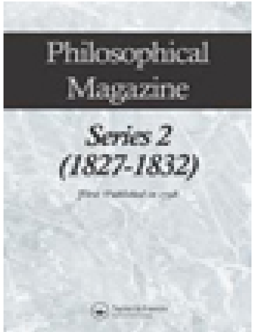

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LV. Remarks on the principle of compound interest. In reply to F.R.S.

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free communication and the ultimate concentration of these truths, we shall be conducted with slow, but with less erring steps, to the more obscure and sublime parts of the system.

LV. *Remarks on the Principle of Compound Interest. In reply to* F. R. S. *By* A Correspondent.

If the interest of a hundred pounds for a day be a penny, it will be 365 pence for a year, according to the principles of simple interest.

But in all questions respecting pecuniary affairs extending to many years, and in all transactions respecting annuities, it becomes necessary to adopt the principle of compound interest, which allows a repeated investment of the capital and interest either yearly or monthly, or at shorter periods, without any limit: although this principle can only be employed in commerce under particular restraints imposed by the laws of usury.

It is lawful, for instance, to receive $\frac{5}{365}l.$ in common years, if not in leap years, each day that 100*l.* is in the hands of a borrower: but at the end of the year, it is only lawful to receive 5*l.* for the use of the 100*l.* without any interest on the interest.

"Dr. Price and his followers" appear to consider the two supposed transactions as regulated by the *same rate* of interest.

The sense in which Dr. Young has understood the "*same rate*" comprehends the supposition of the possibility of laying out the interest from day to day, to be improved at compound interest; by means of which the 5*l.* would receive an addition of about half a year's simple interest on itself, or about half a crown, at the end of the year: making a yearly interest of about 5*l.* 2*s.* 6*d.*; which he considers as more correctly the *same rate* with $\frac{5}{365}l.$ a-day. If this is erroneous, Dr. Young is in the wrong.

It is allowable to use the word *same* in either sense, provided that the definition be borne in mind: but when the definition is forgotten, the confusion may lead to errors in practice. It has been asserted, for instance, that the value of a perpetual annuity payable yearly is exactly equal to that of the same annual sum supposed to be paid "momently" in equal portions: because this result is obtained by supposing the annual interest to be divided through the moments, according to the principle of simple and not of compound interest: and in this manner mathematicians, even of *deserved reputation*, have been able to convince themselves of the truth of a paradox a paradox so revolting to common sense. The fact is, that the obviously greater value of an annuity beginning immediately, and payable hourly or daily at the option of the receiver, is reduced, in their method of computation, by the virtual increase of the discount, to the bare value of an equal annuity of which the payments are all accumulated at the *ends* of the respective years; a change which certainly could not be a matter of indifference either to the payer or to the receiver, and neither of them "would have the least difficulty in determining which of the two Doctors he should prefer to follow," though their *determinations* might be somewhat at variance.

Dr. Young has not asserted that this difference is the same in *all* cases of annuities; although he has taken for granted that it is the same in annuities on lives as in perpetual annuities, because the present value of the remotest possible payments is in both cases evanescent.

The objector has certainly not understood the nature of the argument by which Dr. Young has attempted to prove the inaccuracy, or rather the impropriety, of Dr. Price's estimation of the *identity* of the rate of interest. The tenor of that argument is, that when Dr. Price supposes he is reckoning on two annuities at the same rate of interest, he is in fact employing different rates: for that the discount on 10 shillings, receivable at a certain moment, as a payment of the half-yearly annuity, *is* greater, *in the computation*, than the discount on 10 shillings receivable at the same moment as half of an annual payment; and therefore that the rate of interest cannot properly be called *the same* in the two cases. The objector makes Dr. Young assert that the discount *ought* to be greater when the payment is half-yearly; which is quite a different question, because this comparison relates to one half of the whole number of half-yearly payments only.

When the sense of an author is mistaken, it is easy to triumph over the supposed absurdity of his conclusions: and in *this manner* your correspondent has perfectly succeeded in exposing the errors of those who do not *understand* Dr. Price's solution! With the greater part of his last paragraph, however, I fully agree, though many might be inclined to oppose to him the high authority of Mr. Morgan, whose testimony, though somewhat vague, seems greatly calculated "to encourage the popular delusion of the improved healthiness and greater longevity of the people of this kingdom," which the objector seems so much to deplore.

Waterloo-place, 2d Oct. 1827. F. R. S. L.

LVI. *On*