

THE RATE OF INTEREST

ITS NATURE, DETERMINATION AND
RELATION TO ECONOMIC
PHENOMENA

BY

IRVING FISHER, PH.D.

PROFESSOR OF POLITICAL ECONOMY, YALE UNIVERSITY

New York

THE MACMILLAN COMPANY

1907

All rights reserved

91848
161 9108

HB
539
FS4
1907
Cop. 2

COPYRIGHT, 1907,
By THE MACMILLAN COMPANY.

Set up and printed. Published October, 1907.

Norwood Press
J. S. Cushing Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

CHAPTER III

COST THEORIES

§ 1

WE turn now from those theories of interest based mainly on the idea of *productivity* to those based mainly on that of *cost*.

The first of the cost theories to be examined resembles closely the productivity theories, the only difference being that the "cost of production of capital" takes the place of the value of capital. In the productivity theories, the rate of interest was sought in the ratio between the income from capital and the *value of that capital*. In the cost theory now considered, on the other hand, the rate of interest is sought in the ratio between the income from capital and the *cost of that capital*. This theory is subject to many of the objections which apply to the productivity theories. In the first place, it is necessary, before the ratio of income to cost can be regarded as even commensurable with a rate of interest, that income and cost shall have been reduced to a common denomination of value, as, for instance, dollars. A loom renders its return, or service, by the operation called weaving. The cost of the loom, on the other hand, consists of raw materials, the use of tools, dies, lathes, and other machine-shop appliances, together with human labor. Only when these miscellaneous items are reduced to some common standard of value does the ratio of income to cost become a mere percentage like the rate of interest. But when this reduction to a common standard is effected, the suspicion immediately arises that, after all, the question of interest may have

been begged in the process,—that the labor, materials, and use of tools all derive their value as costs, in part, at least, from discounting the prospective product to which they contribute. In other words, since the cost of capital must be obtained by a process of valuation, this valuation may involve the very rate of interest to be determined.

Nevertheless, the theory which seeks the rate of interest in the ratio of return to cost of capital has certain advantages over that which seeks it in the ratio of return to value of capital; for there are some costs which are not merely the discounted value of expected services. There are two kinds of costs, (1) "interactions"¹ and (2) labor-and-trouble. The value of the former is always determined by discounting some future service; the value of the latter is determined (to the laborer) by the irksomeness or "undesirability" of labor compared with the desirability of money. We are not called upon, however, to strengthen the cost theories by recourse to this distinction between costs which involve discounting and costs which do not; for the cost theories as actually held and advocated take no account of such a distinction, and the costs usually cited are mainly costs which do involve discounting,—in other words, interactions. Such costs certainly cannot be taken as a sufficient foundation for explaining the rate of interest. The tailor reckons among his costs the value of the cloth which he buys; the manufacturer of the cloth reckons among his costs the value of the yarn; the producer of the yarn reckons in his cost the value of the wool. But the value of the wool is found in part by discounting the value of the yarn to which it contributes; that of the yarn, by discounting the value of the cloth; that of the cloth, by discounting the value of the clothes.

It is seldom possible in practice to find a case so pure as not to be obscured by a number of different elements; but let us, for the sake of illustration, consider

¹ See *The Nature of Capital and Income*, Chaps. VII-X.

a dealer in trees, who buys saplings and sells them after they are full grown. In this case there are few other costs besides the cost of *buying* the saplings. We can here see clearly the fallacy involved in regarding the rate of interest as determined by the ratio of the value of the full-grown tree to the cost of the sapling; for the cost of buying the sapling is evidently itself obtained by discounting the value of the tree. In fact, in this case the cost theory becomes identical with the productivity theory; for the cost of buying the sapling is nothing more nor less than the value of the sapling. The only distinction between them is a formal one: the cost of buying the sapling is regarded as pertaining to the income and outgo account; the value of the sapling, to the capital account. Since, then, the cost of buying the sapling is the discounted value of the tree, this cost can be computed only by discounting, and discounting presupposes a rate of interest. In many cases, therefore, "cost" is merely the discounted value of "return." The cost, in these cases at least, depends on the rate of interest, not the rate of interest on the cost.

§ 2

It is true that an article sometimes costs less (or more) than the discounted value of the returns. The ratio of future return to present cost may then temporarily differ from the rate of interest on loans. Thus, a manufacturer calculates that a newly invented machine will earn him \$10 a year for twenty years. If we suppose he is willing to invest on a 5 per cent. basis, namely, that subjectively he values this year's goods at a premium of 5 per cent. compared with next year's goods, then the price he is willing to pay for the machine is \$125, this being the present worth, at 5 per cent., of \$10 a year for twenty years. But it may be that the cost of obtaining the machine is not \$125 but, say, \$100, which corresponds to an 8 per

but the sums given in the table; namely, \$61, \$65, \$68, and so forth?

To push this criticism to the limit, let us finally consider a perpetual annuity of \$100 a year. In this case we shall find that the "cost of waiting" each year is \$100; for the value of such an annuity, reckoned at 5 per cent., is \$2000 reckoned at the beginning of each year, and \$2100 reckoned at the end. If this cost of waiting is to be regarded as a deduction from income, like other costs, we are forced to conclude that the owner of such a perpetual annuity receives each year no income whatever! For, if we deduct from the \$100 of money-income the \$100 of waiting, the remainder each year is zero!

It may be said that we have not always a mere *annuity* to deal with but a definite capital such as a *house* or a *factory* which has involved cost in its construction and the "sacrifice" of waiting for an income, whereas the capital might have been consumed at once. In all such cases, however, we are dealing with the very same principle. The possession of the house or factory, like the title to the annuity, is valuable *only because* of the service or the income which it is expected to yield. If there is for the house or factory an initial labor-cost or expense, this is also true of the annuity. On the other hand, the one as well as the other may come by inheritance and so involves no cost to its owner. What it is desired to emphasize is that in any case the present value is the discounted value of the expected future services or income and that it is *not* any sacrifice or cost of waiting which produces this value but that, on the contrary, it is the existence of this future value which prompts the waiting.

§ 11

It is obvious that the theory which calls "waiting" a cost has worked out its own absurdity. The most that can

be said in its favor is that it makes the capital-value of any article equal to its cost of production. The idea that the value of an article should equal its cost seems to possess a certain fascination for many, if not most, students of economics. That it is false has been sufficiently shown by Böhm-Bawerk through reasoning somewhat similar to the foregoing. That it is absurd when carried to its logical conclusion is evident when we consider what happens if the same method of bookkeeping is carried out with respect to the future as well as the past. It is a poor rule which will not work both ways. This rule, applied to future expected income and outgo, yields the strange result that the capital value of any article is normally not less than, but equal to, the expected income. Thus, to revert to the case of the tree, let us take its value at the end of 14 years. It is then worth \$2, which, in the parlance of the abstinence theorists, is equal to its previous cost of production, consisting of \$1 worth of labor plus \$1 worth of waiting during the 14 years. It is also, in like manner, equal to the future income to be derived from it, which consists of \$3 worth of actual receipts from the sale of the tree, due at the end of eleven more years, less the cost of waiting for those \$3, which amounts to \$1.

In the same way, the ten-year annuitant just considered has, at the beginning, property worth \$772. This, according to any proper bookkeeping, is the discounted value of the future income of \$100 a year for 10 years, the total amount of which is \$1000. But, according to the abstinence theorists, the income which he receives for the whole period is, as has been shown, not this \$1000, but \$772, which is just equal to the value of the property. Pursuing the method of limits, we find that for the owner of a perpetual annuity the same proposition would hold good. According to the true and ordinary method of reckoning, the total income from such an annuity is infinity, although its present capital value is only \$2000. But

according to the abstinence theorists the income itself is not infinite, but only \$2000.¹

Those who are enamored of the simplicity and neatness of the formula of the abstinence theorists, by which the capital value is not greater than *past* cost of production, but exactly equal to it, can scarcely be attracted by the exaggerated simplicity of the inverse theorem which is also involved; namely, that the capital value of any *future* expected income is not less than that income, but exactly equal to it also.

