (It is, however, uncertain whether the increase in capital accumulation will actually take place. If there is no increase in investment corresponding to the fall in wages an imperfect circle will be formed as already described.)

(h) Some Remarks on the Demand for Labour

In connection with these remarks, a few words may here be said as to the general interpretation of the concept of the demand for labour.

(1) In a community of independent producers the supply of labour is identical with the determination to work, which in turn depends on the shape of the utility curve of the goods produced by labour, and also on the disutility curve.

(2) The labour market may be divided into different sections, each of which is considered separately. This is useful for practical purposes when investigating a closed or local labour market or one divided into separate branches. Every trade union and every entrepreneur will follow this method, and neither union nor entrepreneur will consider how their own utilisation of a bigger or smaller elasticity of demand will react on the other branches of the labour market.

The demand for labour within a particular industry depends on the elasticity of demand for the product concerned, on the share of labour costs in total costs, and lastly, on how the expansion or contraction of output affects the price ratios between the other factors in costs. Supposing that the price of the other cost items remains unchanged and that the elasticity of demand for the product is unity, while the share of wages is 40 per cent., the elasticity of demand for labour will be \( \frac{1}{2} \), even if the physical return from labour remains constant. For if, with an output of 100 and labour costs amounting to 40 per cent., output rises by 10 per cent., the total money return will remain unchanged at 100; costs, apart from wages, will be 66 for 110 units, so that only 34 will remain for wages. In the meanwhile, however, the number
of workers has increased by 10 per cent., so that if the wage was formerly 1, it will now be reduced to 0.77, or by 23 per cent. per worker and per unit of product. Only if the elasticity of demand for the product were equal to 2 or if a fall in the price of the other factors in costs could also be expected would the elasticity of demand for labour be unity so that the total wage bill would remain the same.

The demand for labour takes on quite a different aspect when regarded from the standpoint of the whole economic system. If the conditions of employment obtaining at the moment are regarded as stable and unemployment or an extra supply of labour suddenly arises (e.g. as a result of immigration or the working of overtime, or again of an extra influx of workers on the labour market, due to a particularly large yearly contingent of juveniles, making the increase in the extra supply of labour rise above the normal) throughout the economic system and not only in one single industry, the demand for labour will be accompanied by a demand for the goods produced by this labour, and to this extent demand in a balanced system depends on the extra product which these extra workers can be expected to produce. To this extent, too, the variations in marginal productivity determine wages. Whether the money supply increases or remains stationary will affect nominal wages only if the changes in the level of prices and incomes take place simultaneously and uniformly throughout. But real wages will also be affected if the money supply remains stationary and prices are not all lowered uniformly. So far as the elasticity of the total demand for labour is concerned, it is important that the new product and the income it represents should also come on to the market together with the new workers. Even with diminishing returns, elasticity will be greater than unity if the decline in efficiency is gradual.

1 The decline in efficiency would, however, have to be extremely slow. If, for instance, with a staff of 1,000 workers the marginal productivity of the worker is 100, and if it declines even by as little as 0.1 for every additional worker, the marginal return of 1,100 workers will be 90, but the wages of all the 1,100 workers will be 99,000. Thus even a fall of one-thousandth per worker in marginal productivity will mean a fall in the total returns. In practice, the total wages of all the workers can only remain unchanged if the amount lost in wages by the employed workers is smaller than that which accrues to the new workers.

In his Economics of Welfare (p. 709, Part V, Chapter III, pp. 8 et seq.) Pigou gives certain reasons which in his opinion support the view that elasticity is greater than unity. In the first place, there are the personal services, in which productivity per head would not rise appreciably
Under increasing returns it will always be larger than unity, and this will lead to a rise in wages, although a very gradual one\(^1\), if the workers are distributed in the correct proportions.

Thus the elasticity of the demand for labour can only be deduced from the elasticity of the demand for the product when one industry alone is under consideration, because, in this case, the demand of all consumers for the product concerned may be taken as given. But if it is desired to ascertain the elasticity of the demand for labour in general, a notion which is admittedly problematical in itself, we cannot take the previous demand for commodities on the market as constant, but must widen our definition of the market to include the products manufactured by the newly employed workers, which also represent income. It is clear that this extra income, like the demand for goods which it represents, is a result of the extra production. The whole of the increased supply will find a market without any further change in prices than are necessitated by the change in cost ratios. Wages will then be determined by marginal productivity and the movement of the marginal product will determine the distributive shares of wages and profit. Under stable or increasing returns these distributive shares will remain unchanged.

\(^1\) The rise in real wages will be very gradual because only the extra workers, and not those who were formerly employed, will produce a larger output. Diminishing returns, on the other hand, produce an immediate corresponding drop in wages. Hence, if both curves are of the same shape, wages will fall much more rapidly under diminishing returns than they can rise under increasing returns.
(i) The "Douglas-Formula"

An attempt to determine the elasticity of the demand for labour empirically was made by Paul H. Douglas in his *Theory of Wages*. According to this writer, the elasticity of demand for labour during the period investigated by him was four, which amounts to saying that with capital equipment remaining unchanged and a 1 per cent increase in the number of workers employed, wages would have to fall by one-quarter of one per cent. in order to absorb the additional workers. Under this formula, therefore, the total wage bill would increase.

If we applied this formula, to which the author would probably object, to a case of technological unemployment of the order of 10 per cent. of the labouring population, we should obtain the following result: if real wages were reduced to 97.5 (as compared with 100 before mechanisation took place) the displaced workers could then be reabsorbed. Thus the labour-displacing effect of mechanisation would be compensated for by a decrease of 2\frac{1}{2} per cent. in average wages. For many reasons given above, this result is somewhat too favourable. But even this formula shows that mechanisation involves, in the first stages anyhow, a reduction both in wages and in the total wages bill and this even under the extremely favourable conditions of harmonious dynamics.

4. *Reduction of Wages as a Preventive Measure: Some Statistical Data*

Recent writers have given great prominence to the view that labour-saving inventions are induced by the raising of wages or by their maintenance at too high a level, so that the tempo of technical progress could be slackened if wages were more flexible. In Germany in particular much has been made of this argument; it has been asserted that the maintenance or raising of wages provoked the rationalisation movement to which the trade unions subsequently attributed the persistent unemployment. By lowering wages or maintaining them at the economically correct level it is alleged that this rationalisation movement could have been slowed down.

This argument assumes that wages are above the level of
marginal productivity, and that consequently it is more profitable to use capital than labour, so that the entrepreneurs change over to more capitalistic methods of production. This implies a development by imperceptible stages, and also the assumption that organic structure is primarily a function of the wage level. The accuracy of the theory could be tested by an analysis of the facts.

Unfortunately no material is available to show the extent of the advantage which rationalisation gives to the dynamic firm in important and typical cases. The point could only be settled by comparing the economy in wages with the simultaneous increase in expenditure on interest and amortisation involved by the extra capital. But a few points of comparison are nevertheless furnished by the investigations of the American Department of Labor. Some of the relevant data are given below.

In the electric lamp industry¹, for instance, the index of production rose in all branches, including non-manufacturing divisions, from 100 in 1920 to 340 in 1929 and 329 in 1931. The time required to manufacture each lamp fell from 0.099809 man-hour in 1930, to 0.022743 man-hour, that is to say, by 77.2 per cent. The number of workers fell less rapidly because hours of work were reduced, and output rose. In 1920, 10,019 lamps were produced per hour, and in 1931 43,968, so that, in other words, labour productivity rose from 100 to 438.9. In the lamp assembly plants, which employed 55 per cent of all labour in 1920, the number of workers fell from 17,283 in 1920 to 5,817 in 1931.

The automobile tire industry² furnishes an example of the fact that increased efficiency can very well go hand in hand with increased employment, because output rises still more rapidly than efficiency. From 1914 to 1929 the index of production rose from 100 to 1,181, but the index of man-hours only from 100 to 233. (The question of when this will lead to a fall in the demand for labour in other industries and when not has already been discussed.) By 1931 the man-hour index had fallen to 140, while the index of efficiency per man-hour of work had risen further to 681. Productivity per man-hour rose from 100 in 1914 to 279

² *Idem*, No. 585 (Productivity of Labor Series), Boris Stern: "Labor Productivity in the Automobile Tire Industry".
in 1922, and thence to 547 in 1931. This rise in efficiency continued uninterruptedly even during the years in which output fell. Here, therefore, efficiency rose more steeply than in the electric lamp industry, without checking the growth in employment.

As regards the postal service, table K (page 63) shows that the index of total services rendered rose from 100 to 249.4 between 1908 and 1931; the index of employment from 100 to 152.7, and efficiency per worker from 100 to 163.4. Here again, therefore, the general result was an increase in the number of workers employed. The investigator concludes, however, that if the principles of private industry had been ruthlessly applied from 1926 onwards, substantially fewer workers would have been employed, and further, that important technical improvements were in progress which had not yet produced their full fruits by 1931.

Ample data on this subject are also to be found in Mr. Harold Butler's study on "Unemployment Problems in the United States". Non-mechanical factors which increase the efficiency of labour either with or without extra investment are also important. A survey of these factors may be found in William G. Roylance's "The Significance of Non-mechanical Factors in Labor Productivity and Displacement".

All these data indicate that a very large percentage fall in wages would have been necessary to delay the replacement of labour by machinery. Moreover, the average conditions are still too favourably described. In particular firms and departments the rise in efficiency was still greater. Wage reductions would therefore only have been able to hold up mechanisation in certain

1 *Idem, No. 574 (Employment and Unemployment Series), Dr. Witt Bowden: "Technological Changes and Employment in the United States Postal Service".*

2 *INTERNATIONAL LABOUR OFFICE, Geneva, 1931, pp. 48 and 49.*

3 *Monthly Labor Review, United States Department of Labor, November, 1933.*

4 Further data on this subject will be found in the following publications: Dr. Witt Bowden, "Productivity Hours and Compensation of Railroad Labor" (Dep. of Labor; Serial No. R 75); *Year-Book of Agriculture*, United States Department of Agriculture; Harry Jerome, "Mechanisation in Industry" (National Bureau of Economic Research); "Technological Trends and National Policy including the Social Implications of New Inventions (the contributions of S. C. Gillfillan, O. Weitnraub and Bernhard I. Streeck contain material to our problem). *Report of the Subcommittee on Technology to the National Research Committee, Washington, 1937; for Germany compare: Robert A. Brady: "The Rationalization Movement in German Industry", 1933.*
sections of production, and this would have been impossible because the process of mechanisation is a whole.

Still greater economic difficulties arise in connection with wage reductions as a preventive measure if it is remembered that rationalisation, or the shifting of the ratio between capital and labour, does not proceed uniformly throughout, but by fits and starts. Hence any percentage reduction in wages that would be possible in practice would not check rationalisation, even if it took account of the unemployment likely to result from the rationalisation measures. With a saving of 50 per cent on the wage bill, a 10 or 15 per cent cut in wages would not hold up rationalisation unless the interest and amortisation on the new capital needed claimed about 35 to 40 per cent of the normal wage bill. If substantially less than this percentage were needed, the wage reduction would not affect the rationalisation scheme; moreover, the firms would in any case benefit from the economy in wages after rationalisation as well. It must therefore be assumed that although wage reductions can, under certain circumstances, lessen unemployment, they cannot prevent rationalisation.

Under cyclical conditions the differences in costs as between capital-intensive and labour-intensive firms often appear to be so small that a slight adjustment in the wage level would ensure superiority for the labour-intensive firms, and it is inferred from this that a timely wage cut would have prevented rationalisation. This, however, is an illusion. The comparison is usually made when the capital-intensive firms are working far below their full capacity, so that the burden of overheads per unit of product is naturally very much heavier and the differences in costs between rationalised and non-rationalised industries are reduced. And even then it must not be forgotten that the economy in wages will also benefit the capital intensive firms, and, ceteris paribus, again increase their margin of profits.

