

groups, and the power of large multivalent *gegenions* to form compounds of greater stability with proteins than small mono- or di-valent *gegenions*. To these Prof. Rideal (Cambridge) added a fourth in the power of proteins to form co-ordination complexes with dipole molecules of the type of thiourea. The discussion centred largely on titration curves, and Dr. R. K. Schofield (Harpenden) brought forward a valuable new technique based on the use of metaphosphoric acid. Prof. E. J. Bigwood (Brussels) dealt with diffusion in gelatin gels and came in for some friendly criticism at the hands of Mr. E. Hatschek (London). Dr. E. B. R. Prideaux (Nottingham) dealt with diffusion potentials of protein ions and Prof. T. Weigert (Leipzig) with colloidal electrolytes in photographic emulsions. Prof. E. Hammarsten

(Stockholm) and his colleagues pursued the chemistry of the proteins into the chromosomes—to the satisfaction of Dr. Dorothy Wrinch (Oxford), who has worked out the electric behaviour of these bodies. Two papers by Prof. K. Linderström-Lang (Copenhagen), in the absence of the author, were taken as read and the same fate unfortunately fell to the contributions on colloidal carbohydrates from Profs. A. Lottermoser (Dresden) and M. Sameč (Ljubljana). The meeting was brought to an end by a paper on tungsten sols contributed by Dr. F. Eirich (Vienna).

A brief notice cannot do justice to the thirty-seven official papers given at the meeting or to the ensuing discussions, but the full printed report will be issued by the Faraday Society on January 1, 1935.

D. J. L.

Economic Problems of Technological Progress

IN a contribution to the discussion on "The Need for a Technique of Economic Change" arranged by the Department of Industrial Co-operation of Section F (Economic Science and Statistics) at the Aberdeen meeting of the British Association, Mr. N. F. Hall examined the more specifically economic problems which arise as a consequence of technological improvements. Economics, like other sciences, he pointed out, has in the past made progress by adopting the well-tryed method of limiting the number of variables in any problem under review. The necessity for the limitation of variables has resulted in the development of the idea of the 'Stationary State', which has been the most fruitful abstraction for purposes of economic analysis. As soon, however, as one or more of our hypothetical constants becomes a variable, the stimulus of a change in population or increasing technological knowledge alters our simple stationary State into a dynamic system.

The technique of economic change is therefore the accurate interpretation of changes in relative prices under dynamic conditions. Among such changes are those associated with developments in scientific knowledge, which make possible new methods of production and lead either to the output of entirely new goods or to the better fabrication of old ones, or to both things concurrently. This sort of technological change gives rise to numerous economic disturbances, such as the problem of obsolescence or the territorial re-grouping of industries. Limiting the subject, however, for the present purpose to the economic difficulties which arise in securing the orderly development of the new processes rather than in the decent burial of the old, we are confronted with a special case of the general problem of 'uncertainty'. The economist has learned in the last decade to distinguish between those incidents in economic life which are called risks and those which he now defines as 'uncertainties'. A risk such as that of shipwreck or fire is a recurrent circumstance and consequently capable of quantitative measurement and actuarial treatment. Uncertainties, however, are unpredictable and incapable of quantitative measurement; they arise out of the freedom of the mind and the continual possibility of change in human tastes and human knowledge. They reflect in brief the difference between the hypothetical stationary State of simpler economic theory and the real world.

The necessity for specialisation introduces the

element of 'true' uncertainty and a specialised economy can only be, in a very limited sense, a competitive one. The greater the degree of specialisation, the larger will be the zone of uncertainty, as the obstacles in the way of adjustment and re-adjustment will increase as specialisation continues. Here then is the economic problem which is created by every forward step in scientific and in technological knowledge. The utilisation of advancing knowledge in the service of society demands an ever-increasing specialisation both of the men and of the capital goods with which they co-operate. The more both plant and labour are specialised, the greater the difficulties of bringing about further changes, particularly when these changes are on so large a scale that they require a more extensive re-distribution of both men and plant than can be secured by a wise direction of new entrants into industry or by far-seeing investment of new savings. The need for a technique of economic change arises because the benefit of further developments in scientific knowledge would be lost unless in the economic sphere the rigidity which specialisation necessarily brings with it can be overcome.

In the past, neglect of the price problems set up by uncertainty in connexion with the task of introducing new plant and new processes has been a cause of many difficulties. The inherent tendency in free as in 'planned' economic systems to over-develop the new thing seems in large part to arise from a misunderstanding of the way in which these zones of uncertainty, arising out of technological change, influence the price system, so that the economic danger signals given by price changes are either disregarded or entirely ignored. Confusion arises because changes in the prices of, and the economic return upon, new fixed plant—which are the result of changes in the element of uncertainty—are mistakenly considered to represent a permanent shift in the nature of the demand for the particular plant and its products.