§ 12

The fallacy of the abstinence theorists lies in the simple fact that waiting has no independent existence as a "cost." We can never locate it in time, nor estimate its amount, without first knowing some *other* more tangible costs. Waiting means nothing unless there is something waited for, and the cost of waiting can only be estimated in proportion to the magnitude of what is waited for.

It will doubtless take a long time for many to accept the doctrine that the value of capital is not only less than its future expected income, but normally greater than its past cost. Even to those who do not formally accept any cost theory of interest, the interest itself will seem in some sense to be a cost; and in most books on economics, interest, however explained, is regarded as one of the costs of production. It is true that for a debtor who pays interest, the interest is, to him, a real cost, and is debited on

¹ Lest the non-mathematical reader should be puzzled by this result, which seems to contradict the fact already brought out, that under the pseudo-reckoning of the abstinence theorists the net income is zero every year, it must be remembered that this zero income is repeated an infinite number of times, and that when we deal with infinity we can get reliable results only by the method of limits. The mathematical reader will find no difficulty in showing, by the method of limits, that there is a "remainder term" which will, in the supposed accounting, make the total income distributed through all eternity simply equal to the capital value, \$2000.

CHAPTER V

APPRECIATION AND INTEREST

§ 1

IN the four preceding chapters we have criticised those theories of interest which enjoy the greatest currency in present economic and business circles. Inasmuch as we have found radical defects in all of them, our best course now is to formulate *de novo* what seems to us to be the correct theory. At the outset we need to note an oversight common to all the theories reviewed. In none of them is any account taken of the fact that the number expressing the rate of interest depends upon the monetary standard of value in terms of which that rate of interest is expressed. To say that the rate of interest is 4 per cent. means¹ that the quantity of this year's goods which is worth \$100 is equivalent to the quantity of next year's goods which is worth \$104. In this statement we observe that the "goods" which are considered are expressed not in their own special units, — pounds, bushels, yards, etc., — but in terms of a standard of value. The standard of value chosen is usually money. This money, the \$100 and \$104, is nominally exchanged; but actually it merely measures the "goods" which are exchanged. When a man lends \$100 this year in order to obtain \$104 next year, he is really sacrificing not one hundred dollars in money, but one hundred dollars' worth of goods such as food, clothing, books, or pleasure trips, in order to obtain next year not one hundred and four dollars in money, but one hundred and four dollars' worth of other goods which he desires.

¹ See Glossary at end of this volume ; also the writer's *The Nature of Capital and Income* (Chap. XI), the nomenclature of which book is followed in the present work.

Yet the fact that both sets of goods are *measured* in money introduces a monetary factor into the problem of interest. Interest, being a premium in the exchange between the *money* values of this year's and next year's goods, is therefore not wholly an affair of goods, but is partly one of money. The relation of the rate of interest to goods will form the subject of subsequent chapters. The present chapter is devoted to a study of the relation which subsists between the rate of interest and the monetary standard in terms of which it is expressed.

The monetary standard affects the rate of interest in so far as there is a *change* in the value of that standard in reference to other standards. Could it always be assumed that the monetary standard was invariable in value with reference to all goods, the rate of interest reckoned in money would be the same as though it were reckoned in terms of the goods themselves. But if money and goods are to change with reference to each other — in other words, if the money standard “appreciates” or “depreciates” — the number expressing the rate of interest will be affected.

§ 2

The influence of monetary appreciation or depreciation on the rate of interest will be different according to whether or not that appreciation or depreciation is foreseen. If it is not foreseen, the appreciation of money necessarily injures the debtor, because, the purchasing power of money being increased, the principal of his debt, when due, represents a larger quantum of goods than was anticipated when the debt was contracted. But if the appreciation is foreseen, any increased burden in the “principal” may be offset by a reduction in the rate of interest. This fact, strangely enough, has seldom been recognized. The assumption has been tacitly made that contracting parties are powerless to forestall gains or losses due to an upward or downward movement of the monetary standard. Yet no reason

has been given to show that it is any more difficult to make allowance for a change in the unit of value than for a change in any other unit. If the unit of length were changed, and its change were foreknown, it is clear that contracts would be modified accordingly. Suppose, for instance, that a yard were defined (as possibly it once was) as the length of the king's girdle, and suppose the king to be a child. Everybody would then know that the "yard" would probably increase with the king's age, and a merchant who should agree to deliver one thousand "yards" ten years hence would make his terms correspond to his expectations. It would be strange if, in some similar way, an escape could not be found from the effects of changes in the monetary yardstick, provided these changes were known in advance. To offset a foreseen appreciation, it would only be necessary that the rate of interest be correspondingly lower, and to offset a foreseen depreciation, that it be correspondingly higher.¹

If a debt is contracted optionally in either of two standards and one of them is *expected* to change with reference to the other, the rate of interest will by no means be the same in both. A few years ago, during the uncertainty as to the adoption or rejection of "free silver," a syndicate offered the United States government the alternative of some \$65,000,000 of bonds on a 3 per cent. basis in gold, or on a 3 $\frac{1}{4}$ per cent. basis in "coin." Every one knew that the additional $\frac{1}{4}$ per cent. in the latter alternative was due to the mere *possibility* that "coin" might not continue at full gold value, but sink to the level of silver. If the alternative had been between repayment in gold and a — not merely possible but actual — repayment in silver, the additional interest would obviously have exceeded $\frac{1}{4}$ per cent.

¹ For the history of the theory of appreciation and interest, see Appendix to Chap. V, § 1.

§ 3

The relation between the rate of interest and the rate of a foreseen appreciation or depreciation of money may be readily illustrated. In order to illustrate the theory, we may imagine two specified standards of value diverging from each other, in either of which loan contracts may be expressed. Let the two standards be gold and wheat, and let a bushel of wheat be first worth \$1. If the two standards did not diverge, that is, if the price of wheat in terms of gold held good till next year, it is clear that the rate of interest in a gold contract and a wheat contract would be the same; if it were 4 per cent. in gold, it would be 4 per cent. in wheat also. This may be expressed as follows:—

If to-day 100 dollars is the equivalent of 100 bu. @ \$1 per bu., then next year 104 dollars is the equivalent of 104 bu. @ \$1 per bu.

But let us suppose that the price of wheat rises from \$1 to \$1.01. We then readily see that:—

Whereas to-day 100 dollars is the equivalent of 100 bu. @ \$1 per bu., next year 104×1.01 dollars is the equivalent of 104 bu. @ \$1.01 per bu.

If we calculate out the $104 \times \$1.01$, we shall obtain \$105.04 as the sum which next year should be repaid in gold to be equivalent to 104 bu. payable in wheat. In other words, if 4 per cent. is the interest in the wheat standard, its equivalent is $5\frac{1}{10}\frac{4}{10}$ per cent. in the gold standard; or, again, if the rate of interest in wheat is 4 per cent., an appreciation of wheat of 1 per cent. is exactly offset by a rise of $1\frac{1}{10}\frac{4}{10}$ per cent. in the rate of interest in gold. It is thus a matter of indifference whether, under our supposed circumstances, a man who borrows \$1000 expresses his contract in gold and agrees to pay $5\frac{1}{10}\frac{4}{10}$ per cent. interest or translates the same contract into terms of wheat, borrowing the value of

1000 bushels and agreeing to pay 4 per cent. interest. By the first form of contract he pays back \$1000 of gold principal and \$50.40 of gold interest; by the second, he pays back the value of 1000 bu. as principal and of 40 bu. as interest. At the end of a year his debt by the one reckoning is \$1050.40, by the other, 1040 bu., and these are equivalent.

