Chapter 4

THE CHOICE OF UNITS

I

In this and the next three chapters we shall be occupied with an attempt to clear up certain perplexities which have no peculiar or exclusive relevance to the problems which it is our special purpose to examine. Thus these chapters are in the nature of a digression, which will prevent us for a time from pursuing our main theme. Their subject-matter is only discussed here because it does not happen to have been already treated elsewhere in a way which I find adequate to the needs of my own particular enquiry.

The three perplexities which most impeded my progress in writing this book, so that I could not express myself conveniently until I had found some solution for them, are: firstly, the choice of the units of quantity appropriate to the problems of the economic system as a whole; secondly, the part played by expectation in economic analysis; and, thirdly, the definition of income.

II

That the units, in terms of which economists commonly work, are unsatisfactory can be illustrated by the concepts of the national dividend, the stock of real capital and the general price-level:

(i) The national dividend, as defined by Marshall

and Professor Pigou,[1] measures the volume of current output or real income and not the value of output or money-income.[2] Furthermore, it depends, in some sense, on *net* output;—on the net addition, that is to say, to the resources of the community available for consumption or for retention as capital stock, due to the economic activities and sacrifices of the current period, after allowing for the wastage of the stock of real capital existing at the commencement of the period. On this basis an attempt is made to erect a quantitative science. But it is a grave objection to this definition for such a purpose that the community's output of goods and services is a non-homogeneous complex which cannot be measured, strictly speaking, except in certain special cases, as for example when all the items of one output are included in the same proportions in another output.

(ii) The difficulty is even greater when, in order to calculate net output, we try to measure the net addition to capital equipment; for we have to find some basis for a quantitative comparison between the new items of equipment produced during the period and the old items which have perished by wastage. In order to arrive at the net national dividend, Professor Pigou[3] deducts such obsolescence, etc., 'as may fairly be called "normal"; and the practical test of normality is that the depletion is sufficiently regular to be foreseen, if not in detail, at least in the large'. But, since this deduction is not a deduction in terms of money, he is involved in assuming that there can be a change in physical quantity, although there has been no physical change; i.e. he is covertly introducing changes in *value*.

[1] *Vide* Pigou, *Economics of Welfare*, *passim*, and particularly Part I, Chap. iii.

[2] Though, as a convenient compromise, the real income, which is taken to constitute the national dividend, is usually limited to those goods and services which can be bought for money.

[3] *Economics of Welfare*, Part I, Chap. v, on 'What is Meant by Maintaining Capital Intact'; as amended by a recent article in the *Economic Journal*, June 1935, p. 225.

Moreover, he is unable to devise any satisfactory formula[1] to evaluate new equipment against old when, owing to changes in technique, the two are not identical. I believe that the concept at which Professor Pigou is aiming is the right and appropriate concept for economic analysis. But, until a satisfactory system of units has been adopted, its precise definition is an impossible task. The problem of comparing one real output with another and of then calculating net output by setting off new items of equipment against the wastage of old items presents conundrums which permit, one can confidently say, of no solution.

(iii) Thirdly, the well-known, but unavoidable, element of vagueness which admittedly attends the concept of the general price-level makes this term very unsatisfactory for the purposes of a causal analysis, which ought to be exact.

Nevertheless these difficulties are rightly regarded as 'conundrums'. They are 'purely theoretical' in the sense that they never perplex, or indeed enter in any way into, business decisions and have no relevance to the causal sequence of economic events, which are clear-cut and determinate in spite of the quantitative indeterminacy of these concepts. It is natural, therefore, to conclude that they not only lack precision but are unnecessary. Obviously our quantitative analysis must be expressed without using any quantitatively vague expressions. And, indeed, as soon as one makes the attempt, it becomes clear, as I hope to show, that one can get on much better without them.

The fact that two incommensurable collections of miscellaneous objects cannot in themselves provide the material for a quantitative analysis need not, of course, prevent us from making approximate statistical comparisons, depending on some broad element of judgment rather than of strict calculation, which may possess significance and validity within certain limits.

[1] Cf. Prof. Hayek's criticisms, *Economica*, August 1935, p. 247.