In the case of labour-saving improvements involving a big reduction in costs, any preventive reduction in wages would probably be larger than that which would allow the displaced workers to be reabsorbed. If this is so, the thesis that technical progress, and particularly rationalisation, is induced by high wages is untenable.

It is hardly necessary to summarise the conclusions of this chapter. It is clear from what has been said that there can be no
question of automatic compensation, and that on the contrary labour-saving technical improvements set in motion a lengthy process of adjustment, and it is not until the final stages of this process are reached that the unemployed can be reabsorbed. In the cases here discussed this process lasts a considerable time, even if prices and wages are assumed to adjust themselves rapidly to the changed circumstances.

It must also be remembered that the considerations put forward in this chapter apply to a state of harmonious growth disturbed by technical progress, and in which the disturbance is overcome by the familiar phenomena of adjustment. In reality this adjustment does not usually take place, but the disturbance gives rise to effects which prepare the way for still greater disturbances in the future. These later consequences of labour-saving technical improvements, which have not yet been discussed, will be dealt with in the following chapter. As a result, the effects of labour-saving investment proper only appear in connection with the counter effects of the economic cycle. Although displacement takes place, therefore, unemployment need not increase immediately. In the following chapter an attempt will be made to determine the part played by displacement in the unemployment which characterises slump periods.

Unemployment during cyclical depressions does not, however, raise the same problems as in a state of harmonious growth such as we have discussed in the present chapter. It is then no indication that wages are above the level of marginal productivity, but is primarily due to the disproportionate growth of different industries which has been continuously aggravated during the upward trend of the cycle. The main problem is to restore output and prices to their right proportions and to consolidate the extra credit, although the problem of the right level for wages naturally also plays an important part. These questions will be dealt with in the following chapter.

Although in the present chapter we have dealt with assumptions rather than facts, our arguments are nevertheless an important aid to the understanding of the real situation. Unemployment, which is at first concealed by cyclical conditions, is none the less latent under this disguise, and the reaction is therefore
all the stronger when, after the period of feverish investment, the expansion of the economic system is forced back by restrictions of credit and by the disturbances due to disproportionate growth of different branches of production and disproportionalities in distribution of the national income.
CHAPTER VI
ELASTICITY OF MODERN MONETARY SYSTEMS
AND ITS IMPLICATIONS

IMPORTANCE OF THE MONETARY ASPECT

The method we have so far followed of considering our problem in isolation cannot give a true picture of the real situation, in which forces are at work which partly disguise and partly distort the process described. This process does not run its course in isolation, but within the framework of the business cycle. Displacement and its effects therefore form an inseparable part of the cyclical development of the economy; this in turn is governed by certain fundamental factors, the dynamic forces of growth, population and technical progress. But the effects of these forces are also primarily governed by the money system. In saying this I do not wish to uphold a one-sided monetary theory, but, on the other hand, it would be wrong to disregard the effect of monetary phenomena through which the real factors act upon the economic process.

The effects of technical progress are also obscured by shifts in international trade and by political developments (war, etc.), which also affect employment. Hence they cannot be separated from the economic process as a whole. The general picture of the economy, as shaped by all these different sets of circumstances, shows the course of concrete business conditions, so that our exposition should logically take the form of a scheme of the cyclical movement subject to the modifications necessitated by the change in the data due to the labour-saving improvements. It is within such a theoretically constructed scheme that the influence of these labour-saving technical methods could be determined.
But such an extension of our field of enquiry is beyond the scope of the present study, nor is it necessary in order to explain the important influence of technical progress on the labour market. For there remain two main factors in the situation which still have to be taken into account in order to transform the set of circumstances described schematically above into a more or less accurate representation of real conditions. In the first place, we must examine how far a more elastic monetary system can influence — that is to say, moderate or retard — the effects of technical progress on the labour market. For this purpose we must abandon the assumption that the money supply expands regularly at a given tempo, and consider how far the disturbances we have described will be mitigated or aggravated if the money supply is able to expand faster than the normal trend of growth or periodically to contract either relatively or even absolutely.

A second point which will be considered later (see Chapter VIII) concerns the structural problems of modern industry, which may give rise to exactly the opposite kind of difficulties from those hitherto discussed. These arise out of the fact that there may exist capital-saving as well as labour-saving inventions, so that capital may be displaced and, of course, investment itself may encounter difficulties in the course of economic development. Theoretically, this means that the demand curve for capital may be just as discontinuous as, in my view, the demand curve for labour often is.

**Fluctuations of Active Money in Modern Monetary Systems**

In order to solve our problem of how far the effects of labour-saving technical progress can be modified by varying the supply of money, and especially by expanding it during the upward and contracting it during the downward phase of the cycle, we must first consider how the active money in circulation is commonly expanded or contracted in our present banking system. It is always the active supply — that is to say, the quantity of money which comes on the market as purchasing power — which is the important factor. We have here to deal with the purchasing power which on the average actually reaches the market within a unit of time. If, for instance, a labour-saving technical inven-
tion rapidly improves the prospects of investment in a particular industry, the volume of investment in the remaining industries will not be maintained unless it is possible to finance this extra investment over and above the normal rate, a condition which depends on an increase in the volume of active money in circulation\footnote{1}. The following considerations are intended to clear the ground for an analysis of the monetary aspects of the process with which we are concerned.

**Expansion of Circulation**

The following are the three main ways in which the active money in circulation can be expanded:

(a) *Pure Gold Standard*

In monetary systems of this kind the note-issuing bank is bound to buy up whatever quantities of the metal on which the currency is based are presented to it. It would have to do this even were it not legally compelled to do so because otherwise its own stock of currency metal would depreciate and the basis of the currency would thus be altered. If the equivalent of this currency basis brought on to the market, which we will assume to be gold, is paid out in notes and if these are used to buy commodities, the active money supply is directly expanded. In this case expansion takes place without the necessity for any intervention by the issuing bank. The active money supply can be reduced to its former level later if the ratio of the covering gold to the note circulation increases correspondingly. This will happen if, for instance, the equivalent of the gold sold to the issuing bank is again deposited in the form of notes; if, for example, the amount by which the currency has been expanded is used to build up reserves. It is thus possible that an expansion

\footnote{1}{Although in earlier discussions of this problem due weight was attached to the point of the greater need for capital involved by labour-saving inventions, the possibility of satisfying this additional demand for money, at least temporarily, by creating new money was disregarded. On this point see, for instance, Alvin Johnson: *The Effect of Labour-Saving Devices upon Wages*, op. cit., p. 108, where only the two possibilities of withdrawing capital from other uses and accumulating new capital by more intensive saving are discussed.}
of the gold supply will not lead to a corresponding expansion in the supply of active money in circulation; this has actually happened on several occasions during recent years.

The situation is essentially the same when the rise in the gold holdings of the issuing bank is the result of foreign trade, and the subsequent effects are also identical.

(b) Creation of Extra Money

This is always done through credit expansion. The chief method used is that of increasing the circulation of bank-notes.

We will consider here only such credits as are advanced by the banks to producers. In so far as they were originally granted on the basis of a metal currency in the form of notes secured by gold deposits (even in the case of private banks), the assumption was that only part of the notes in circulation would normally be presented for conversion. A considerable fraction remained in circulation without ever being presented at the banks' counters, so that the money supply could constantly be expanded beyond the limits of the minted currency. With the abandonment of the use of precious metals in domestic financial transactions, which took place in most countries after the war, the basis for the issue of bank-notes was widened. This is now only limited by the covering regulations of the bank of issue, even these having been suspended in certain countries and in the case of metal currencies, by exchange variations beyond the gold points. In many countries control of foreign trade has replaced the automatic protection of parity formerly ensured by a gold or silver currency. In issuing notes on the basis of gold deposits, private banks or the central bank which had the monopoly of note-issuing ran a twofold risk. In the first place, if the notes were redeemable it had to reckon with the possibility that more gold might be demanded than the bank had available. Against this eventuality the bank's only effective protection was to suspend conversion, a device which always had to be adopted in the event of a rush on gold. To-day, however, this question of redeemability no longer plays an important part. The second risk, which is still an appreciable one to-day, lies in the uncertainty whether credits granted in the form of notes will be repaid. If these credits, which are always short-term credits, are not repaid — that is to say, if they are frozen — the bank's operations are necessarily
hampered, because it will subsequently have fewer funds at its disposal. Moreover, it will also have to write off any losses on credits granted as bad debts and cover them out of profits or capital. But in banks as in any other undertakings, and especially in an issuing bank, a large proportion of losses may remain invisible — if, for instance, frozen credits are constantly renewed and therefore continue to figure as assets in the books. If the State itself is the borrower, the limits of this process are especially wide. Very often the fact that repayment of the loans can no longer be expected does not become obvious until the depression supervenes.

(c) Cheque Payments

The system of cheque payment which developed during the nineteenth century was superimposed on the other two means by which the quantity of money was being augmented; it opens up a new source of money which is largely independent of the decisions of the central bank. In fact, it gives to all banks to some extent the powers of a central bank.

In view of all the possibilities of increasing the quantity of active money within the modern monetary system, it is obvious that the introduction of a new process of production can only be held up by the absence of extra means of payment if the quantity of money in circulation cannot be increased or if the velocity of circulation has already reached a maximum.

An increase in the supply of money in the most narrow sense of the word can only be said to take place when money flows into the note-issuing bank and when the latter expands the note circulation on this basis. On the other hand, the paying in of these notes as demand deposits, which will then lead to the formation of further deposits and also the extension of the transfer system of payment, under which an ever-growing number of book transfers is interpolated between every two cash transactions, may be described either as an increase in the quantity of money or in the velocity of circulation. If therefore the monetary system has already utilised the metal and bank-note basis of the currency to the full, so that there can be no further relending of deposits, or of non-cash methods of payment including bank transfers, the active money in circulation can only be expanded if gold flows into the central bank and the note issue
is enlarged accordingly or if the central bank makes fiduciary issue. This increased supply of money will then gradually reach the same velocity of circulation as formerly obtained with the smaller supply.

The increase in the active money supply brought about by the adoption of means of payment other than cash will take place mainly during the period in which this method is establishing itself. This period may last between 50 and 100 years. Under this system, payments from the customers of bank A to other persons, which had previously been made in cash, are now made by cheque, and the persons who have their accounts with banks B, C, etc., will in turn make their payments to the customers of bank A by cheque. In this way the scales will be kept permanently balanced because the payments and receipts of every economic subject are bound to cancel each other out in the long run. Thus the result of the change-over to a system of non-cash payments is to increase the number of transactions not involving cash which can be interpolated between every two cash transactions, so that although the amount of currency in circulation remains stationary, the active money supply rises. This, however, is only possible if the cheque system is generally adopted. Where the system of bank transfers is customary, however, the banks' stock of money may diminish although payments remain the same and may remain stationary although payments increase. What happens then is that some payments are made by cash and some by cheque. While the economy is in process of changing over to the credit method of payment, the active money stream will be able to expand even though the currency does not, and if the currency expands, the active money stream will be able to expand still more quickly than the currency. If the system of bank transfers were absolutely general, the monetary system would set no limits to the growth of deposits and therefore to the amount of credit. The only sign that the banks had given too much credit would then be the change in the price level and a fall in the rate of exchange, and possibly also difficulties in recovering the credits. (The same holds true for a fiduciary issue.)