It is to be noted that we have been regarding gold or wheat as standards of value and not as media of exchange. In either contract the actual liquidation need not be made either in actual gold or wheat. The speculator who sells wheat "short" comes very close to using wheat as a standard, but not as a medium.

The relative change in the two standards may be spoken of either as an appreciation of wheat relatively to gold, or as a depreciation of gold relatively to wheat. We are not compelled to inquire which is the "absolute" change. If we use the first of these two modes of expression, we may say that since one bushel changes in value from \$1. to \$1.01, wheat has appreciated 1 per cent.; if we use the second mode of expression, we may say a gold dollar has fallen in its wheat value from one bushel to $\frac{100}{101}$ of a bushel, and has therefore depreciated by $\frac{1}{101}$ or $.99\frac{1}{101}$ per cent.¹

§ 4

In our numerical example, the appreciation (1 per cent.) of one standard relatively to the other, and likewise the depreciation ($.99\frac{1}{101}$ per cent.) of the latter standard relatively to the former, are not quite so great as the difference ($1\frac{4}{100}$ per cent.) in the rate of interest. This slight disparity must always exist so long as the rate of interest is reckoned annually or discontinuously. But the shorter the period of "compounding," the less the disparity; that is, the more

¹ For the general formula connecting the rates of interest in any two diverging standards, see Appendix to Chap. V, § 2.

nearly equal are the two magnitudes: (1) the rate of divergence between the two standards, whether measured as appreciation or depreciation, and (2) the difference between the rates of interest in the two standards. When the rates are "reckoned continuously," the disparity disappears altogether.¹

§ 5

Having established the truth and generality² of the principle connecting the rates of interest in two standards and the appreciation of one of them relatively to the other, we next inquire what limits, if any, are imposed on the three magnitudes; namely, the two rates of interest in the respective standards and the rate of relative appreciation between the standards. From what has been said it might seem that, when the appreciation is sufficiently rapid, the rate of interest in the upward-moving standard, in order to equalize the burden, would have to be zero or even negative. For instance, if the rate of interest in gold is 4 per cent., and if wheat appreciates relatively to gold at 4 per cent. also, the rate of interest in wheat, if perfectly adjusted, would have to sink to zero! But we know that zero or negative interest is practically impossible. Wheat would be hoarded, and this action would effectually prevent the rate of interest in terms of wheat from passing below the zero mark. But this very limitation on the possible rate of interest carries with it a limitation on the

¹ For the mathematical demonstration of this proposition, see Appendix to Chap. V, § 3. For the significance of "continuous" reckoning, see *The Nature of Capital and Income*, Chap. XII; also Chap. XIII and Appendix. We have here an example of the fact there observed that, considered mathematically, the analytical relations connected with the rate of interest are simplest when that rate is reckoned continuously. Since, however, the rate of interest reckoned continuously is so rarely used in practice, we shall adhere, in the remainder of our discussion, to the system of annual reckoning.

² For mathematical proofs, numerical illustrations, and formulae see Appendix to Chap. V, §§ 4 to 9 inclusive.

possible rate of appreciation. If interest on money, for instance, were 4 per cent., it would be impossible for wheat to have a foreknown appreciation of 10 per cent. per annum relatively to money; for it would immediately be bought and held for the rise. It would therefore rise at once to the discounted value of its future expected value, and its succeeding rise could not exceed the rate of interest.¹ In other words, if interest is 4 per cent., it is impossible that wheat should be worth \$1 to-day and \$1.10 next year foreknown to-day. For, under these circumstances, holding for a rise would give a sure return of 10 per cent. The lowest price of present wheat possible would be the \$1.10 discounted at 4 per cent., or about \$1.06. At this figure the rate of interest in gold is 4 per cent., but *in wheat* it is zero per cent. We should have: —

To-day \$106 equivalent to 100 bu. @ \$1.06 per bushel.
Next year \$110 equivalent to 100 bu. @ \$1.10 per bushel.

and the two alternative forms of contract would be: for \$106 this year \$110 are returned next year, or (about) 4 per cent., and for 100 bu. this year 100 bu. are returned next year, or zero per cent. Every case of holding wheat or land or other wealth for a rise may be, in fact, regarded as a case of zero interest in terms of these articles as standards of value.

The same principle which prevents the rate of interest in wheat or land from being negative also prevents a negative interest in money. A lender, rather than exchange \$101 to-day for \$100 next year, would hoard his \$101. It is important to emphasize the fact that the limits imposed on the rates of interest and appreciation come from the possibility of hoarding money without loss. If money were a perishable commodity, like fruit, the limit would be pushed into the region of negative quantities.

¹ See *The Nature of Capital and Income*, on the rate of rise of "discount curves," Chap. XIII.

One can imagine a loan based on strawberries or peaches, contracted in summer and payable in winter, with *negative* interest.¹ Or, again, we may define a "dollar" as consisting of a constantly increasing number of grains of gold, the weight of which is to double yearly. *Such "dollars" cannot be hoarded without necessarily becoming fewer with time*, and if interest in the old fixed-weight dollars is 5 per cent., it will be *minus* $47\frac{1}{2}$ per cent. in the new dollars of increasing weight; for he who borrows \$100 (2580 grains) to-day will need to pay back only \$52.50 (2709 grains) one year hence.

§ 6

The relation existing between interest and appreciation implies, then, that the "rate of interest" is always relative to the standard in which it is expressed. The fact that interest *in money* is high, say 15 per cent., may merely indicate that general prices are expected to rise at the rate of 10 per cent., and that the rate of interest in terms of *goods* is not high, but only $4\frac{1}{2}$ per cent.

We thus need to distinguish between interest in terms of money and interest in terms of goods. The first thought suggested by this fact is that the rate of interest in money is "nominal," and that in goods "real." But this distinction is not sufficient, for no two forms of goods maintain, or are expected to maintain, a constant price ratio toward each other. *There are therefore just as many rates of interest in goods as there are forms of goods diverging in value.*

Is there, then, no absolute standard of value, as utility, in terms of which "real" interest should be expressed? To this we reply that any absolute standard is absolute only for a particular individual.² The fact that a dollar

¹ Cf. Böhm-Bawerk, *The Positive Theory of Capital*, pp. 252, 297; Landry, *L'Intérêt du Capital*, p. 49.

² Marshall, *Principles of Economics*, Vol. I, 3d ed. New York (Macmillan), 1895, p. 198, and *Royal Commission on Depression of*

is a smaller unit to a millionaire than to a poor laborer has as its consequence that, as the millionaire grows poorer his dollar grows larger, while as the laborer grows richer his dollar grows smaller. On account of such changes in personal fortunes, the dollar will be constantly appreciating and depreciating in different degrees among different men and classes. But if the dollar appreciates in terms of absolute utility in the eyes of one man, and depreciates in a corresponding standard of utility in the eyes of another, the rates of interest in the men's "absolute" standards must be different in the two cases; for the rates of interest to both persons in terms of objective units, such as money, *must by the operations of the market be the same*. If, in the gold standard, \$100 to-day is equivalent to \$104 due one year hence, both for him who is growing richer and for him who is growing poorer, the rates in terms of absolute utility will be different for the two men. Thus, suppose that the dollar to-day is worth to each man one unit of utility, but that one year hence, to the man who is growing richer, the dollar will be worth slightly less—let us say, $\frac{99}{100}$ of one unit of utility. Consequently, when he considers \$100 to-day as equivalent to \$104 due next year, he is virtually contrasting in his mind 100 units of utility to-day with $104 \times .99$, or about 103 units of utility next year. His rate of interest, therefore, in terms of absolute utility, is 3 per cent. Similar calculations for the man whose fortunes were declining, and to whom the marginal utility of the dollar was increasing 1 per cent. per annum, would show that whereas \$100 to-day is equivalent in his estimation to \$104 next year, 100 units of present utility are equivalent to about 105 units of next year's utility. To him, therefore, the rate of interest in the absolute standard would be 5 per cent.