But the proper place for such things as net real output and the general level of prices lies within the field of historical and statistical description, and their purpose should be to satisfy historical or social curiosity, a purpose for which perfect precision—such as our causal analysis requires, whether or not our knowledge of the actual values of the relevant quantities is complete or exact—is neither usual nor necessary. To say that net output to-day is greater, but the price-level lower, than ten years ago or one year ago, is a proposition of a similar character to the statement that Queen Victoria was a better queen but not a happier woman than Queen Elizabeth—a proposition not without meaning and not without interest, but unsuitable as material for the differential calculus. Our precision will be a mock precision if we try to use such partly vague and non-quantitative concepts as the basis of a quantitative analysis.

III

On *every* particular occasion, let it be remembered, an entrepreneur is concerned with decisions as to the scale on which to work a given capital equipment; and when we say that the expectation of an increased demand, i.e. a raising of the aggregate demand function, will lead to an increase in aggregate output, we really mean that the firms, which own the capital equipment, will be induced to associate with it a greater aggregate employment of labour. In the case of an individual firm or industry producing a homogeneous product we can speak legitimately, if we wish, of increases or decreases of output. But when we are aggregating the activities of all firms, we cannot speak accurately except in terms of quantities of employment applied to a given equipment. The concepts of output as a whole and its price-level are not required in this context, since we have no need of an absolute

measure of current aggregate output, such as would enable us to compare its amount with the amount which would result from the association of a different capital equipment with a different quantity of employment. When, for purposes of description or rough comparison, we wish to speak of an increase of output, we must rely on the general presumption that the amount of employment associated with a given capital equipment will be a satisfactory index of the amount of resultant output;—the two being presumed to increase and decrease together, though not in a definite numerical proportion.

In dealing with the theory of employment I propose, therefore, to make use of only two fundamental units of quantity, namely, quantities of money-value and quantities of employment. The first of these is strictly homogeneous, and the second can be made so. For, in so far as different grades and kinds of labour and salaried assistance enjoy a more or less fixed relative remuneration, the quantity of employment can be sufficiently defined for our purpose by taking an hour's employment of ordinary labour as our unit and weighting an hour's employment of special labour in proportion to its remuneration; i.e. an hour of special labour remunerated at double ordinary rates will count as two units. We shall call the unit in which the quantity of employment is measured the labour-unit; and the money-wage of a labour-unit we shall call the wage-unit.[1] Thus, if E is the wages (and salaries) bill, W the wage-unit, and N the quantity of employment, $E = N.W$.

This assumption of homogeneity in the supply of labour is not upset by the obvious fact of great differences in the specialised skill of individual workers and in their suitability for different occupations. For,

[1] If X stands for any quantity measured in terms of money, it will often be convenient to write X_w for the same quantity measured in terms of the wage-unit.

if the remuneration of the workers is proportional to their efficiency, the differences are dealt with by our having regarded individuals as contributing to the supply of labour in proportion to their remuneration; whilst if, as output increases, a given firm has to bring in labour which is less and less efficient for its special purposes per wage-unit paid to it, this is merely one factor among others leading to a diminishing return from the capital equipment in terms of output as more labour is employed on it. We subsume, so to speak, the non-homogeneity of equally remunerated labour units in the equipment, which we regard as less and less adapted to employ the available labour units as output increases, instead of regarding the available labour units as less and less adapted to use a homogeneous capital equipment. Thus if there is no surplus of specialised or practised labour and the use of less suitable labour involves a higher labour cost per unit of output, this means that the rate at which the return from the equipment diminishes as employment increases is more rapid than it would be if there were such a surplus.[1] Even in the limiting case where different labour units were so highly specialised as to be altogether incapable of being substituted for one another, there is no awkwardness; for this merely means that the elasticity of supply of output from a particular type of capital equipment falls suddenly to zero when all the available labour specialised to its use is already employed.[2] Thus our assumption of a homo-

[1] This is the main reason why the supply price of output rises with increasing demand even when there is still a surplus of equipment identical in type with the equipment in use. If we suppose that the surplus supply of labour forms a pool equally available to all entrepreneurs and that labour employed for a given purpose is rewarded, in part at least, per unit of effort and not with strict regard to its efficiency in its actual particular employment (which is in most cases the realistic assumption to make), the diminishing efficiency of the labour employed is an outstanding example of rising supply price with increasing output, not due to internal diseconomies.