These few remarks are necessary to show the scope provided for and the limits set to economic expansion by the modern monetary system. What is called credit expansion is merely the

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utilisation of the available opportunities for development, but
this can increase the stream of purchasing power just as effec­
tively as actual expansion of the currency ¹.

FACILITIES FOR CREDIT EXPANSION AT THE END OF THE DEPRESSION

If during a boom period production, and therefore turn­
over and prices, rises as far as is permitted by the monetary
system, and if, in consequence of the briskness of business,
income and credits also rise, the total value of deposits will, of
course, increase, so that with a given ratio between total payments
and cash payments the banks will ultimately have to have
recourse to the central bank, which will then be able to issue the
notes necessary to finance the increased turnover of business,
within the limits allowed by the currency laws. In such periods
it is probable that the proportion of cash payments will diminish.

The scope provided by the banking system for credit expan­
sion — in other words, for the creation of extra money — at the
beginning of the boom is therefore extremely wide. The fact
that it is hardly ever used to the full is due to the difficulty of
speeding up the velocity of circulation on the one hand, and to
the amount of circulating cash necessary on the other, the latter
being the factor which determines what fraction of deposits must
be kept in cash form. If, for instance, with 2 milliards metal
reserves, the statutory maximum for the note circulation is 6 mil­
liards, the remaining 4 milliards represent extra money of the
first order, provided that none of the amount is hoarded. If of
these 4 milliards, 2 milliards are permanently circulating in small
sums ², while 2 milliards lie in the banks in the form of cash
reserves, the banks will be able to advance these deposits to other
borrowers.

¹ Somary upholds substantially the same view when he says that "an
expansion of the means provided by the credit bank system is only possible
(a) by attracting foreign money; (b) by extending the system of bank
transfers in place of cash payments — not very important in economically
advanced countries, in which the limits of both systems are rigid; (c) by
resorting more freely to the issuing bank ". Method (b) still has greater
possibilities than Somary assumes, especially in the world economy as a
whole. (Compare his Bankpolitik, 3rd. edition, p. 73.)

² These milliards are reserves of cash also, inasmuch as the circu­
lation of money is identical with the private reserves of cash. Every
payment is the shifting of money from one individual cash reserve to
another.
Thus means of payment other than actual currency are created in the familiar manner. This process will be able to continue so long as no rise in the circulating currency (i.e. the formation of new individual cash holdings by the newly engaged workers, for instance) reduces the banks' reserves of cash to a point where they regard it as dangerous to grant further credit. Every increase in deposits will therefore give rise to an outflow of notes into private circulation, and vice versa. When a saturation point is reached, there will be no further increase in deposits. The creation of extra money on the basis of securities will then also come to a stop, because these new means of payment too will partly take the form of cash, which will result in a fresh outflow of notes into circulation.

Thus when all the possibilities latent in an elastic monetary and credit system have been exhausted, no further substantial increase in the active money supply will be able to take place. Every depression, however, will, owing to the severe shrinkage of production, renew the possibilities of monetary expansion; the total circulation of money diminishes, the velocity of circulation is retarded, and reserves increase. This means that side by side with the displacement of the factors of capital and labour from production, fresh opportunities arise of expanding production through credit. How far this expansion of production can proceed without seriously upsetting the price level depends upon the extent of real reserves available.

Credit Expansion for Financing Technical Improvements

We must now consider the bearing of these remarks on our particular problem. What we have to examine is how much significance attaches to the fact that the supply of purchasing power which reaches the market no longer increases regularly at a given rate, say 3 per cent., as previously assumed, but that when need arises it can expand rapidly by 6, 10, or even 15 per cent. This increase does not, of course, take place all at once, but over a certain period of time.

Reserves, in this case, means unused capacity and idle factors; which are, as it were, the unused capacity of the economic system as a whole; but whereas the unused capacity of firms is already investment, idle factors, e.g. unemployed workers, are potential capacity only.
Even in the normal course of economic development the general expansion of production goes hand in hand with a simultaneous rise in circulating capital and fixed capital. There is little point in discussing which increases first, since it is just as true to say that there must be an increase in fixed capital before circulating capital can usefully be enlarged as the reverse. We may therefore say especially when all branches of production expand proportionately there is a simultaneous rise in both fixed and circulating capital.

The simplest theoretical case is that of the constant production of a currency basis which, when it comes into circulation and is uniformly distributed, places purchasing power in the hands of the entrepreneurs, enabling them to pay more workers than before. Theoretically, therefore, the whole of this process can take place without credit. Individual incomes, it is true, do not increase, but the national dividend increases, and with it the circulating capital of the producers, together with their invested capital purchased with extra profits which take the form of circulating capital in other undertakings during certain stages of their progress.

Historically, the process of industrial growth has in fact always been accompanied by an expanding output of precious metals, and this had led a number of economists to take gold production as the yardstick of economic development. But the methods of increasing the money stream which we have discussed above show that the rate of growth of production does not depend on the gold output even where gold has been retained as far as possible as the basis of the currency, nor can increase in gold production serve as an index of economic activity.

An increase in the active money in circulation by means of credit expansion — the genuine creation of extra credit (supplied by the issue of notes) as well as the lending out of deposits which had previously lain idle — will have the same effect as an increase in the supply of gold in the case of a gold currency. The additional money created will circulate in the same way as the previous supply from the outset. The extra purchasing power will go to form the incomes corresponding to the services rendered by the extra workers, and to provide the interest and amortisation on the new capital invested in the previous year. In this case prices within the system will not alter, provided that there is no further change in technique. The whole process, which
implies a permanent expansion of annual production from year to year, can only develop without raising the value of money if there is a simultaneous and corresponding increase in the money supply. Even if the extra money is created through credit expansion (and this happens even with a metal currency, through the issue of additional notes), this does not mean that the entire growth of production is financed by credit directly. The first credit advanced is transformed into the income of other persons as soon as it is spent, and gives rise to deposits which are just as real as those made out of savings, in the sense that the purchasing power they represent cannot be recalled; it has finally flowed into the stream of circulation. And this is true of all payments made out of the original credit. Not until the latter is called in and repaid will the whole chain of economic transactions to which it gave rise be broken, and in this sense credit contraction represents a bigger curtailment of production than that which could directly correspond to the amount of credit withdrawn.

The basis for industrial expansion provided by an increased output of gold is no more stable than that provided by extending the use of means of payment other than actual currency. Cyclical fluctuations are just as likely; inflationary booms have been and still are provoked by an over-supply of new gold. Conversely, too, gold may sometimes lie idle. As the velocity of circulation of gold may vary, the extent of production is not determined by the supply of gold alone. If for any reason the supply of money increases disproportionately, this will generally be because some firms wish to obtain credit in order to extend their business because market conditions justify this extension, while others have no reason to reduce their customary rate of expansion.

What are the causes which may lead to this increased demand for credit?

If technique remains unchanged and the only variable factor is the population, and if habits of saving have grown up corresponding to this growth in population, one of two things will happen as the result of the investment of savings: either the stock of money will remain stationary, and pressure will be exercised on wages and prices which, however, will leave per capita production and real labour and capital incomes unchanged; or the increased value of money will lead to an increased production of gold and thus to the restoration of the former price level. In neither case, however, will there be any particular or especially
promising incentive to heavy investment, and hence to a heavy demand for capital. This might arise as the result of a sudden shifting of demand (see above, page 39), but it is not likely save in quite exceptional cases. Under these circumstances therefore any sudden expansion of the money stream can only be brought about by monetary factors, e.g. through a discovery of gold, by debasing the currency, or by a Government issue of notes to cover a deficit. The case of a large discovery of gold is a factor outside the economic field, although it has the same effect as a sudden and temporary lowering of the cost of gold production, or technical progress in the gold-mining industry, whereas the expansion of the currency by Government action is always intended to promote consumption.

Heavy demands on the credit market are therefore only likely to arise as the result of sudden prospects of large profits, created in particular by the opening up of new markets, the manufacture of new products, and improved methods of production in the broadest sense of the term. But, as in the more advanced stages of economic development at least, technical progress usually also involves the finding of new markets, it may be regarded as the main cause of the demands for credit which arise spasmodically on the capital market.

**Short-term Credits in Fact Long-term Credits**

In a capitalistic economy, these additional credits are normally advanced by the banks in the form of short-term credits. Very often they can be granted owing to the fact that the note circulation has not been expanded to the statutory maximum and that deposits are lying idle. Further important factors are the possibility of extending the use of means of payment other than actual currency, and the growth of the gold reserves of the note-issuing banks. Modern monetary systems are therefore usually capable of providing credits to enlarge business capital, especially after the economic process has been purged by the depression and the financial situation is liquid. At the outset, however, the expansion of short-term credit will merely increase the amount of working capital available, whereas every expanding firm will also need a greater amount of additional fixed capital than under the normal rate of growth. In many cases, this need for fixed capital will manifest itself in the first place as an increasing
demand for working capital in the capital goods industries, which will subsequently give rise to a corresponding demand for long-term investment, first in the consumption goods industries and later, when unused capacities are fully employed, in the capital goods industries. This interlocked series of credit operations will only be able to proceed smoothly if the investments concerned are consolidated — that is to say, if they can ultimately be financed out of savings\textsuperscript{1}. Hence great importance is quite rightly attached to the question of the capital market. It is true that every expansion of production implies a possible increase in the volume of savings, but dangerous stresses may arise if the reserves of idle savings are small and if business credit is expanded to an extent exceeding the rise in savings which may be expected as a result of the boom, an eventuality which is all too probable, because modern systems of payments permit of a very rapid increase in the supply of money and therefore in business credits.

**The "Natural Rate of Interest"**

Nor can it justifiably be maintained that such a dangerous expansion of credit is only possible when the rate of interest on investments falls below the natural rate for capital formed out of savings, because the strain is caused by the expansion of short-term credit, to which the concept of a natural rate of interest does not apply\textsuperscript{2}.

Something must be said at this point on the question of the natural rate of interest. It will be remembered that Wicksell first upheld the view that money can only remain neutral so long as the market rate of interest is equal to the marginal productivity of newly invested savings. The practical significance of this concept is very small. In the first place, there is a large

\textsuperscript{1} The actual savings, at any time, are, however, influenced by credit policy in so far as that changes the process of production, and whether savings will eventually prove to have been made in suitable quantities depends upon the success of the production initiated by the additional credit.

\textsuperscript{2} In his article on "Monetary Expansion and the Structure of Production" (Social Research, November 1934), Neisser comes to the conclusion that if credit expansion were limited to 5 per cent. of working capital yearly, this danger would be averted — that is to say, money would be made neutral.
number of different rates of interest, for which it is impossible
to determine a natural rate. Further, it is extremely difficult to
ascertain the exact amount of savings in any business period,
because savings often come on to the money market temporarily
in the form of a supply of short-term money. And lastly, the
prospects of profit from investments can never be forecast with
certainty, and a general anticipation as to possible profits cannot
influence the market in such a way as to ensure its fulfilment. For
all these reasons, credit policy cannot be based on the prin-
ciple of a natural rate of interest.

Nor is it any easier to determine the correct bank rate for
short-term credit. The notion of a natural rate of interest is not
applicable to the short-term credit market, because wherever the
money market is liquid and the credit available cannot be fully
used, the rate of interest actually paid is higher than the natural
rate. When the quantity of short-term money available exceeds
the current and future supply of savings, it cannot all be used to
expand business capital without danger of over-development.
Under free competition the rate of interest should, strictly speak-
ing, fall to zero in all these cases. That this does not actually take
place is because the supply will be withheld if the rate of interest
falls too low. When this situation obtains, it will not be evident
until too late that the interest rate on short-term credits was too
low, not indeed because of the conditions on the money market
but because of those on the investment market. Unfortunately,
free competition does not lead to the fixing of a rate of interest
on both kinds of credit which ensures the investment of sums
equal to the whole supply of genuine savings, and no more. This
would only occur if there were a pre-established equilibrium
between the purchasing power available for short-term and long-
term investment respectively. In the existing circumstances
there is a perpetual threat of over-expansion beyond the normal
rate of growth.