Trade, 1886, p. 423; the writer's "Mathematical Investigations in the Theory of Value and Prices," *Transactions of the Connecticut Academy*, New Haven, 1892, pp. 11-23, 86-89; A. C. Pigou, "Some Remarks on Utility," *Economic Journal*, March, 1903, p. 60.

From this explanation it is very evident that if we seek to postulate an absolute standard of value in which the rates of interest are to be reckoned, we cannot fix one which will be uniform for all the individuals in the market. Supply and demand operate only to make *objective* rates equal. Hereafter we shall confine ourselves to a study of objective interest; and since the objective standard usually employed is money, the rate of interest, unless otherwise specified, will be taken in this book to mean the rate of interest in terms of the money standard. ✓

As was observed at the beginning of this chapter, it makes a great difference whether the relative divergence of the different standards is or is not known in advance. In actual fact it usually happens that future appreciation or depreciation is neither entirely foreseen nor entirely unforeseen. An intermediate condition is usually maintained. When prices are rising, the rate of interest is usually high, but not as high as it should be to compensate for the rise; and when prices are falling, the rate of interest is usually low, but not as low as it should be to compensate for the fall. The facts as they are actually found in the market will be given in Chapter XIV. ✓

CHAPTER VI

TIME-PREFERENCE

§ 1

In the last chapter we saw that the number expressing the rate of interest depends on the standard of value in which present and future goods are expressed. We saw how the rate of interest in one standard is to be derived from the rate of interest in any other standard.

It is clear that this translation of the rate of interest from one standard to another does not constitute a *complete determination of the rate of interest in any standard whatever*; for it assumes that the rate in *some one* standard is already known, and merely enables us on the basis of this known rate to calculate the rates in other standards. The case is similar to the conversion of temperature from the Fahrenheit system into the Centigrade or the Réaumur, which clearly does not determine temperature itself; or, to the conversion of the price of cotton in dollars into its price in shillings or francs, which does not determine the price of cotton itself. The relation which has been shown between appreciation (or depreciation) and interest therefore solves merely the problem of *translating* the rate of interest from one standard into another; but the problem of *determining* — the rate of interest is still left untouched. This problem — the problem of determining the rate of interest — now demands attention.

In our theory we shall find a place for each of the partial truths which we have found in the foregoing review of the productivity, cost, and agio theories. Our presentation may, in fact, be classified as a form of the agio theory, differing from Böhm-Bawerk's version chiefly by the omission of

the "technical advantage of present over future goods," and from agio theories in general by the explicit introduction of the income-concept. The income-concept plays the central rôle.

The theory of interest bears a close resemblance to the theory of prices, of which, in fact, it might be regarded as a part; for, as was shown in *The Nature of Capital and Income*, Chap. XII, the rate of interest expresses a price in the exchange between present and future goods. Just as in the ordinary theory of prices the ratio of exchange of any two articles is based on a psychological or subjective element, — their comparative marginal utility, — so in the theory of interest the rate of interest, or the premium in the exchange between present and future goods, is based on a subjective prototype; namely, the preference for present over future goods.

This "time-preference" is the central fact in the theory of interest.¹ It is what Rae calls the "effective desire for accumulation," and very nearly what Böhm-Bawerk calls the "perspective undervaluation of the future."² It is the (percentage) excess of the present desirability³ of present goods over the present desirability of an equal amount of future goods.

¹ Cf. Bullock, *Introduction to the Study of Economics* (Silver, Burdett & Company), 1900, p. 390; Fetter, *Economics*, New York (Century Co.), 1904, p. 135.

² At least, as applied to objective goods. Böhm-Bawerk applies it to subjective pleasures, which he translates into objective goods at a ratio depending on the "relative provision for present and future needs." As we have seen in § 6 of the preceding chapter, it is possible to translate the rate of interest (and, it might have been added, the rate of preference) from an objective to a subjective standard, or *vice versa*, provided we know the rate at which the two standards are diverging. We prefer to base our reasoning in this book on rates of preference and rates of interest expressed in terms of an objective, monetary standard. As we have seen, the rate of preference expressed in terms of subjective standards will be different for different individuals.

³ Or "ophelimity," or "utility." See *The Nature of Capital and Income*, Chap. III.

§ 2

But what are these "goods" which are thus contrasted? At first sight it might seem that the "goods" compared may be indiscriminately *wealth*, *property*, or *services*.¹ It is true that present machines are preferred to future machines; present houses to future houses; land possessed to-day to land available next year; present food or clothing to future food or clothing; present stocks or bonds to future stocks or bonds; present music to future music, and so on. But a slight examination will show that some of these cases of preference are reducible to others. When present capital (whether capital-wealth or capital-property) is preferred to future capital, this preference is really a preference for the income of the first capital as compared with the income of the second. The reason we would choose a present fruit tree rather than a similar tree available in ten years is that the fruit production of the first will occur earlier than that of the second. The reason one prefers immediate tenancy of a house to the right to occupy it in six months is that the uses of the house begin six months earlier in one case than in the other. In short, capital-wealth available early is preferred to capital-wealth of like kind available at a more remote time, because the *income* of the former is available earlier than the *income* of the latter. For the same reason, early capital-property is preferred to late capital-property of the same description. For property is merely a claim to future income; and the earlier the property is acquired, the earlier will the income accrue, of the right to which the property consists.

Thus, all time-preference resolves itself into the preference for early income over late income. Moreover, the preference for present income over future income resolves itself into the preference for present *final* income over future *final* income. The income from an article of capital which

¹ For definitions of these terms, see Glossary.

consists merely of an "interaction"¹ or "preparatory service"² is desired for the sake of the final income to which that interaction paves the way. We prefer present bread baking to future bread baking because the enjoyment of the resulting bread is available earlier in the one case than in the other. Present weaving is preferred to future weaving, because the earlier the weaving takes place the sooner will the cloth be manufactured, and the sooner will the clothing made from it be worn by the consumer.

When, as is usually the case, exchange intervenes between the weaving and the use of the clothes, the goal in the process is somewhat obscured by the fact that the manufacturer feels his preference for present weaving over future weaving, not because the clothes will be more early available, but because he will be enabled to sell the cloth earlier. To him, early sales are more advantageous than deferred sales, because the earlier the money is received the earlier can he spend it for his own personal uses,—the shelter and the comforts of various kinds constituting *his* real income. It is not he, but his customers, those who buy the cloth he manufactures, that base their preference for present cloth over future cloth on the earlier availability of the clothes which can be made from it. But in both cases the mind's eye is fixed on some ultimate enjoyable income to which the interaction in question is a mere preparatory step. We thus see that all preference for present over future goods resolves itself, in the last analysis, into a *preference for early enjoyable income over late enjoyable income*. This simple proposition would have received attention before had there been at hand a clear-cut concept of income.

§ 3

In *The Nature of Capital and Income*³ it was shown that income ultimately consists of the stream of conscious-

¹ See Glossary.

² See *The Nature of Capital and Income*, Chap. IX.

³ Chap. X.

ness. Or, if we prefer to stop just short of this subjective income, we may say that income consists of the objective services which impinge upon our persons and are on the point of producing the subjective effects on consciousness. In short, the income-stream consists of nourishment, clothing, shelter, amusements, the gratification of vanity, and other miscellaneous items. It is this income-stream upon which attention now centers. Henceforth, instead of speaking vaguely and loosely of the preference for present "goods" over future "goods," we shall speak of the preference for *present enjoyable income* over *future enjoyable income*. "Present" and "future" are, of course, used in a comparative sense only; in a more accurate statement we should substitute "early" and "deferred."