[2] How the supply curve in ordinary use is supposed to deal with the above difficulty I cannot say, since those who use this curve have not made their assumptions very clear. Probably they are assuming that labour

geneous unit of labour involves no difficulties unless there is great instability in the relative remuneration of different labour-units; and even this difficulty can be dealt with, if it arises, by supposing a rapid liability to change in the supply of labour and the shape of the aggregate supply function.

It is my belief that much unnecessary perplexity can be avoided if we limit ourselves strictly to the two units, money and labour, when we are dealing with the behaviour of the economic system as a whole; reserving the use of units of particular outputs and equipments to the occasions when we are analysing the output of individual firms or industries in isolation; and the use of vague concepts, such as the quantity of output as a whole, the quantity of capital equipment as a whole and the general level of prices, to the occasions when we are attempting some historical comparison which is within certain (perhaps fairly wide) limits avowedly unprecise and approximate.

employed for a given purpose is always rewarded with strict regard to its efficiency for that purpose. But this is unrealistic. Perhaps the essential reason for treating the varying efficiency of labour as though it belonged to the equipment lies in the fact that the increasing surpluses, which emerge as output is increased, accrue in practice mainly to the owners of the equipment and not to the more efficient workers (though these may get an advantage through being employed more regularly and by receiving earlier promotion); that is to say, men of differing efficiency working at the same job are seldom paid at rates closely proportional to their efficiencies. Where, however, increased pay for higher efficiency occurs, and in so far as it occurs my method takes account of it; since in calculating the number of labour units employed, the individual workers are weighted in proportion to their remuneration. On my assumptions interesting complications obviously arise where we are dealing with particular supply curves since their shape will depend on the demand for suitable labour in other directions. To ignore these complications would, as I have said, be unrealistic. But we need not consider them when we are dealing with employment as a whole, provided we assume that a given volume of effective demand has a particular distribution of this demand between different products uniquely associated with it. It may be, however, that this would not hold good irrespective of the particular cause of the change in demand. E.g. an increase in effective demand due to an increased propensity to consume might find itself faced by a different aggregate supply function from that which would face an equal increase in demand due to an increased inducement to invest. All this, however, belongs to the detailed analysis of the general ideas here set forth, which it is no part of my immediate purpose to pursue.

It follows that we shall measure changes in current output by reference to the number of hours of labour paid for (whether to satisfy consumers or to produce fresh capital equipment) on the existing capital equipment, hours of skilled labour being weighted in proportion to their remuneration. We have no need of a quantitative comparison between this output and the output which would result from associating a different set of workers with a different capital equipment. To predict how entrepreneurs possessing a given equipment will respond to a shift in the aggregate demand function it is not necessary to know how the quantity of the resulting output, the standard of life and the general level of prices would compare with what they were at a different date or in another country.

IV

It is easily shown that the conditions of supply, such as are usually expressed in terms of the supply curve, and the elasticity of supply relating output to price, can be handled in terms of our two chosen units by means of the aggregate supply function, without reference to quantities of output, whether we are concerned with a particular firm or industry or with economic activity as a whole. For the aggregate supply function for a given firm (and similarly for a given industry or for industry as a whole) is given by

$$Z_r = \phi_r(N_r),$$

where Z_r is the proceeds (net of user cost) the expectation of which will induce a level of employment N_r. If, therefore, the relation between employment and output is such that an employment N_r results in an output O_r, where $O_r = \psi_r(N_r)$, it follows that

$$p = \frac{Z_r + U_r(N_r)}{O_r.} = \frac{\phi_r(N_r) + U_r(N_r)}{\psi_r(N_r)}$$

is the ordinary supply curve, where $U_r(N_r)$ is the (expected) user cost corresponding to a level of employment N_r.

Thus in the case of each homogeneous commodity, for which $O_r = \psi_r(N_r)$ has a definite meaning, we can evaluate $Z_r = \phi_r(N_r)$ in the ordinary way; but we can then aggregate the N_r's in a way in which we cannot aggregate the O_r's, since ΣO_r is not a numerical quantity. Moreover, if we can assume that, in a given environment, a given aggregate employment will be distributed in a unique way between different industries, so that N_r is a function of N, further simplifications are possible.