Thus, through the mechanism of a preliminary grant of
short-term credits, leading later to a demand for capital, the

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1 The fact that on a limited market prices are actually determined by
the general anticipation of profit (e.g. on the money exchange) should
not blind us to the fact that anticipations, however widely held, and even
if used as the basis of economic planning, can ultimately only determine
the course of development if they do not disturb the proportions between
industries and incomes necessary to ensure equilibrium.

2 This danger can only be effectively averted through general planning.
demand for capital goods can be suddenly expanded beyond the normal even if the necessary savings are not yet available. The crucial question is whether this will counteract the displacement brought about by technical progress, which, as we saw above, was due to the difficulty of financing all investments when there was a lag in spending additional profits; that is to say, whether the elasticity of the money system will ensure a permanent expansion of production which outweighs displacement. If so it will be accompanied by so rapid a rise in the supply of capital that the workers released both by the primary and the secondary waves of unemployment will be able to find employment, first in the manufacture of extra capital goods, and later in the newly-built plants, unless compensation had already taken place in some other form. The problem is then essentially whether, given reserves of labour and the possibility of increasing the material means of production, production can be expanded without friction even in the case of rapid labour-saving technical progress. This is a general problem of all business cycle policy, its sole distinctive feature here being that as a result of changes in the sphere of production there is a sudden extra demand for labour succeeded later by a sharp decline.

Expansion of Credit Reducing Temporarily "Technological Unemployment"

Thus, when the process of displacement takes place in an economy in which the supply of gold and credit are highly elastic, the question of compensation for the unemployment created by technical progress presents itself in a somewhat different form from that under which we considered it in connection with the financing of the necessary extra investments out of savings. Within the narrow limits set to the economic field in the latter case, it seemed impossible to avoid unemployment and readjustment could only be expected at the cost of drastic changes in prices and incomes, and even then only at the end of a long-protracted process. If we assume that the supply of gold and credit are elastic, however, the question arises whether technical progress does not create a new initial situation enabling employment capacity to be enlarged by a fresh combination of capital and labour, which can be financed by recourse to extra short and
long-term credit. In this case, not only will a regular process of growth, adjusted to the growth of the population and corresponding to a simultaneously expanding supply of money, take place; this process will also be accompanied by a spasmodic, i.e. a temporarily more rapid, but just as permanent, process of expansion, in which ultimately the displaced workers will find employment and the extra output markets.

This question of the accelerated expansion of production can again only be elucidated by a gradual approximation to reality. The first point to be examined will be the effect of credit expansion to finance labour-saving inventions, first, when all reserves of the material means of production are fully employed, and secondly, under the assumption that unused capacities are available.

At this point therefore the question of compensation turns into that of whether displacement can be entirely avoided by a temporary speeding up of the process of expansion; or whether the unemployment which will then arise as a consequence of cyclical conditions can be attributed in part at least to technological displacement.
CHAPTER VII

TECHNICAL IMPROVEMENTS AND THE BUSINESS CYCLE

EFFECTS OF CREDIT EXPANSION WHEN PRODUCTION IS OPERATING TO FULL CAPACITY

The starting point of our present line of argument is the situation originally described. We assume that the productive system is operating without any reserves of the material instruments of production. Even if some firms have to close down as a result of technical progress, this does not lead to the creation of such reserves except in those cases where the means of production thus released can be used for other forms of production. As a rule, these means of production temporarily or permanently drop out of the economic circle, together, of course, with the profits and depreciation allowances attaching to them.

Let us now assume that the whole of the additional demand for capital in excess of normal requirements can be satisfied by credit expansion within a flexible monetary system. This extra demand for capital will arise either to finance the normal expansion of the other (static) branches of production, from which the accustomed flow of capital has been diverted owing to the technical improvements in the dynamic industries, or to finance these improvements in the dynamic firms themselves.

It is, of course, impossible to isolate this extra credit from all the other phenomena of the capital market. But in any case a larger amount of purchasing power than before will now be available for the acquisition of capital goods. Real demand will also rise, because labour-saving inventions require investment in the dynamic firms.

The amount of extra capital needed will, in the nature of things, not always be the same. In the example selected above
it amounts to 528 millions, and the process will proceed more or less as follows\footnote{The question of the rate of interest on this additional capital is not discussed here. If the credit system is flexible, it may be assumed that the rate of interest will not rise very far, since otherwise the demand for capital would decline in the static firms, the extent of this decline depending on the structure of demand. The demand for capital in the static firms will only remain stationary if credit expansion is followed by a rise in prices which permits of a substantial rise in the interest rate also; but this obviously leads us back to the problems of the business cycle.}: 

The new credit created flows into production, and new capital goods will be ordered. It is, however, uncertain where these will be produced. Under our assumptions, no unused capacity is available anywhere in the economic system; even the workers who will subsequently be displaced are still in their wonted employment. Hence the extra output can only be produced in one of the following ways:

(a) Extra capital goods may be produced by having recourse to double shifts or night shifts. Strictly speaking, this is also a form of the mobilisation of unused capacity; the possibility is therefore mentioned here merely for the sake of completeness and will not be discussed in further detail.

(b) The production of new capital goods can only be expanded by setting up new firms. Such new firms will be in course of construction in any expanding economic system. But if the demand for capital goods is rising, labour will be required to build the necessary plant more quickly or on a larger scale. Under our assumptions, however, the employment capacity of the existing firms is already saturated and there is as yet no unemployment, so that strictly speaking it will not be possible to produce either additional plant for the construction of capital goods or additional capital goods themselves in excess of the provision made under these heads in the scheme of production. The purchasers of capital goods will receive the new credits in the form of additional purchasing power, and will use all their purchasing power on a market on which there has as yet been no change in the quantity of capital goods available because the supply of capital goods cannot be expanded immediately. Hence prices will rise, and the extra credits will pass into the hands of the manufacturers of capital goods in the form of purchasing power. If, in the strict sense, no unused capacity is available, it will be impossible to produce any extra capital goods, and the only
alternative will lie in the redirection of the factors of production. That is to say that more workers and more of the material factors of production will now be used in the preparatory stages of the production of capital goods. This means that the plant for producing capital goods will be extended, while the actual production of capital goods will temporarily shrink. This consequence only appears so far removed from reality because our assumption that no unused capacity at all is available does not fit the facts. But even under this unrealistic assumption there is a way out of the difficulty: some of the capital goods required can be supplied by cutting down consumption. In the first place, there are certain kinds of capital goods which are at the same time consumption goods, such as coal and building materials. Secondly, undertakings manufacturing consumption goods can often switch over to the production of capital goods without any further investment, the workers too being simply switched over to other duties. In this case the production of consumption goods will be cut down. This process will have been preceded by a rise in the prices of capital goods because only in this way can the firms concerned be induced to change over to the manufacture of capital goods. The result will be a shortage of consumption goods, the prices of which will accordingly also rise. As it will be some time before these increases in price even themselves out, differential profits will be earned. Moreover, owing to the varying elasticity of demand for the different goods, the new price ratios will also vary widely. There will be no rise in wages, because if firms simply change over from one kind of production to another, the demand for labour will not expand.

The Rise in Prices and Profits

Thus the rise in prices and profits, with wages remaining stationary or lagging behind, leads to increased production of capital goods (when the latter has risen sufficiently to satisfy demand, the process of expansion will automatically come to a stop). The rise in prices will, however, in itself increase the need for capital. The figure of 528 millions given above only applies under the assumption that prices remain constant. Not only will the extra credits be insufficient to finance production as normally planned if prices rise, but extra money will also be required to finance the old demand. If, for instance, the price
of capital goods rises by 5 per cent., all purchasers will be obliged to pay 5 per cent. more for their capital goods.

If prices rise by 5 per cent., the amount of money required by the static producers, in addition to their replacement expenses, will rise from 7,000 to 7,350. The dynamic producers, who have an extra 528 units of purchasing power, will be able to acquire only 500 units if prices rise by 5 per cent., so that they will have to spend about 554 millions in order to adjust production completely to the new technique. Whether the extra credit will suffice will depend upon whether the full demand for capital goods can be met with a 5 per cent. increase in prices or not. The amount of this extra credit will now be 904 millions. If the 5 per cent. increase in prices does not enable 7 ½ per cent. more capital goods to be manufactured than were required to meet the normal expansion of demand, further credit expansion will be necessary and will soon take on an inflationary character; and at this stage better capital equipment will rather be obtained by securing a larger share of purchasing power. This process of price-raising will incite both the dynamic and the static producers to further efforts and they will try to make up for the rise in prices by obtaining further credits. The whole process can then only be checked if the production of consumption goods is cut down to an extent sufficient to create a balance between supply and demand in the field of capital goods, or if the banks themselves put a stop to credit expansion. At this point, however, the same arguments apply as were stated under our previous assumption of a normally expanding money supply without credit expansion.

The demand for capital created by labour-saving technical improvements will be still greater if we apply our assumption that production is being carried on without any reserves more strictly. In this case it will be necessary to enlarge the plants for the production of capital equipment in one or other of the branches concerned, and in due course over the whole field of the

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1 The demand for capital goods for the purpose of new investments increases from 2,000 to 2,528. 5,000 units will be produced, as before, in the form of capital goods for replacement. If it is impossible to expand the production of capital goods further, the cost for 7,000 units will be 7,528, i.e. prices will rise by 7.5 per cent. But if production of consumption goods is cut down in order to enlarge the supply of capital goods, the rise in prices will be split up and thus need not be so large. On the other hand, however, the increased demand for capital goods to produce new means of production may lead to a further rise in prices if credit is available, and this in turn to a larger demand for extra credit.
production of capital goods, and this may give rise to an unusually large demand for capital. If, in accordance with our example, an extra 7 per cent. of the total output of capital goods has to be manufactured in a single year, and if an average of 4 per cent. of the fixed capital is invested yearly, this additional output will require an expansion of plant equal to nearly twice the normal annual growth. This expansion cannot be expected if it is obvious in advance that the extra requirements will only be temporary. But if there is any prospect that they will continue (see below), a trend is created and a rapidly increasing demand for capital arises. This also leads to an additional demand for transport arrangements, houses, power stations, etc., beyond the normal rate of expansion. Such a sudden and intense expansion of demand, economically justified by the fact that the economic system has to adapt itself to a more capitalistic organic structure, is likely to occur when rationalisation is not confined to a single industry, however important, but when the same technical principles are also applied to other branches. Once a movement of this kind is set on foot, the extension of plant for the manufacture of capital goods will also become urgently necessary.

This phase may last for a number of years. While it is still in progress, the firms in which rationalisation was first introduced will already have reduced their staffs and their demand for new capital goods will also have ceased. But this demand will now come from the other industries, so that under our assumptions the workers displaced at this stage will find employment again owing to the demand for labour of the producers of capital goods.

If no reserves are available, however, this process will be unable to last for very long, and the rationalisation movement will soon come to an end. When this happens, and as soon as the credit system reaches the limits of its expansion (and the fewer the reserves available, the sooner this will occur, because the increase in prices will then be more rapid), the production of capital goods will decline. Here again, therefore, the problem of unemployment once more arises. The question of compen-

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1 If 4 per cent. of the fixed capital is invested every year, this investment will grow every year by 4 per cent. also, that is from 4 to 4.16, 4.32 and so on; if now an extra of 7 per cent. of these 4 per cent. is invested, investments will have to increase from 4 to 4.44 in the second year, which requires an increase in plant (producing investment goods) that is greater by about 175 per cent. than the increase in a normal year.
sation under these circumstances can more suitably be dealt with when we discuss the hypothesis of the existence of reserves at the beginning of the boom period.