It should be noted that the preference for present over future goods, when thus reduced to its lowest terms, rides the values of the contrasted present and future goods of the interest element. When any other goods than enjoyable income are considered, their values already imply a rate of interest. When we say that interest is the premium on the value of a present house over that of a future house, we are apt to forget that the value of each house is itself based on a rate of interest. We have seen¹ that the price of a house is the discounted value of its future income. In the process of discounting there lurks a rate of interest. The value of houses will rise or fall as the rate of interest falls or rises. Hence, when we compare the values of present and future houses, both terms of the comparison involve the rate of interest. If, therefore, we undertake to make the rate of interest depend on the relative preference for present over future houses, we are making it depend on two elements, in each of which it already enters. The same is true of all capital, and also of those items of income which we have called interactions; for the value of an interaction is the discounted value of the ultimate income

¹ See *supra*, Chap. II, and *The Nature of Capital and Income*, Chap. XIII.

to which that interaction leads. We could not rest satisfied in the statement that interest is the premium on the value of present tree-planting over that of future tree-planting; for the value of each tree-planting itself depends on the rate at which the future income from the tree is discounted. But when present *ultimate* income is compared with future *ultimate* income, the case is different, for the value of ultimate income involves no interest whatever. We see, therefore, that the reduction of the problem of interest to a comparative value of present and future enjoyable income avoids the difficulty of making interest depend on magnitudes which themselves depend directly on interest.

§ 4

Having seen that time-preference is really a preference for early enjoyable income compared with remote enjoyable income, we next note that this preference depends on the entire future income-stream, that is, the amount of income and the manner in which it is distributed in time. It depends on the relative abundance of the early and remote incomes — or what we may call the time-shape of the income-stream. If future income is particularly abundant, its possessor would evidently be willing to sacrifice a large amount of it for the sake of a relatively small amount of present income.¹ Thus, in winter, the possessor of a strawberry patch might be willing to sell two boxes of strawberries, due in six months, for one available to-day, while in strawberry season he might, on the contrary, be

¹ It is noteworthy that, though lacking any definite theory of income, those writers who have made the most successful analysis of the rate of interest have, in substance, made it depend, to some extent, at least, on income. Thus Böhm-Bawerk, as has been observed, gives as one of the "three circumstances" affecting the "preference for present goods" the "relative provision for present and future"; and Landry virtually states the same relation, on p. 55 of *L'Intérêt du Capital*.

willing to give up two boxes of his then abundant crop for the right to one box in the succeeding winter.

It is, therefore, not necessary here to distinguish, as Böhm-Bawerk does, between the principles which lead to the *existence* of interest and those which regulate the *rate* of interest; for to determine the rate of interest will include the determination of whether the rate must necessarily always be greater than zero. As a matter of fact, the rate — may theoretically be negative, as in the case just mentioned of strawberries in strawberry season, or in the case cited by Böhm-Bawerk himself, of ice in winter. The reason such negative interest is not actually encountered in the market is that perishable articles such as ice and strawberries are never used as standards of value. We express our rates of interest in money, even if our contracts relate to strawberries or ice. But money possesses durability, and may be hoarded without loss. This explains why the rate of interest in terms of money can never be negative.¹

The proposition that the preference of any individual for present over future income depends upon his prospective enjoyable income corresponds to the proposition in the theory of prices, that the marginal utility of any article depends upon the quantity of that article; both propositions are fundamental in their respective spheres.

When it is said that the time-preference of an individual depends on his enjoyable income, it is meant that the rate of preference for, say, \$100 worth of this year's enjoyable income over \$100 worth of next year's enjoyable income depends upon the entire character of the individual's income-stream.

An income-stream is made up of a large number of different elements, some of which contribute to nourishment, others to shelter, others to amusement, etc. In a complete enumeration of these elements, we should need to distinguish the use of each different kind of food, the

¹ See *Supra*, Chap. V, § 5.

gratification of every variety of human want. Each of these constitutes a particular filament of the income-stream, extending from the present out into the indefinite future and varying at different points of time in respect to size and probability of attainment. A man's rate of time-preference, therefore, depends on the size and probability at various moments of the entire collection of income-elements. For the graphic representation, however, of size and distribution in time, it is simpler to lump together these innumerable elements of income, expressed in terms of money. We may say, therefore, that an individual's time-preference depends on the following four elements:—

- ✓1. On the *size* of the income-stream.
- ✓2. On its *distribution in time*,—according as it accrues evenly or unevenly, and if unevenly, according to the periods at which it is expected to be relatively abundant and the periods at which relatively scarce.
- ✓3. On the *composition* of the income-stream,—what part consists of nourishment, what part clothing, what part shelter, etc.
- ✓4. On the *probability* of the income-stream and its constituent elements.

We shall consider these in order.

§ 5

Our first step, then, is to show how a person's time-preference depends on the *size* of his income. In general, it may be said that the smaller the income the higher is the preference for present over future income. It is true that a small income implies a keen appreciation of future wants as well as of immediate wants. Poverty bears down heavily on all parts of a man's life, both that which is im-

mediate and that which is remote. But it enhances the utility of immediate income *even more* than of future income. This result is partly rational, because of the importance, by supplying present needs, of keeping up the continuity of life and the ability to cope with the future; and partly irrational, because the pressure of present needs blinds one to the needs of the future. As to the rational side, it is clear that present income is absolutely indispensable, not only for the present, but even as a precondition to the attainment of future income. "A man must live." Any one who values his life would prefer to rob the future for the benefit of the present, so far, at least, as to keep life going. If one has only one loaf of bread he would not preserve it for next year; for if he did he would starve in the meantime. A single break in the thread of life suffices to cut off all the future. And not only is a certain minimum of present income necessary to prevent starvation, but the nearer this minimum is approached the more precious does present income appear, relatively to future income.

As to the irrational side, the effect of poverty is often to relax foresight and self-control and tempt one to "trust to luck" for the future, if only the all-absorbing clamor of present necessities is satisfied.

We see, then, that a low income tends to produce a high time-preference, partly from lack of foresight and self-control, and partly from the thought that provision for the present is necessary both for itself and for the future as well.

§ 6

We come next to the influence upon time-preference of the distribution of income in time — the *time-shape* of the income-stream. The concept of the time-shape of one's income-stream is fundamental in the following chapters. Four different types of time-shape may be distinguished:

uniform income, as represented in Figure 2;¹ increasing income (Fig. 3); decreasing income (Fig. 4); and fluctuating



FIG. 2.

income (Fig. 5). The effect of possessing an increasing income is to make the preference for present over future

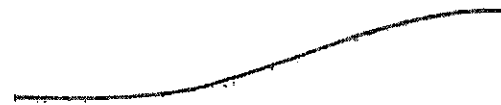


FIG. 3.

income higher than otherwise, for it means that present income is relatively scarce and future income abundant.

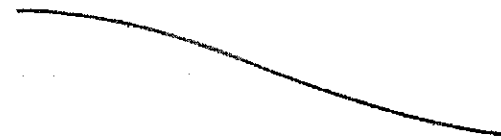


FIG. 4.

A man who is now enjoying an income of only \$1000 a year, but expects in ten years to be enjoying one of \$10,000 a year, will prize a dollar to-day far more than a dollar due ten years hence. He may, in fact, borrow

¹ In these curves, time is represented horizontally and rate of flow of income vertically, as in *The Nature of Capital and Income*, Chap. XIII.

Sec. 6]

TIME-PREFERENCE

97

money to eke out this year's income, and make repayment by sacrificing from the more abundant income ten years later. Reversely, a gradually decreasing income, making, as it does, present income relatively abundant and future income scarce, tends to reduce the preference for present as compared with future income. A man who has a salary of \$10,000 at present, but expects to retire in a few years on half pay, will not have a very high preference for present income over future. He will want to save from his present abundance to provide for coming needs.

