

THE RATE OF INTEREST AND THE DURATION OF LIFE

(To the Editors of the Journal of the Institute of Actuaries)

SIRS,

In his paper in *J.I.A.* Vol. LXVI, p. 167, Mr Raynes pointed to the connexion between the fundamental level of the rate of interest (about which the market rate oscillates) and the length of life, employing ideas and phraseology very similar to those used in a paper read by me before the Actuarial Society of Australasia on 2 September 1929, which, in the absence of mention, it must be presumed he had never seen.

Later, Mr H. Vaughan (*J.I.A.*, Vol. LXVI, p. 513) drew attention to Sir William Petty's propounding of a similar theory in 1662, and to the mention thereof by W. B. Hodge, who deprecated it, and by Prof. Cassel, who supported it.

The idea that there is such a connexion seems so obvious, that it would be surprising if it did not spring up all through the centuries. It presented itself to me spontaneously as self evident many years ago upon different reasoning from that employed by Petty and Cassel and in a somewhat different form.

Sir William Petty's suggestion was that the rate of interest ultimately depended upon "the number of years which I conceive one man of fifty years old, another of twenty-eight, and another of seven years old, all being alive together, may be thought to live, that is to say, of a grand-father, father and child; few men having reason to take care of more remote posterity".

Prof. Cassel's line of reasoning can be followed from the example given by him: "Let us suppose...that a capitalist...has on an average 30 more years to live. Then if the rate of interest is high he will not gain very much by exchanging his interest income for an annuity: but if the rate of interest falls below 2 per cent the gain becomes substantial and the capitalist will readily be induced to consume his capital."

I would suggest that these explanations are rather remote from the elementary factors and origins; for apart from other things they presuppose conditions not existing everywhere, and which certainly did not exist when discount or interest first arose, and thus to some extent tend to impede a clear conception of the subject.

I make bold to point to some of the arguments in my paper, partly because it seems, upon reflection, to be due to the author thereof as well as to the local Society and to the subject, that the voice therein should not continue to remain silent. These were:

- (1) That the buying of properties or incomes upon a simple calculation of the number of years' purchase, that is, upon a simple time calculation, must have long preceded any mental conception of

interest or technical monetary discount. In a primitive state of society there would be no knowledge of discount or interest tables or rates.

- (2) My paper says: "Capital is income reduced to one dimension less by the elimination of time. The instrument by which time is eliminated is discount. Discount, being a human time function, must be based upon a human measure of future time." Mr Raynes's similar expression "human valuations of future income" more than half conceals the real point.
- (3) That the fundamental value of an income must be roughly based upon the probable period of enjoyment of which in a settled state of affairs the duration of life is more or less the limit.
- (4) If, whether from the general shortness of life, or *any other cause*, people could only reckon upon a probability of say 3 years' enjoyment of an income, it would be preposterous to give 20 years' purchase for it.

The powerful mental idea of an interest rate in a given transaction originated in all probability as an *ex post facto* conception of mathematical equivalence. Theory generally comes later than practice.

If 20 years' purchase be given, that is a fact. The conception that it involves interest at 5 per cent is not necessarily a fact: it is merely equivalent to that as well as to a lot of other hypotheses. Things which are equal to the same thing are not necessarily identical. And when all knowledge of mathematics, save the rudiments of arithmetic, might be supposed to have vanished, the solid fact would still remain that future income could and would be bought upon a simple time calculation, which therefore may be considered to be the veritable skeleton of the structure. And we may be sure that such time calculation could never possibly ignore the limiting effect of the length of life, which even the most ignorant savage is able to sense from daily observation of those around him. The process need be no more than an assessment of the time that must elapse before capital would be recouped, and of the reasonableness of that time, having regard to the various hazards, perhaps dominating, or perhaps negligible, such as war, turbulence, etc., with death in the background as the one inescapable or implacable factor. That calculation, however simple, contains the theory of interest in a matchbox, clear, comprehensive, and undeniable.

While the conventional division of an interest rate, into interest proper and risk premium, fits conveniently into the ordinary conception of interest, it could with much greater generality be said that the high rate in certain investments was all pure interest or discount, the increased rate or reduced capital value being essentially a recognition of a shortening of the probable time of enjoyment. The splitting of the rate, while of value as a practical expedient, could be described theoretically as a distortion

due to twisting the time factor into a conventional shape: for it assumes these particular investments to have a longer period, and then introduces the secondary factor described as risk premium to justify that, in much the same way as the Ptolemaic system of astronomy, by starting wrongly, had to bring in all sorts of corrections and justifications.

The period of probable enjoyment may vary as between different times, places, and transactions. Thus it is possible to have a high vitality rate and a relatively high interest rate in a given country, the British Dominions for example, because other factors intervene to affect the expectation of enjoyment in the minds of the lenders. Distance from the lenders, including geographical, political, and military factors in the term, is itself a detraction from the probabilities of enjoyment.

I am, Sirs, etc.,

A. T. TRAVERSI

18 MARTIN PLACE, SYDNEY

6 *May* 1937