The assumption that no unused capacities are available is here interpreted in its strictest sense. In practice, however, the economic system is never so rigid. "Full employment of productive plant" can also be interpreted to mean that although employment capacity is not limited absolutely, the practical capacity is already fully utilised and that the extension of production is cutting into the margin between practical and theoretical capacity. All industries are then subject to the law of increasing cost, and a still larger rise in prices would be necessary. As a result of the operation of increasing costs, however, real wages will be bound to fall if productive equipment is used more fully. This fall in wages will permit the use of a part of the output of finished goods as capital goods. To balance this there will be an increase in profits, which will indeed increase the supply of capital, but will only negligibly affect the feverish demand for an expansion of credit.

Effects of Credit Expansion when Production is Operating Below Capacity

Let us now examine the problem from a more realistic angle, taking into consideration the fact that, in actual practice, the means of production are never employed to their full capacity. A certain amount of unused capacity can always be counted upon, and stocks of raw materials and auxiliary materials as well as the machinery will also be constantly available. Moreover, in addition to these there will be reserves such as vacant premises or unused transport facilities. If demand increases and prices rise, unused and obsolete plant will again be set to work in all industries. And lastly, large reserves of unused capacity will be constantly available in the capital goods industries which supply replacements. As the lifetime of the various instruments of production is never a fixed span, old plant can continue for some time to be used side by side with the new. It is no exaggeration to estimate that productive equipment is seldom used up to more than 80 per cent. of its theoretical capacity. How large these reserves actually are was clearly seen during the war, when
production was expanded with such amazing rapidity merely on the basis of the existing productive equipment.

The fact that such reserves exist does not, of course, imply that the financing of new plant to expand production can be entirely neglected. If it were, the friction that the existence of reserves helps to prevent would very soon make itself felt. New investment in this field is necessary because from time to time the full capacity of all the means of production is called into play, and also because repairs are constantly necessary which put a certain amount of plant out of action. The same applies to the stocks of raw materials, etc., in which a large proportion of the working capital is tied up. Stocks of raw materials are necessary to meet fluctuations in demand and stocks of finished goods for the same reason, and also in order to enable the various and fluctuating needs of customers to be satisfied. Temporarily, at least, a very substantial increase in the output of all branches of production is necessary.

In addition to these normal reserves, there are in every depression disused undertakings which are also available for the expansion of production. For the present, however, we will ignore the special conditions obtaining in a depression and simply assume that, within given limits and over a given period, production can be expanded without any further investment. If, now, a labour-saving invention creates a sudden large demand for capital, these reserves will play only an indirect part in meeting the demand of the dynamic firms, since this demand will mainly involve new investments — in mechanical plant for instance, mines, cranes, road-building machinery, the change-over to an automatic telephone system, etc. The only importance of reserves in this case will be to enable the new capital goods required by the dynamic firms to be manufactured in existing plants. The static firms and industries, on the other hand, will temporarily be able to do without the extra capital they normally need, without thereby being prevented from expanding their production. Hence, secondary unemployment will not at first occur (see page 177). But sooner or later these temporarily delayed investments will have to be made good. What actually happens, therefore, is that the extra demand for capital is spread over a longer period. If no new improvements in technique supervene, bringing with them further dis-
turbances, normal expansion in the firms and industries in which there is no change in technique will not at first be checked.

If the reserves available are sufficiently large, matters will probably proceed as follows: undertakings and workers formerly engaged in manufacturing capital goods for the static firms will now produce those which are urgently required by the dynamic firms. At first the static firms will be able to expand their output normally up to a certain point without any further investment. If extra credit is available, the new capital goods required by the static firms and industries can also be produced by having recourse to the unused capacity of the capital goods industries. The necessary labour will be available in the permanent reserve army of the unemployed. The more rapidly and completely this retarded progress is made up, the sooner will the old ratio of reserves be re-established.

**Fluctuations and Prosperity due to Investments in Labour-saving Devices**

But even though this increased output of capital goods is facilitated by calling on reserves, extra credit will still be necessary. This case differs from that previously considered, in which no reserves were assumed to be available, in that production is expanded more rapidly, the rise in prices is smaller (during the first phase of credit expansion prices will not rise at all) and the output of consumption goods need not be reduced. For all these reasons, a smaller expansion of credit will be required than in the former case.

If the application of labour-saving methods is confined to this one industry, the demand for capital goods throughout the economic system in general will fall back to the old level once the extra investment has taken place. The usual reserves of productive capacity will then again be built up. Nevertheless, the decline in the demand for capital goods will necessarily affect the market; it will only be small enough to pass unnoticed if the whole of the additional demand could be satisfied by calling unused capacities into play and spreading the extra output over a long period—that is to say, if the necessary quantity of extra capital goods can be produced by existing firms, subject to the postponing of replacements. This would also be reflected in a smaller call on the resources of the capital market. The spread-
ing of this extra production over a longish period, by calling reserves into action along the whole front of capital goods production and subsequently allowing them to fall back into their normal role of unused capacity, is conceivable under a planned economy, but hardly possible in our existing economic system, governed as it is by market conditions, because the very suddenness of the demand usually sets a boom in motion (given the other conditions, including in particular flexibility of credit and the resultant favourable interest rates), when every producer is determined to vie with his rivals in the field of investment.

Let us now consider briefly the subsequent effects of the investment of this extra capital.

The credit of 528 millions, which in our example was the lowest sum necessary to finance the extra investment, and which would be correspondingly larger in the event of an increase in prices, will gradually be repaid to the banks out of the increased profits of the dynamic producers, thus restoring their former liquidity. While this process lasts, the purchasing power represented by the extra profits will not come on to the market, so that there will be a corresponding decline in total production. Thus, although the primary effect of credit expansion and the existence of reserves was to prevent any unemployment, its reactions on total production cannot be avoided because the output of capital goods falls back to its old level, the monetary expression of this being the repayment of the extra credits out of profits. There will be a still greater shrinkage in production if in subsequent years the extra credits are paid back out of savings with the result that the rate of investment falls below the normal.

But the process of rationalisation is not confined, as inventions usually are, to single industries. Mechanisation consists in the introduction of technical principles which are applicable over a wide field, so that several successive waves of rationalisation may be expected to follow one another. In this case, the demand for capital will continue for some time, all reserves will gradually be called into play, and the process, both in the field of production and in the monetary sphere, will take on the inflationary character described above.

The sole factor which may militate against a rapid rise in prices in the latter phases of this feverish investment boom is the circumstance that as the labour-saving methods gradually come into operation, they lead to a displacement of labour. But this
again is offset, at least for the time being, by the fact that the increased production of capital goods also has a secondary effect on all other industries by creating a larger demand for their products. Nevertheless it may happen that in the last stages of the upward phase there is a decline in the demand for workers in the mechanised industries, particularly in the case of specially skilled workers who cannot find employment in other undertakings.

**The Set-back on the Labour Market after a Prosperity Period of Mechanisation**

We must now consider the position which arises at the end of a period of expansion characterised by the mechanisation of production rather than by the creation of new industries. The usual reaction sets in which heralds the collapse of the boom: the production of capital goods declines because the demand for them falls off once the effects of the extra investment are exhausted or because liquidity appears to have been jeopardised. Furthermore, the banks call in their loans, and have then to be paid back out of profits or by the postponement of replacements. This inevitably reacts on even those industries which were not chiefly instrumental in creating the boom, such as transport undertakings, power works, etc. The general process of contraction will also affect the labour market in the manner described below.

Several classes of workers will now be thrown out of employment. First, the extra workers who were engaged in the capital goods industries. Secondly, the workers who were engaged owing to the secondary effects of the increased production of capital goods; this indeed assumes that, in spite of the expansion of capital goods production, the output of consumption goods has not declined, but the assumption is justified and corresponds to the facts, as any statistics of production will show. And, thirdly, when the boom is over, the decline in employment 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.

Hence the labour market will be very drastically affected and the effects will again be cumulative, because the rapid decline in employment will also cause a fall in prices which will further aggravate business conditions.
A comparison between this kind of boom, induced by mechanisation, and the periods of prosperity due to the expectation of profit created by new industries (e.g. railways, electricity) shows various differences between the two. In the first place, if, during the boom, new industries arose which met a solvent demand without any change having taken place in the technique of existing industries, the new product will seek to establish side by side with the old and, to the extent to which it finds a market, production as a whole will expand (see Chapter I). The only reactions will then be a decline in the capital goods industries, which expanded disproportionately during the upswing, and the secondary disturbances this involves. In the meantime, however, the normal process of expansion will have continued as usual, so that when the depression occurs the volume of production will be larger than at the time of the last depression. Consequently, the output of finished goods will fall little if at all, especially if new industries have come on to the market, bringing a fresh demand for labour; in this case, employment capacity will have expanded and the depression will be only a mild one. During a period of expansion of this kind there will be no appreciable change in the organic structure of production as a whole, since the new industries will probably not be more highly capitalised than the old ones. The over-proportionate growth of industry in general will thus involve a permanently increased demand for labour.

Why Compensation fails during Depression

After a period of rationalisation, on the contrary, employment capacity is lower than before and large groups of workers will be thrown out of employment. In this case, displacement occurs during the depression and intensifies the unemployment normally accompanying it. The situation is aggravated by the fact that at this stage of the general process the compensatory factors are particularly weak; the downward trend of prices in itself discourages any expansion of production, quite apart from the fact that total incomes are shrinking and the tendency to buy in general is falling off. Hence it is possible that, at this stage, no profits at all are obtained as a result of rationalisation. Moreover, any profits that may be earned will be used not to expand
production but to pay back loans, so that the saving in wages has no compensatory effects.

But even a fall in prices will be unable to revive sales during this phase, and output will have to be expanded in order to provide employment for the same number of workers as before. Lastly, as regards a reduction in wages, which many economists hold to be inevitable and desirable in this case\(^1\), even this would have no effect since it would lead neither to the investment of extra profits nor to a sufficiently large increase in demand, while on the other hand it would appreciably reduce the demand of the workers themselves.

This point appears to the present writer to be especially important. Under normally balanced conditions, a general wage reduction may produce considerable effect by transferring purchasing power from the workers to the consumers and producers, because demand may subsequently be increased to the full extent of the fall of wages by lowering prices. This argument holds good in spite of the fact that wages are only a fraction of costs. It is the general reduction of wages because of its influence on prices in every branch of production which results in far-reaching consequences. We must not overlook the fact, however (page 203), that such a policy always entails a reduction in the real wages and that therefore the workers' group, in spite of increasing production, has to reduce its consumption. But even this "remedy" cannot now effectively be used. If, namely, this reduction in wages, with a corresponding fall in prices, takes place in the phase of the economic cycle considered above, the situation is very much more unfavourable as regards the expansion of employment. The demand curves will not, indeed, remain unchanged\(^2\), and no corresponding expansion of consumption may be expected from a reduction in prices at a time when every producer is intent on building up reserves. If sales were nevertheless to expand, or inversely if prices were not

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\(^1\) Provided, however, in the case of Wicksell for instance, that an equilibrium exists in which falling wages lead to profits which can be re-invested immediately.