The extent of these effects will of course vary greatly with different individuals. Corresponding to a given ascend-

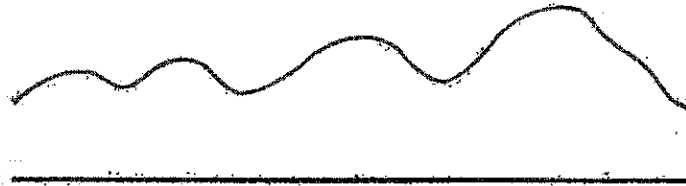


FIG. 5.

ing income, one individual may have a preference of 10 per cent., and another only 4 per cent. What we need here to emphasize is merely that, given a descending instead of an ascending income, both of these individuals would experience a reduction of time-preference, — the first, say, to 5 per cent. and the second, say, to 2 per cent.

If we consider the combined effect on time-preference of both the *size* and *time-shape* of income, we shall observe that those with small incomes are much more sensitive to time-shape in their feeling of time-preference than are those with large incomes. For a poor man, a *very slight* stinting of the present suffices to enhance enormously his preference for present over future income; and reversely, a *very slight* increase in his present income will suffice to

enormously lessen that preference. A rich man, on the other hand, requires a relatively large variation in the comparative amounts of this year's and next year's income to suffer any material change of time-preference.

It is clear that the dependence of time-preference on time-shape of income is practically identical with what Böhm-Bawerk calls the "first circumstance" making for the superiority of present over future goods:¹

"The first great cause of difference in value between present and future goods consists in the different circumstances of want and provision in present and future. . . . If a person is badly in want of certain goods, or of goods in general, while he has reason to hope that, at a future period, he will be better off, he will always value a given quantity of immediately available goods at a higher figure than the same quantity of future goods."

§ 7

— We come next to the influence of the *composition* of the income-stream on the time-preference of its possessor. An income worth \$5000 may, for one individual, comprise one set of enjoyable services, and for another, an entirely different set. The inhabitants of one country may have relatively more house-shelter and less food-element in their incomes than those of another. These differences will have an influence in one direction or the other upon the time-preference. Diminution of any one constituent of income would have an effect upon the time-preference similar to the effect of diminution of income in general. A decrease of the food element would be felt especially, both because this element usually forms a considerable part of income and because it is a prime necessity.

Were we to pursue the subject in detail, we should need to resolve a person's income into the elements of which it is composed, — nourishment, shelter, clothing, and other gratifications. As we have seen, the income-stream is a complex magnitude consisting of a large number of sepa-

¹ *The Positive Theory of Capital*, p. 249.

Sec. 8]

TIME-PREFERENCE

99

rate filaments, one for each separate constituent. Any individual's rate of preference depends on this complex magnitude in its entirety. Theoretically a change in any of these individual partial income-streams will influence the rate of preference. A bread famine, a large wheat crop, the outlook for the fuel supply, electric light service, shoes, or diamonds, all should be taken into account in a statement designed fully to cover the influence of the income-stream upon time-preference.

It is not necessary to formulate the concept of "composition" of an income-stream in such a way as to divorce it from the concepts of size and time-shape; for the composition of an income-stream is included in a statement of the size and time-shape of each filament of which that income-stream consists. We content ourselves by considering all these elements of income lumped together in a single sum of money value. We need not here concern ourselves with the principles which govern the valuation of the sum. These principles constitute the theory of prices, not of interest; and these prices, as we have already observed, being prices of *final* or enjoyable elements of income, do not, like the prices of capital or of interactions, embarrass us by direct dependence on the rate of interest which we are seeking to solve. Assuming, then, the elements of which incomes are composed to be adjusted according to the principles which regulate prices, we shall hereafter usually treat an income-stream as a homogeneous quantum expressible in terms of gold or some other monetary standard. Our task is therefore reduced to answering the question: Enjoyable incomes being expressed in terms of money, what determines the rate of interest in terms of this same money?

§ 8

We come finally to the element of risk. Income, being future, is always subject to some uncertainty, and this un-

certainty must naturally have an influence on the rate of time-preference of the possessor. We have seen that time-preference is the preference for \$1 *certain* added to immediate income over \$1, also *certain*, added to income one year hence. The influence of risk on time-preference therefore means the influence of uncertainties in the anticipated income of an individual upon his relative valuation of present and future small increments of income, both increments being *certain*. The manner in which risk operates upon time-preference will differ according to the particular periods in the future to which the risk applies. If the possessor of income regards the income of the immediate future as fairly well assured, but fears the loss of income in more remote periods, he may be aroused to a high appreciation of the needs of that remote future and save from his present *certain* abundance in order to provide for the later *possible* scarcity. Income in which this sort of risk exists tends, therefore, to produce a low rate of time-preference for income which is immediate and certain as compared with income which is remote and uncertain. In actual fact, such a type is not uncommon. The remote future is usually less known than the immediate future. This means that the risk connected with distant income is greater than that connected with income near at hand. The chance of disease, accident, disability, or death is always to be reckoned with, but under ordinary circumstances is greater in the remote future than in the immediate future. Consequently there is usually a tendency toward a low time-preference. This tendency is expressed in the phrase to "lay up for a rainy day."

But the influence of risk is not always in the direction of lowering time-preference. Sometimes the relative uncertainty is reversed, and immediate income is subject to higher risk than remote income. Such is the case in war or other temporary threat of misfortune. Such is also the case when an individual is assured a permanent position with a salary after a certain time, but in the mean-

time must obtain a precarious subsistence. In these cases the effect of the risk element is to enhance the estimation in which immediate income is held. Again the risk may, instead of applying especially to remote periods or especially to immediate periods, apply to all alike. Such a condition largely explains why salaries and wages are lower than the average earnings of those who work for themselves. Those who choose salaries rather than profits are willing to accept a low income in order to get rid of a precarious one. Since a risky income, if the risk applies evenly to all parts of the income-stream, is nearly equivalent to a low income, and since a low income, as we have seen, tends to create a high time-preference, risk, if uniformly distributed in time, must tend to raise time-preference.

We see, then, that risk tends in some cases to increase and in others to decrease the rate of time-preference. But there is a common principle in all these cases. Whether the result is a high or a low time-preference, the primary fact is that the risk of losing the income in a particular period of time operates as a virtual impoverishment of the income in that period, and hence increases the estimation in which it is held. If that period is a remote one, the risk to which it is subject makes for a high appreciation of remote income; if the period is the immediate future, the risk makes for a high appreciation of immediate income; if the risk is in all periods of time, it acts as a virtual decrease of income all along the line.

There are, however, anomalous individuals in whom caution is absent or perverted. Upon these, risk will have quite the opposite effects. Some persons, who see great speculative chances in the remote future, may treat that future as though it were especially well-endowed, and therefore be willing to sacrifice a large amount of their "great expectations" in the future for the sake of a relatively small addition to their present income. In other words, they will have a high time-preference. The same individuals, if receiving an income which is risky for all periods

of time alike, might have, as a result, a low instead of a high time-preference.

The income to which risk applies may be either the income from articles of capital external to man, or the income from man himself. In the latter case the risk of losing the income is the risk of death or invalidism. This risk — the uncertainty as to human life and health — differs somewhat from the uncertainty of income dependent on objective capital; for the cessation of life not only produces a cessation of income from the human machine, but a cessation of the enjoyment of all income whatsoever. For persons who have children whose future welfare they have at heart, this consideration loses much of its force. A man with wife and children is willing to pay a high insurance premium in order that they may continue to enjoy an income after his death, while an unmarried man, or a man who cares only for self-indulgence and wishes to "make the day and the journey alike," will not try to continue the income after his death. Uncertainty of life in the latter case is especially calculated to produce a high degree of time-preference. Sailors offer a good example. They are natural spendthrifts, and when they have money use it lavishly. The risk of shipwreck is constantly before them, and their motto is, "A short life and a merry one."