Nearly all proposals for monetary manipulation seem to be open to the fatal objection that they are built upon the assumption that there is little or no change in technological processes and that uncertainty is absent. The result is that they cannot be made to apply to 'real' conditions. Proposals for arbitrary alterations in the supply of legal tender money will also fail to achieve the objectives of stabilising the price level or of providing a quantity

of purchasing power "sufficient to carry off the whole potential product of modern industrial plant", because this stream of purchasing power—however it might be injected into the system—has an influence upon the general price level and upon the volume of economic activities, which varies with the degree of uncertainty present. It is necessary rather to look to improvements in the methods employed in financing new processes as the first practical step in the development of a technique of economic change.

Changes in uncertainty lead to extensive variations in capital values and in the prices of capital goods. The objective must be to isolate the economic effects of these price shifts to prevent them causing either over-investment in new processes or general Stock Exchange disturbances. Existing financial institutions in their own interest might agree that they would not themselves finance directly the develop-

ment of any new process but would pool a limited quantity of their resources to form a special holding company, which would itself finance the necessary number of unit companies to try out a new process or processes. The knowledge that such a pool existed should deter the private investor from walking into a field which is already undergoing professional development, and the Stock Exchange might be prevailed upon not to give facilities to competing new issues. Financial interests would lose some of their spectacular profits, but their business would become more stabilised and less subject to violent fluctuation than in the past. Once the method had been fairly tried and tested, there would soon be felt a need for closer co-operation between financial interests and technological research, as well as for a centralisation of part of the economic intelligence services of finance.

Scottish Fisheries in 1933*

ACCORDING to the annual report of the Fishery Board for Scotland, both the white-fish and herring fishing branches of the Scottish fishing industry gave cause for anxiety during 1933, and, while the prospects of the former afterwards improved, those of the latter steadily deteriorated. The fishing industry as a whole continued to suffer from the effects of the world-wide economic depression, and the herring industry has proved specially vulnerable, owing to the preponderating degree to which it is dependent on overseas markets.

The white-fish fisheries yielded actually a catch lighter by some 4 per cent than in 1932, and the lowest aggregate value for any post-War year; but the decline in the average price per cwt. which had been in progress for a number of years was arrested, the average for 1933 being 17s. 9d. as against 17s. 4d. in 1932. In very many cases, operations were being conducted on an unremunerative basis, and new construction, even to replace vessels lost, had therefore been suspended. This was believed to be largely due—apart from the effects of the general depression—to unregulated competition, partly owing to the large foreign landings and imports, and partly to failure to maintain a proper standard of quality and size in much of the fish marketed; and a comprehensive policy to deal with the situation was embodied in the Sea-Fishing Industry Act, 1933.

It was hoped that the imposition of minimum sizes for fresh fish exposed for sale, with its corollary of minimum mesh, would not only ensure better prices, but tend also to conserve stocks, and lead ultimately to a marked improvement in both the quality and value of landings; that the closing of the distant northern grounds for the four warmest months of the year would prevent excessive supplies of fish which, under present conditions, are necessarily of inferior quality when landed and tend seriously to depress the market; and that the regulation of imports would check competition that seemed to threaten the existence of the British industry.

Owing to the variety of factors operative, including the 10 per cent import duty imposed in 1932, and the adverse exchange as affecting German fishermen in particular, as well as normal fluctuations in the fisheries and changing economic conditions, it did

not prove possible up to the end of the year to appraise with certainty the effects of this new legislation. It seemed clear, however, that it would be of benefit to fishermen and vessel owners, and this general impression has been confirmed by later experience. The new legislation is approved by the trawling section of the industry, but some dissatisfaction has been expressed by fish merchants and export curers at the curtailment of supplies necessarily involved, and also by some inshore fishermen.

No further large fishing units have yet been constructed for use in Scotland as a result of the improvement in returns; but steady progress is being made in the construction of medium-sized motor-boats for white-fish fishing, especially seining in the Moray Firth area, which is doubtless encouraged by the assurance of better markets.

Herring fishing was conducted under conditions which almost precluded any possibility of general success. The development of the summer fishing was delayed until beyond the middle of June by a dispute regarding the discount allowed by fish salesmen on curers' purchases of herrings; and when a settlement was reached, catches during what is normally the main part of the season were so light that, although prices rose to an uneconomic level for curers, fishermen failed to earn sufficient to cover working expenses. A heavier fishing unexpectedly experienced in August retrieved to some extent the position of fishermen, but a break in the Continental prices for cured herrings consequent on the increase in supplies adversely affected curers and other firms engaged in the distribution of cured herrings.

The principal markets for cured herrings, in order of importance, were Germany, Poland (with Danzig), Latvia and the United States. Several attempts were made during the year to dispose in the home markets of pickled herrings put up in small containers, and herrings prepared in various new ways usually involving smoking, but in no case so far with any outstanding success.

The encroachment of trawlers on Scottish inshore waters, particularly on the west coast, caused much concern during the year, and the Board found it necessary to submit proposals for the strengthening of its patrol fleet, and at the same time a Government Bill, since passed, was introduced increasing the penalties for illegal fishing.

* Fishery Board for Scotland, Fifty-second Report, for the year 1933. (Edinburgh and London: H.M. Stationery Office, 1934.) 1s. 6d. net.