\(^2\) At this phase of the business cycle, a fall in prices will not cause sales to expand even if they would not have declined had prices remained unchanged; that is to say, demand will be rigid. This will happen if the former consumers of the product use the amount they have saved on it to build up reserves, and if the other consumers who, under stable conditions, would have come on the market as purchasers are afraid to increase or change the nature of their consumption.
lowered, the larger sums earned as depreciation allowances and profits will not come into circulation but will be used to pay off credits or to form reserves. On the other hand, the wage reduction will lead to a fully equivalent and perhaps even larger fall in demand on the workers' part.

At this stage of the business cycle, therefore, the reduction in wages (which will be bound to take place if conditions on the labour market are unfavourable) will merely lead to lower employment of existing plant and will thus augment idle capacity which is so great an obstacle to business recovery. In spite of this, a wage reduction may be inevitable if only because of the situation on the labour market and although it is in no way justified by a decline in physical returns. It may perhaps help to restore liquidity and make unremunerative investments profitable again up to a certain point, but it will not lead to an increase in employment.

In point of fact, wage reduction during a depression goes hand in hand with a decline in employment, so that total labour incomes shrink even faster than the number of workers employed.\(^1\)

The compensatory factors can therefore only begin to operate when the conditions for the revival of production are established. The larger the number of workers displaced, and consequently the lower the proportion of capacity in use, the longer it will take to establish these conditions and the greater the unemployment which will be involved. The effects of displacement may also be considerably aggravated and prolonged by secondary unemployment, and a situation may arise in which a general revival of production is only possible through State intervention.

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\(^1\) This is illustrated by the following data for recent years in the United States, taken from the Survey of Current Business, 1936 Supplement, pp. 29, 36, 11.

**FACTORY EMPLOYMENT AND PAYROLLS**

<table>
<thead>
<tr>
<th>Monthly average (1923-1925 = 100)</th>
<th>Employment</th>
<th>Payrolls</th>
<th>Cost of living (1923 = 100)</th>
</tr>
</thead>
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<tr>
<td>1929</td>
<td>104.7</td>
<td>109.1</td>
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</tr>
<tr>
<td>1930</td>
<td>91.3</td>
<td>88.5</td>
<td>96.7</td>
</tr>
<tr>
<td>1931</td>
<td>77.3</td>
<td>67.4</td>
<td>87.2</td>
</tr>
<tr>
<td>1932</td>
<td>65.5</td>
<td>46.4</td>
<td>77.9</td>
</tr>
<tr>
<td>1933</td>
<td>72.0</td>
<td>49.4</td>
<td>74.9</td>
</tr>
<tr>
<td>1934</td>
<td>83.4</td>
<td>62.8</td>
<td>79.4</td>
</tr>
<tr>
<td>1935</td>
<td>85.9</td>
<td>71.2</td>
<td>82.6</td>
</tr>
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</table>
Technological Unemployment Greater in a Cyclical Process compared with Harmonious Dynamics

The opinion that the effects of labour-saving methods are not only delayed but also mitigated by the operation of cyclical factors is therefore exactly contrary to the truth. It is true that without any credit expansion the static industries would have contracted; on the other hand, however, mechanisation would have been held up by a shortage of capital and the whole process of rationalisation thereby checked. In a balanced economy, too, demand curves may be expected to remain comparatively constant. The accumulation of disturbances under cyclical conditions, on the contrary, prolongs the period which must elapse before conditions can be established enabling the displaced workers also to be reabsorbed in the general process of expansion.

Other considerations also point to the same conclusion. If during a period of rationalisation investment is financed entirely out of savings, production and consequently the national income will relatively decline, or, rather, expansion will be slowed down. The extent to which full employment can be restored by varying incomes (especially wages) or prices has already been discussed. If credit can be expanded, the relative decline in the national income can at first be averted. The national income will increase as an immediate result of the growing need for capital, and reserves of capital goods and labour will be mobilised. A subsequent reaction cannot, however, be avoided. In contrast to what takes place when expansion is financed by the investment of savings alone, unemployment, due to the rationalisation process, will indeed be prevented, but the primary displacement will occur later in its full force and cannot be counterbalanced by any form of compensation (investment of extra profits) when the situation is such that the expansion of the economic system, which alone would allow the displaced workers to be absorbed, is impossible. And this will lead to a further wave of secondary unemployment now as the consequence of rapidly shrinking purchasing power which will not be less in volume than that resulting from the relatively slower growth of the static industries.

We have seen that technical progress aggravates the typical phenomena of depression. When it takes place during a period of prosperity, it stores up a larger volume of unemployment for
the depression. Evidence of this effect of technical progress in the last boom period is furnished by the unemployment in the consumption goods industries. As the rationalisation movement mainly affected the consumption goods industries, its effects should appear in the shifting of the ratio between output and the number of workers employed. According to the Handbook of Business Statistics for 1933, the index of production in the capital goods industries fell from 100 (1928) to 47.7, or by 52.3 per cent. The index of employment fell by 47 per cent., or, at a conservative estimate of the amount of short time worked, by 53.4 during the same period. In the finished goods industries, on the other hand, the index of production fell by 23 per cent. and the number of full-time workers by 32 per cent., or, taking short time into account, by 41 per cent. In the boot and shoe industry, production fell by 14.7 per cent. and employment by 30 per cent. These figures illustrate the effects of rationalisation.

Without so radical a change in methods of production in the consumption goods industries, the situation in the depression would be different. If output in the finished goods industries fell by only 10 per cent. during the depression, the number of unemployed could also be only 10 per cent. of the maximum during the previous boom. Assuming that at the height of the boom overtime was worked in some cases at least, and that short time was also worked before any workers were dismissed, unemployment in the trough of the depression in the finished goods industries may be estimated at some 7 per cent. Thus a lower percentage would be obtained for the period 1928-1933 if it could be assumed that the demand for labour in the consumption goods industries developed proportionately with output; unemployment in these industries would then have been 23 per cent. instead of 41 per cent. But if this much larger number of workers had been employed, a correspondingly larger quantity of consumption goods would have to be produced for them. If 77 per cent. of the workers employed in the finished goods industries in 1928 had been still employed instead of 59 per cent., their numbers would have been larger by 30.5 per cent. in 1932 than they actually were. If average wages in the finished goods industries were only 40 per cent. of total wages and the workers spent 33 per cent. of their wages on such goods, the demand for these goods would rise in consequence of the improvement in employment in these industries themselves, although less than
might be expected. Sales of consumption goods would still rise by only 3 per cent., or from 77 to about 80 per cent. of what they were in 1928.

There is, however, another point which should not be forgotten. If the number of workers employed in any branch of production — in this case the consumption goods industries — falls, not only does their purchasing power disappear from the market, but a whole series of purchases financed by this purchasing power also fail to take place. Now during a depression the decline in employment is always a factor in the process of contraction — that is to say, that the fall in purchasing power due to unemployment is not offset during the depression by new active purchasing power accruing to other economic subjects, and consequently a series of exchanges are eliminated. Hence the view that a fall in employment merely represents a transfer of purchasing power is false so far as the phase of the economic process here under consideration is concerned. If the effect of the investments in the consumption goods industries is to save labour, and they lead to a temporary over-expansion of the capital goods industries, this will store up an excess of capacity which will cause a particularly violent reaction because expenditure on replacements and on new plant will be drastically cut down and the production of capital goods will necessarily shrink very considerably. It is to this factor that much of the decline in capital goods production must undoubtedly be attributed. We shall not be far wrong in ascribing the fall in the production of capital goods during the most recent depression, in countries such as the United States and Germany, to the rising efficiency in the consumption goods industries.

It has been shown then that labour-saving technical improvements make the trough of the depression deeper and consequently longer and it is only in this guise that technological unemployment will appear.
CHAPTER VIII

THE SPECIAL CASE OF CAPITAL-SAVING TECHNICAL IMPROVEMENTS

DEFINITION OF CAPITAL-SAVING IMPROVEMENTS

So far little consideration has been given to the problem of capital-saving technical progress, attention having been focused almost entirely on the displacement of labour by machinery and rationalisation. As a rule the introduction of labour-saving methods goes hand in hand with increased capitalisation; they therefore reduce the marginal productivity of labour, under the assumptions generally accepted, and increase that of capital. Capital-saving inventions should have precisely the opposite effect\(^1\), but the difficulty in determining this effect lies in the fact that they also react on the labour market. The following different cases may be distinguished:

(1) "Genuine" capital-saving improvements, which lead to an economy of capital in the sense of the material factors of production, as when cables are rendered unnecessary by the introduction of wireless telegraphy. In such cases a smaller amount of purchasing power is needed to finance the same degree of efficiency.

(2) The value of the invested capital is also affected by labour-saving improvements in capital goods production, how-

\(^1\) This is the view held by Pigou, who takes as his starting point the case of an invention affecting only products which are not consumed by the workers themselves. He then defines as capital-saving inventions all those which increase the marginal product of labour in terms of the goods consumed by the workers, as labour-saving all those which diminish it, and as neutral all those which leave it unchanged. Cf. Pigou, *Economics of Welfare*, Part V, Chapter IV, section 3.
ever. It may indeed happen that only the labour directly required for the production of capital goods is reduced, as in the case of mass production of machinery, but that the capital required for the production of the machinery has nevertheless to be increased. In the machine-building industry itself we then have a clear case of a labour-saving improvement, but it will act as capital-saving (if the price of the machines falls) in the industries using the machines concerned. As a general definition, we may describe as capital-saving improvements or changes all those which lead, directly or indirectly, to the tying up of a smaller amount of capital in the manufacture of the same quantity of product, given the same technique in producing that product. The economic effect of this second group of capital-saving inventions is exactly the same as that of the first; in both cases the capital necessary for the manufacture of the same amount of product is reduced, and as from our point of view capital means the capital goods produced, there is an economy of labour in producing the capital goods.

Thus, a capital-saving invention may be assumed if an output of one million units, which previously required a capital investment of 100, can now be produced with a capital of 90. The same applies if the invested capital rises from 100 to 300, but this extra capital allows an output of 5 million units or even more. Wherever the need for capital increases, therefore, but not proportionately to the increase in output and employment, so that output stands in a higher ratio to the invested capital, a capital-saving invention may be presumed. The fall in costs is then imputable to the capital account and not to the wages bill, and the capital-labour ratio in the industry concerned is lowered. In the case of labour-saving inventions, on the contrary, the same volume of production requires a smaller number of workers than before but a larger supply of capital. Examples of this are the introduction of an automatic telephone system or the mass production of automobiles.

We might mention here another kind of capital-saving improvement, namely, a reduction of costs in the production of capital goods, the results of which we shall not, however, discuss fully because they approximate very closely to those of labour-saving improvements. An increase in the amount of capital used per worker is quite consistent with a reduction in the amount of capital used per unit of output. For instance, suppose that the
price of new machines is reduced and workers are displaced to a greater extent than the proportional fall in the price of machines; nevertheless, if output increases the amount of capital per unit of output will show a decrease. In such cases capital and labour-saving improvements occur at the same time.

**The Special Case of the Building Industry**

Inventions in the building industry occupy an intermediate position. In so far as this industry is engaged in building dwelling houses, these are theoretically durable consumption goods, and the fall in costs can therefore be described as labour-saving. As, however, these durable consumption goods cannot be paid for out of the consumers' incomes, their production depends on the accumulation of savings. Every reduction in the cost of a given amount of housing space, provided that the demand for housing remains constant, accordingly involves a decline in the demand for the capital formed by savings, irrespective of considerations such as whether the economy in capital is made in the production of building materials or in the actual building. If these economies lead to a fall in rents, the result will be a considerable increase in the demand for houses, given the great elasticity of this demand in many European countries (it is much less elastic in the United States). Consequently, the demand for savings and the employing capacity of the building industry will not decline. But where capital-saving and labour-saving inventions in the building industry affect the erection of industrial plant, they will have the effect of economising capital, and whether and to what extent compensation arises will then depend upon circumstances.