The effect of risk, therefore, is manifold, according to the degree and range of application of risk to various periods of time; according to the cautious or incautious character of the individual; according to whether or not the risk in question applies to human life, and if so, according to whether or not the individual's interest in the future extends beyond his own lifetime. The manner in which these tendencies operate upon the rate of interest will be discussed in Chapter XI.

§ 9

The proposition that the preference for present over future income depends upon the income, its size, time-

shape, composition, and probability, does not deny that it may depend on other factors also, just as, in the theory of prices, the proposition that the marginal utility of an article depends upon the quantity of that article does not deny that it may depend on other elements as well. But the dependence of time-preference on income is of most importance, for time-preference is a preference *for* income. It is in the same way that the dependence of the marginal utility of bread on the quantity of bread is more important than its dependence on the quantity of some other commodity, such as butter. As to the dependence of this time-preference for income on other factors than that income, these other factors may conveniently be regarded as affecting the "form of the function" which expresses its dependence on income. In this light may be considered the influence of "the personal equation." It is clear that the rate of time-preference which corresponds to a specific income-stream will not be the same for everybody. One man may have a time-preference of 5 per cent. and another 10 per cent., although both have the same income. The difference will be due to the personal characteristics of the individuals. These characteristics are chiefly five in number:¹ (1) foresight, (2) self-control, (3) habit, (4) expectation of life, (5) interest in the lives of other persons. We shall take these up in order.

(1) First, as to foresight. Generally speaking, the greater the foresight, the less the rate of time-preference, and *vice versa*.² In the case of primitive races and uninstructed

¹ Cf. Rae's *Sociological Theory of Capital*, p. 54. Also Böhm-Bawerk, *The Positive Theory of Capital*, Book V, Chap. III.

² To be exact, we should observe that lack of foresight may either increase or decrease time-preference. Although most persons who lack foresight err by failing to give due weight to the importance of future needs, or, what amounts to the same thing, by overestimating the provision existing for such future needs, cases are not lacking in which the opposite error is committed; that is, the individual exaggerates the needs of the future or underestimates the provision likely to be made for them. In order not to complicate the text, only the former

classes of society, the future is seldom considered in its true proportions. The story is told of such a person that he would not mend his leaky roof when it was raining, for fear of getting more wet, nor when it was not raining, because he did not then need shelter. Among such persons, the preference for present gratification is powerful because their comprehension of the future is weak. In regard to foresight, Rae states:¹—

“The actual presence of the immediate object of desire in the mind, by exciting the attention, seems to rouse all the faculties, as it were, to fix their view on it, and leads them to a very lively conception of the enjoyments which it offers to their instant possession. The prospects of future good, which future years may hold out to us, seem at such a moment dull and dubious, and are apt to be slighted, for objects on which the daylight is falling strongly, and showing us in all their freshness just within our grasp. There is no man, perhaps, to whom a good to be enjoyed to-day, would not seem of very different importance, from one exactly similar to be enjoyed twelve years hence, even though the arrival of both were equally certain.”

The sagacious business man represents the other extreme; he is constantly forecasting. These differences in degrees of foresight produce corresponding differences in the dependence of time-preference on the character of income. Thus, for a given income, say \$1000 a year, the reckless might have a time-preference of 10 per cent., when the forehanded would experience a preference of only 5 per cent. In both cases the preference will depend on the size of the income, being higher the lower the income; but the particular rates corresponding to a particular income in the two cases will be entirely different. Therefore the rate of preference, in general, will be higher in a community consisting of reckless individuals than in one consisting of the opposite type.

and more common error will be hereafter referred to when “lack of foresight” is mentioned. But the reader may in each such case readily add the possibility of the contrary error.

¹ *Sociological Theory of Capital*, p. 54.

(2) We come next to self-control. This trait, though distinct from foresight, is usually associated with it and has very similar effects. Foresight has to do with *thinking*, self-control with *willing*. A weak will usually goes with a weak intellect, though not necessarily, and not always. The effect of a weak will is similar to the effect of inferior foresight. Like those workmen who cannot carry their pay home Saturday night, but spend it on the way in the grogshop, many persons cannot deny themselves any present indulgence, even when they know definitely what the consequences will be in the future. Others, on the contrary, have no difficulty in stinting themselves in the face of all temptations.

(3) The third characteristic of human nature which needs to be considered is habit. That to which one is accustomed exerts necessarily a powerful influence upon his valuations and therefore upon his time-preference. This influence may be in either direction. Rich men's sons, accustomed to the enjoyment of a large income, are apt to put a higher valuation on present compared with future income than would persons of the same income who were brought up under different conditions. If they suffer a reverse of fortune, they find it harder to live moderately than those of equal means who have risen instead of fallen in the economic scale; and this will be true even if foresight and self-control are the same in the two cases.

(4) The fourth circumstance which may influence the form of the function by which time-preference depends on the character of income has to do with the uncertainty of life of the recipient of that income. We have already seen in a different connection that the time-preference of an individual will be affected by the prospect of a long or short life, both because the termination of life brings the termination of the income from labor, and because it also terminates the enjoyment of all income. It is the latter fact in which we are here interested; the expectation of life affects the dependence of time-preference on income. There

will be differences among different classes, different individuals, and different ages of the same individual. So far as age is concerned, the usual course of events is as follows: The time-preference in the early periods of life is high because foresight and self-control are weak. Children are notorious spendthrifts. A little later, when the individual has acquired some self-control and foresight, he will still have a high rate of preference, but for another reason,—the prospect of an ascending income-stream. His present income is small, but he looks forward to having an ample income in five or ten years. As the time of marriage and middle life approaches, the opposite tendency may assert itself. Foreseeing the needs of middle life and anticipating no increase in the provision for those needs, he will cease to borrow and begin to save. After he has passed middle age, when his children have become self-supporting, and he looks forward to declining years, matters are reversed again. He will want to enjoy his income while he may, the income beyond his death being of no significance to him except as it can be bequeathed to his descendants. The prospect of death plays an important rôle in the thoughts of the old. One evidence of this is the prominence given to it in all philosophical and religious systems.¹ The philosophy of Horace, for instance, was summed up in the maxim "*carpe diem*," which is practically the same as the still older maxim, "eat, drink, and be merry, for tomorrow we die." The chance of death may be said to be the most important *rational* factor tending to make the rate of time-preference high, and anything that would tend to prolong human life would tend at the same time to reduce the rate of time-preference. As Rae says:²—

"Were life to endure forever, were the capacity to enjoy in perfection all its goods, both mental and corporeal, to be prolonged

¹ See Metchnikoff, *Nature of Man*, English translation, New York (Putnam's), 1903, Part II.

² *The Sociological Theory of Capital*, pp. 53-54.

with it, and were we guided solely by the dictates of reason, there could be no limit to the formation of means for future gratification, till our utmost wishes were supplied. A pleasure to be enjoyed, or a pain to be endured, fifty or a hundred years hence, would be considered deserving the same attention as if it were to befall us fifty or a hundred minutes hence, and the sacrifice of a smaller present good, for a greater future good, would be readily made, to whatever period that futurity might extend. But life, and the power to enjoy it, are the most uncertain of all things, and we are not guided altogether by reason. We know not the period when death may come upon us, but we know that it may come in a few days, and must come in a few years. Why then be providing goods that cannot be enjoyed until times, which, though not very remote, may never come to us, or until times still more remote, and which we are convinced we shall never see? If life, too, is of uncertain duration and the time that death comes between us and all our possessions unknown, the approaches of old age are at least certain, and are dulling, day by day, the relish of every pleasure."

The shortness of life thus tends powerfully to raise the rate of time-preference. This is especially evident when the income-streams compared are long. A lover of music will prefer a piano at once to a piano available next year, because, since either will outlast his own life, he will get one more year's use out of the piano available at once.