**Economic Problems Arising from Capital-saving Improvements**

We must now turn to an analysis of capital-saving inventions. Capital-saving inventions allow of either of two courses. The technical equipment of the undertaking per worker may be left unchanged and the released capital applied to other uses, or the saving may be used to improve technical equipment, provided of course that such improvement is possible.

In the first case, it is important that the re-investment of the released capital should take place at once. The longer the inter-
val between the displacement of capital and its re-investment, the more protracted will be the unemployment in the capital goods industries which this saving in capital will involve. The demand for labour will only be maintained if all the capital economised is actually invested.

This released capital can be used to build new undertakings of the same kind and the same technical structure as those already in existence only if the necessary labour is available on the market. Total production will then expand more rapidly than before. Wages will rise because a smaller amount of capital is required for the same total output as before. If the released capital is used in this way, it will be difficult, if not practically impossible, to ensure that it is distributed in the right proportions, and this may lead to disturbances later.

In the second case, existing undertakings are rendered technically more efficient without increasing their capital value by a reduction in the cost of producing capital goods (their prices also being assumed to fall). If the rise in technical efficiency is not too rapid, the labour force can be kept at its previous level. In this case wages should rise as a result of the increase in the marginal productivity of labour, but if this technical change again leads to a large saving in labour, i.e. if it leads to labour-saving improvements, the downward pressure on wages will predominate. The actual course of events in practice depends on technical possibilities.

**Capital-saving balancing Labour-saving Improvements**

Labour-saving improvements entail an increase in the capital intensity of production, in other words, fresh investments. In a harmoniously developing economy, in which the normal growth of the static branches of production can no longer be adequately financed owing to the increasing demand of the dynamic firms for capital, this disturbance may be counteracted by the simultaneous introduction of a capital-saving improvement. If, for instance, the amount of new capital required by a normally expanding system is 3 per cent. of the invested capital, and if, following a labour-saving invention, this rises by 16 per cent., i.e., to 3½ per cent., while at the same time the capital needed is reduced by capital-saving inventions by 8 per cent. (¾ per cent. of the invested capital), capital requirements will not rise
as rapidly as in our previous example, and there will be only an 8 per cent. reduction in the capital available for the static firms. And lastly, there will be much less secondary unemployment in this case, although the primary unemployment resulting from the labour-saving improvement cannot be prevented.

**Cumulative Effects of Both Types of Improvements**

Nevertheless the labour-saving aspect of capital-saving improvements will still find expression, although at a later date. Once the capital equipment required by the dynamic firms has been produced and their demand for capital accordingly shrinks, a smaller total capital will be required to finance the normal expansion of production. The demand for capital goods will fall by 8 per cent., if the prices of these goods remain unchanged, and by an even larger proportion if they fall, as they may do in consequence of the unemployment in the capital goods industries. The problem will then arise of whether and how this surplus capital can be invested so that the displaced workers can be re-employed.

The general result is still clearer in the case about to be described. Labour-saving and capital-saving improvements may occur simultaneously in the same industries. The economy in labour will then naturally involve a change in technical structure, but sometimes without requiring a higher rate of investment than the normal. If, for instance, the rationalisation measures can be financed out of the depreciation fund supplemented by the extra profits earned in the industry, there will be no need for the dynamic industries to call on the capital market for extra resources. If, moreover, a much larger output can then be produced with the same number of workers and the same amount of capital as before, given an elasticity of demand greater or = 1, production will increase sufficiently to prevent any disturbances. Very often, however, prices will not fall quickly enough in such cases, and consequently both capital and labour will be thrown out of employment.

If the demand for capital also declines simultaneously in other industries, because part of the normal expansion of production can be financed out of the depreciation fund owing to the increase in efficiency, the effect of the capital-saving improvements in displacing labour will at once make itself felt. There
will then be an immediate downward pressure both on wages (for two reasons) and on the rate of interest. These two changes will not be compensated for automatically unless there is a corresponding fall in prices; and if such a rise does not take place, a fresh problem is created, namely, how to employ the released capital and the displaced workers in new production; in other words, how to speed up the tempo of general growth without friction.\(^1\)

New problems can only fail to arise out of this situation if the surplus capital is invested without delay. But where labour-saving improvements have already produced unemployment and the writing off of capital has been delayed in the old undertakings as well, this will not be easy.\(^2\) In such cases existing industries are unlikely to expand, and the only scope for the investment of new capital will be in new industries or in foreign countries. The fact that when labour-saving and capital-saving improvements occur together, the active money stream shrinks, will not contribute to an automatic revival, because the only result will be to increase deposits if, for the reasons already stated, there is no rise in demand. The money thus rendered idle may ask for investment, but idle money does not necessarily lead to expansion of production. The reabsorption of the displaced capital and labour will therefore meet with obstacles in the present case unless a fall in prices follows that in costs. The fact that extra profits are made will not act as a compensating factor because if prices remain constant they cannot be invested. If, moreover, profits are not invested, for whatever reason, there will be a surplus of idle capital and idle labour on the market. The amount of capital and labour available will depend upon the primary displacement caused by the capital-saving and labour-saving improvements and on the rigidity of the price system. The greater the rigidity of prices, the more of the capital previously invested will be released, because the constantly growing depreciation fund is not reinvested. This is a factor which may have a very unfavourable effect on the situation.

\(^1\) Theoretically this case is identical with the rise in the productivity of labour without extra capital investment, already described.

\(^2\) The fall in prices is also checked by the fact that producers postpone writing down the book value of their old plant for as long as possible, so that the lowering of costs due to capital-saving inventions does not fully appear.
This possibility is the most interesting. So far as its effects on the labour market are concerned, it has much in common with the case of labour-saving improvements involving an increase in capitalisation, described in detail above, although displacement is attended in the first case with a shortage of capital and in the present one with a surplus of capital. This merely shows, however, that the disturbance of equilibrium is the decisive factor. Unemployment may be aggravated by a sudden rise in the demand for capital which cannot be satisfied, just as by a sudden fall in the demand for capital goods for the manufacture of the means of production, although genuine savings are available. In both cases primary unemployment will arise in the dynamic firms. If subsequent developments are influenced by a shortage of capital, secondary unemployment will also occur in the static firms. If, on the contrary, there is a simultaneous decline in the demand for labour in the capital goods industries, there will be no secondary unemployment due to the decline in the supply of capital, but a second wave of unemployment will arise in the capital goods industries.

This phenomenon of unemployment due to difficulty in investing released capital resembles the situation which obtains at the end of the process of liquidation in a depression. In both cases the difficulty is in finding a field for the investment of new capital, and protracted unemployment occurs. There is, however, a difference in the fact that at the end of a depression undertakings in nearly all industries are operating below their full capacity, so that the prospects for further investment are small or non-existent. In the present case, on the contrary, the existing firms will remain fully employed, so that the problem is simpler. As the same output is now produced with a smaller staff and less capital than before, both capital and labour will be released. If production now develops harmoniously — that is, in harmony with the scale of needs — income will expand proportionately to the production of the extra goods. But as the average efficiency of labour will have risen, prices must fall, since otherwise it would be impossible to dispose of the larger output without consumers’ credit expansion. If prices were to remain unchanged, there would be the same amount of income as before the introduction of the labour-saving and capital-saving improvements, but a much larger quantity of goods — a situation which would involve serious
disturbances. Even if prices are lowered, it will be a difficult matter to ensure the correct distribution of capital and labour over the different industries. Thus the lack of employment for capital and labour in the "normal" depression is related to the repayment of the unduly large credits granted during the boom, while it is due in this case to the rigidity of prices; or, even if the price system is flexible, the difficulty of distributing the available factors of production appropriately over the different branches of industry may prevent expansion.

**Elasticity of Demand for Capital Decisive for Compensating Effects of Capital-saving Improvements**

The possibility of overcoming the disturbances produced by capital-saving improvements unaccompanied by labour-saving improvements will mainly depend on the elasticity of the demand for capital. If this demand is comparatively rigid in the particular industry in which the capital-saving methods are introduced, the released capital will only be able to find employment in other industries. As a rule, the more important capital-saving inventions meet wants which cannot easily be expanded, e.g. transport services or coal. In other industries, such as electricity, demand can indeed be expanded very considerably by lowering prices, but in most cases this would not lead to an increased demand for new capital but merely to a fuller use of existing plant capacity. Reference has already been made to a sphere of production in which demand is especially elastic, i.e. house-building. This is the only industry which can be expanded more or less proportionately to the economy in capital, but even here the possibilities of expansion are limited. If the capital-saving improvements are introduced simultaneously in a large number of industries and are on a large scale, it will be difficult to find an adequate field for investment. It is clear therefore that the lowering of capital costs places a very great strain on the elasticity of the economic system.

The reasons for this are as follows:

The share of capital costs and depreciation allowances in total costs of production is small and the interest on industrial investments is not a decisive factor in the national dividend, whereas, on the other hand, the manufacture of capital goods absorbs a very high proportion of labour. (The usual statistics classify as
capital goods production various industries which, in my opinion, should rank as consumption goods.

Accordingly, every capital-saving improvement means the displacement of comparatively large bodies of workers. These workers cannot be reabsorbed into the productive system except in the capital goods industries, since there is no incentive for any expansion of the consumption goods industries because the demand for consumption goods will at best (i.e., after the unemployed have been absorbed into the capital goods industries) remain stationary. The market for consumption goods can only be widened if, and to the extent that, the lowering of costs of production in the capital goods industries also leads to a lowering of costs in the consumption goods industries. But, even so, only part of the unemployment due to the capital-saving technical improvements will be compensated for, as will be seen below. Moreover, this process requires time and the economy in costs is often reflected in such tiny fractional reductions in prices that no considerable rise in demand can be expected. Thus the disturbances caused by important capital-saving improvements can only be effectively overcome by the establishment of new industries or by the export of capital.

A depression in the capital goods industries is therefore especially stubborn because it leads to the displacement of capital goods and labour which cannot as a rule be employed in other branches of production and can only be set to work again when opportunities arise for fresh investment on a large scale.

**CAPITAL-SAVING TECHNICAL PROGRESS A NEW PHENOMENON**

Considering general economic development during the age of industrial capitalism, it may be said that during the nineteenth century industrial progress was dominated either by inventions leading to the introduction of new industries or by technical improvements which, while requiring higher capitalisation, also

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1 In the usual terminology of production statistics, primary production, semi-manufactured goods, etc., are classified under capital goods, as also building materials. Logically speaking, all production which is directly used for consumption (domestic coal, housing, etc.) should be reckoned as the production of consumption goods, together with those raw materials and half-finished goods which enter into the physical composition of consumption goods, such as leather in shoes, wood in furniture, etc. If these sections of capital goods production could be isolated, it would be seen that the variations in capital goods production are considerably wider than the statistics indicate.
had a labour-saving effect in the finished goods industries. It was not until the twentieth century that the great age of capital-sav­
ing improvements set in. The effects of these, too, are influenced by cyclical factors. Although such inventions mean an economy in capital, this will lead in boom periods to only a relative decline in the production of capital goods; that is to say, that in spite of the economy in capital, investments will expand beyond the measure of real savings, thus building up surplus capacity. A very great expansion of production will then take place in the finished goods industries, because it will now be possible to finance larger potential capacity with the same amount of capital. The advantage in costs obtained by the new firms in the finished goods industries from the fact that their plant now costs them less will, on the other hand, not be so great as in the case of labour-saving improvements alone, because all firms will benefit from the lowering of capital costs.

Special Features of the Business Cycle under the Impact of Capital-saving Improvements

If this phase of capital-saving progress plays an important part in the boom, it will lead to difficulties which will be very hard to overcome when the depression supervenes. If the boom was mainly induced by inventions (in the sense given to this term in the first chapter), the essential problem will be to correct the disproportionalities in the distribution of capital and to substitute real savings for the credit expansion by which the extra investments were financed, or to write off those which have proved unsound. But if the capital-saving technical improvements are important, the normal growth of total production can in future be financed by a very much smaller capital outlay than before, and in many industries even without fresh investment, i.e. out of the depreciation funds alone. That is to say, that the same rate of increase in the national dividend can be achieved by invest­ing a smaller percentage of the total national capital. Even in this case, however, the rate of investment will be increased above the normal during the height of the boom by expanding credit within the margin available, and this will create a total capacity exceeding the purchasing power of the income available and spent, prices remaining unchanged. (We are ignoring, for the time being, the complications created by labour-saving improve­
ments.) Theoretically, under free competition, prices could and should be lowered to a point where all the factors of production can find employment. But it can nevertheless be shown that, even where the lowering of costs has full play, the effect of capital-saving technical improvements in displacing capital and labour can only partly be averted as the process of development proceeds.

Schematic Estimate of Unemployment Due to Capital-saving Improvements

Let us assume, as a theoretical example, that costs of production in the manufacture of capital goods are lowered by 10 per cent., and that consequently 20 per cent. of the workers employed in producing capital goods are displaced. Here then, without any increase in total costs, the output of capital goods will increase by 11 per cent. Supposing now that the fall in costs is fully reflected in prices, the prices of capital goods will fall by 10 per cent. and there will be a corresponding lowering in the costs of production of consumption goods. If the production of consumption goods expands by 3 per cent. year by year, 5 per cent. of the capital value being reinvested and the number of workers increasing by 1\% per cent. annually, and if the rate of depreciation is fixed at 10 per cent., the consumption goods industries will come on the market as purchasers of capital goods to the value of 15 per cent. of their capital. This 15 per cent. of their capital value may be taken to represent 30 per cent. of their turnover (sales), a proportion which considerably exceeds the average. If now the price of capital goods falls by 10 per cent., there will be a reduction of 3 per cent. in the costs of the consumption goods industries, and if, as the result of this saving, production can be expanded by 3 per cent., 3 per cent. more workers will also find employment in the consumption goods industries. Supposing further that 60 per cent. of all workers are employed in the production of consumption goods and 40 per cent. in the production of capital goods, the expansion of production in the consumption goods industries will increase employment by 1.8 per cent. of the total number of workers.

It is important to determine the extent to which the demand of the consumption goods industries for capital goods must rise in order to make possible this extra, irregular 3 per cent. increase.
If the depreciation rate is 10 per cent. of invested capital (and
this is above the average as the rate of amortisation on buildings
is usually lower) and if 5 per cent. of the fixed capital is invested,
a 3 per cent. expansion of production would require an extra
capital investment representing 20 per cent. of annual purchases
of capital goods; and as the production of capital goods expands
by only 10 per cent., if total costs remain constant, this would
ensure full employment in that branch for another two years,
provided that the fall in costs were fully reflected in the price of
the capital goods and that the producers of consumption goods
were prepared to expand their output subject to a proportionate
fall in prices.

At the end of the two years the production of consumption
goods will thus have risen by 3 per cent. and the number of
workers employed there will also have increased by 3 per cent. —
that is, by 1.8 per cent. of the total number of workers. This rise
in employment in the consumption goods industries will be bal-
anced, when the period of increased production of capital goods
is over, by a decline in employment in the capital goods indus-
tries, because after this intermediate phase of the expansion of
total production the consumption goods industries will have to
revert to their old rate of growth. The invested capital will then
have risen by 3 per cent. (in terms of capital goods) and although
this represents a smaller value than before, now that the prices of
capital goods have been lowered by 10 per cent., production
cannot be expanded any further because the market cannot absorb
more than 3 per cent. of extra products if prices have only fallen
by 3 per cent. But this 3 per cent. increase in the production of
consumption goods involves only an increase of 3 per cent. in
the annual purchases of capital goods (as compared with the
situation before the introduction of the capital-saving technical
improvements). Hence, capital goods production as a whole
will rise by 3 per cent. when these technical improvements have
taken effect. If, before the technical improvements were intro-
duced, 40 per cent. of all workers were employed in the produc-
tion of capital goods and this proportion was then reduced by
20 per cent. to 32 per cent., it will now rise again by 3 per cent.,

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The total capital now represents a lower value because the reduction
in the prices of capital goods is reflected in the writing down of capital
values.
that is to say, to about 33 workers; and as 1.8 per cent. more were employed in the consumption goods industries, total employment will fall from 100 to $33 + 61.8 = 94.8$, i.e. 5.2 per cent. Moreover, as secondary unemployment is also to be expected in the finished goods industries in consequence of this primary unemployment, a longer lasting unemployment of 5 per cent. will have to be assumed even if the fall in costs is fully reflected in prices.

The assumption that the capital basis of the consumption goods industries will be broadened without any change in technique does not, however, conform to the observed facts. Capital-saving technical improvements are accompanied by labour-saving improvements in the consumption goods industries, which will allow production to be expanded by 3 per cent., for instance (according to our previous example), with the same number of workers as before. Where this is the case the compensating effects arising out of the expansion of production will clearly fail to materialise unless prices are further reduced.

Thus capital-saving technical improvements have the same effect in the capital goods industries as labour-saving technical improvements in the consumption goods industries, and the displacement of workers is naturally considerably greater when prices are not lowered to correspond with the fall in costs and when the rate of interest also does not fall accordingly.

If prices, contrary to the previous example, do not fall at all, or fall less than they should do, and if wages do not rise but fall because production declines, once credit has been expanded to the full limits of the margin available, unsaleable stocks of goods will accumulate on the market. This will give rise to the mistaken view that wages should be lowered in order to enable these goods to be sold, whereas the real reason why they cannot be sold is because prices were not reduced. A wage cut will only have the effect of increasing sales if prices are lowered simultaneously, so that the purchasing power of other incomes is raised and attracted to the market. Under our present assumptions the reduction of wages alone would not stimulate the market. Here the rigidity of prices is the decisive factor in preventing an expansion of demand, and there is no reason to expect that prices will yield to a reduction in wages when they did not react to the lowering of costs brought about by the capital-saving technical improvements.
Our analysis therefore shows that unemployment is by no means a reliable sign that the wage level is too high. Although, in spite of this, unemployment may sometimes lead to wage reductions, it will not thereby be reduced, especially if this occurs during a phase of the business cycle unfavourable to the expansion of total production.

**Reduction of Hours of Work as a Remedy**

When unemployment is created by the simultaneous introduction of labour-saving and capital-saving improvements, recourse may also be had to the reduction of hours of work as a means of overcoming the resultant disturbances. When labour productivity is rapidly rising, for instance, it is an obvious solution to spread the available amount of work over all the workers who are able to work, just because it is more productive. Under our assumptions it will then be possible to maintain real wages (provided that prices fall) although the money wages of the individual worker fall. It is true that this will not really ensure the full utilisation of capacity, but it will appear to do so because when hours are reduced more workers can be employed than before. The effect of the capital- and labour-saving inventions will then appear not in the form of a rise in real wages in terms of goods, but as an increase in leisure, which may also be regarded as one form of an increase in real wages. If hours of work can be reduced without involving a reduction in real incomes or raising the rate of saving, this means that the efficiency both of labour and of capital must have risen. Under these circumstances it is in fact only the internal resistance to the adjustment of the system to this higher productivity that prevents both labour and capital from being used to the full, with the ultimate result of a higher national income, even though the economic subjects themselves would prefer to work the same hours as before and to increase their earnings. These difficulties would not arise in a planned economy.

Thus capital-saving inventions reduce the number of workers necessary in the capital goods industries and cut down the time needed to manufacture the means of production. This means, in the current terminology, that they make the process of production less roundabout; for instance, the time required to sink a shaft may be shortened from seven to four years, or that required
to build a factory from a year to six months without any more workers being needed. The general effect of this is that an economy can be equipped with the necessary means of production and labour in less time than before.

This process is identical with the tendency towards a lower organic structure of total production, even though this tendency is constantly being counteracted by the introduction of new labour-saving methods in individual undertakings. The reduction in the amount of capital necessary to produce a given output gives fresh significance to the old dictum that value and wealth are two different things. The lowering of costs through technical progress must necessarily involve a decline in the values related to the costs of production of previous periods, since the whole significance of the calculations linking up the past with the present is that the services rendered by labour in the past are not assessed on the basis of the time they required then, but on that of the time they now require. The process of devaluation admittedly takes some time, because it means overcoming the resistance of private firms. To them the writing off of capital values spells economic ruin, especially if they are in debt, and their resistance is one of the most powerful factors preventing the reinvestment of released capital from proceeding without friction.

**Problem of Revaluation of Capital due to Capital-saving Improvements**

If capital-saving improvements proceed at a given tempo, the adjustment of the values of old investments to the lowered costs must lead to a decline in the total value of existing plant as well as of durable consumption goods. If, for instance, when the price of the factors of production remains unchanged, the capital equipment of the economy increases by 3 per cent. annually, and if costs in the manufacture of capital goods are reduced by 3 per cent, or more, capital values will remain constant or may even fall. Over a short period, however, the rate of interest is also important. If the rate of interest falls because there is less scope for investment, i.e. because owing to the resistance described above the demand for capital does not expand correspondingly, the value of capital investments will rise. But this will only be
a temporary movement, since in the long run values cannot rise above costs. It is only during an intermediate period when returns are not falling as rapidly as the rate of interest that capital values will show a tendency to rise.

The capital value of old plant may fall to zero if the technical structure of the old plants involves costs, e.g. wages, which, reckoned per unit of production, are appreciably higher than in the new firms and can therefore only partly be recovered from prices. The lower the return on capital, the smaller the margin for these losses, so that the depreciation of old capital will be particularly severe when capital-saving and labour-saving improvements, i.e. the reduction of costs by means of capital-saving improvements and the mechanisation of the industry concerned, coincide. The capital of the old firms will then disappear more rapidly from the total process, and capital values will thus be adjusted to a lower scale of total values. This is a familiar process, but it is important to make it quite clear that over a long period capital-saving improvements may involve a decline in the amount of labour which can be invested in capital goods. This raises especially difficult problems in a capitalist economy. It may be recalled once more that the investment of new capital will always be particularly difficult when existing industries are operating considerably below their full capacity, and also that the more or less monopolistic organisation of important industries in large firms or corporations often acts as a bar to fresh investment because these firms do not want to bring about the depreciation of their old plant.

The Question of Over-saving

The difficulties analysed here, which are usually ascribed to "over-saving", are discussed in a publication of the Brookings Institute, *The Formation of Capital*¹, with special reference to the United States. The writer examines the process of the formation of capital on the one hand and the extent of investment on the other, his book being the first major attempt² at a quantitative assessment of the difficulties of economic expansion, a

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² Principles, Book IV, Chapter 4.
subject already broached by John Stuart Mill¹. The problem is especially hard to solve in practice when cyclical conditions are unfavourable. This deadlock has forced economic theory along new paths in exploration of the effects of public works, and has also conduced, in the field of practical politics, to an influential and successful policy of public works as a method of overcoming the difficulties solved in the past by inventions and the export of capital. The investment of savings or the creation of extra credit to finance public works is intended to counteract the friction due to the slowing down of the turnover of capital and induce that expansion of investment without which employment must decline in the capital goods industries, and therefore throughout the whole economy.

¹ Moulton's findings have been questioned and it may well be, that the method applied is not satisfactory. But the problem exists and should be subjected to further research.