From what has been said it is clear that there are three periods in his life when a man's time-preference is especially high: (1) in early life it is high because of youthful recklessness; (2) in the preparatory stage, because future income seems relatively abundant; and (3) late in life, because future income seems relatively superfluous.

(5) But whereas the shortness or uncertainty of life tends to raise the rate of time-preference, its effect is greatly mitigated by the fifth circumstance, the care for the welfare of posterity. Probably the most powerful cause tending to reduce the rate of interest is the love of one's children and the desire to provide for their good. When these sentiments decay, as they did at the time of the decline and fall of the Roman Empire, and the fashion is to exhaust wealth in

self-indulgence and leave little or nothing to offspring, the rate of time-preference and rate of interest will be high. At such times the motto, "After us the deluge," indicates the feverish desire to squander in the present, at whatever cost to the future.¹

In a community like the United States, where parents regard their lives as continuing after death in the lives of their children, there exists a high appreciation of the needs of the future which tends, therefore, to produce a low rate of time-preference. It is this sentiment which is responsible for the enormous extension of life insurance. At present in the United States the insurance on lives amounts to \$20,000,000,000. This represents, for the most part, an investment of the present generation for the next. The investment of this sum springs out of a low time-preference, and tends to produce a low rate of interest.

Not only does the regard for posterity lower interest, but the increase of posterity has in part the same effect. So far as an increase in the size of a family reduces the income *per capita* of that family, it operates, like impoverishment, to increase time-preference. So far as it adds to future needs rather than to immediate needs, it operates, like a descending income-stream, to diminish time-preference. Parents with large families feel the importance of providing for future years far more than parents otherwise similar but with small families. They try harder to save and to take out life insurance. In other words, their rate of preference for present over future income is lowered. An increase of population, therefore, will, other things being equal, reduce the rate of interest. This proposition must not be thought to conflict with the reciprocal proposition that the same prudent regard for the future which is created by the responsibilities of parenthood itself tends to diminish the number of offspring. An increase of population tends toward a low time-preference, but reciprocally a low

¹ See Rae, *The Sociological Theory of Capital*, p. 97.

time-preference tends to check such increase. Hence it is that the thrifty Frenchman and Scotchman have small families.

§ 10

Time-preference, therefore, depends for each individual on his income; that is, its size, time-shape, composition, and probability; but the *form* of this dependence differs according to the various circumstances of the individual. The circumstances which will tend to make his time-preference high are (1) shortsightedness, (2) a weak will, (3) the habit of spending freely, (4) the shortness and uncertainty of his life, (5) selfishness, or the absence of any desire to provide for posterity. The reverse conditions will tend to make his rate of preference low; namely, (1) a high degree of foresight, which enables him to give to the future such attention as it deserves; (2) a high degree of self-control, which enables him to abstain from present income in order to increase future income; (3) the habit of thrift; (4) the probability of long life; (5) the possession of a family and a high regard for their welfare after his death.

The resultant of these various tendencies in any one individual will determine the degree of his time-preference *in relation to any particular income*. This result will differ as between individuals, and as between different times for the same individual. The essential fact, however, is that *for any given individual at any given time, his time-preference depends in a definite manner upon the size, shape, composition, and probability of his income-stream.*

§ 11

This view, that the rate of time-preference and consequently the rate of interest depend upon income, needs to be contrasted with the common view, which makes the

rate of interest depend merely on the scarcity or abundance of capital. It is commonly believed that where capital is scarce, interest is high, and where capital is plentiful, interest is low. In a general way there is undoubtedly some truth in this proposition; and yet it contains a misinterpretation of borrowing and lending. It is true that when and where men are anxious to lend, interest is low, and when and where men are anxious to borrow, interest is high. But it is not true that the more capital a man has the more anxious he is to lend, and the less capital he has the more anxious he is to borrow. The willingness to lend or borrow depends primarily, not upon the amount of one's capital, but upon the character of the income which he gets from it, — whether this income is large or small, immediate or deferred, of what elements it consists, whether it is certain or uncertain.

The proposition that abundance of capital tends to lower interest is thus very superficial; for abundant capital merely means abundant income. Capital-value is discounted income. Behind, or rather beyond, a capital of \$100,000 is the income which that capital represents. To fix attention on the \$100,000 capital instead of on the income is to use the capital as a cloak to cover up the real factor in the case. Moreover, capital-value is itself dependent on the rate of interest. The capital-value of a farm will be doubled if the rate of interest is halved. In such a case there would be found more capital in farms; for the farms in a community would rise, say, from \$10,000,000 to \$20,000,000. But it is not the rise in capital which produces the fall in interest. On the contrary, it is the fall in the interest rate which produces the rise in the valuation of capital. If we attempt to make the rate of interest depend on capital-value, then, since capital-value depends on two factors, — the prospective income *and the rate of interest*, — we thereby make the interest rate depend partly on income and partly on itself. The dependence on itself is of course nugatory, and we are brought back to

its dependence on income as the only fact of real significance.

But even as thus amended and explained, the proposition that the rate of interest depends on the amount of capital is not satisfactory. The mere amount of capital does not tell us much about the income for which that capital stands. To know that one man has a capital worth \$100,000, and another \$200,000, shows, to be sure, that the latter man may have an income of double the value of the former; but it tells us absolutely nothing as to the "time-shapes" of the two incomes; and the time-shape of income has, as we have seen, a most profound influence on the time-preference of its possessor.

Let us suppose two communities similar in population, distribution of wealth, and all other particulars except in the amount of their capital and the character of the income which that capital represents. One of these two communities we shall suppose has a capital of \$100,000 invested, as in Nevada, in mines and quarries nearly exhausted, while in the other community there is \$200,000 of capital invested in young orchards and forests, as in Florida. According to the theory that abundance of capital makes interest low, we should expect the Nevada community to have a high rate of interest compared with the Florida community. But it is evident that, unless other circumstances should interfere, the opposite would be the case; for Nevada has to contemplate a decreasing future income, and in order to offset the depreciation of capital which follows from this condition,¹ she would be seeking to lend or invest part of the income of the present or immediate future, in the hope of offsetting the decreased product of the mines in the more remote future. The Florida planters, on the contrary, would be inclined to borrow against their future crops. If the two communities are supposed to be commercially connected, it would be Nevada which would lend to Florida, notwithstanding the fact that the lending community was the

¹ See *The Nature of Capital and Income*, Chap. XIV.

poorer in capital of the two. From the illustration it is clear that the mere amount of capital-value is not only a misleading but a very inadequate criterion of the rate of interest.¹

Apologists for the common statement that abundance or scarcity of capital lowers or raises interest might be inclined to argue that it is not the total capital, but only the "loanable capital" which should be included, and that the Nevada community had more "loanable capital" than the Florida community. But the phrase "loanable capital" is merely another cloak to cover the fact that it is not the amount of capital, but the decision to lend or borrow it, which is important. To give this proposition meaning, "loanable capital" must be taken, not in the literal sense of capital which *can* be lent, — for all capital is loanable in this sense; but in the sense of capital which persons are *willing* to lend. Hence, to state that in any community there is abundance of loanable capital is merely to state that there is in that community a willingness to lend a great deal of capital. Consequently, the proposition that the rate of interest, or preference for present over future goods, is low when loanable capital is abundant becomes reduced to the platitude that the rate of preference for present over future goods is low when men wish to lend.

But it may be said, surely in a money market there exists at one time a large visible supply of loanable money and at another time a small visible supply, and this supply affects the rate of interest. This, again, is a true but a superficial statement. A little examination will show that the abundance or shortage of loanable bank funds is merely a measure of the decision of merchants to discount or deposit, — in other words, to borrow or lend, — and does not give us any clew as to the reason why they do so. The money or credit

¹ One of the few defects in Rae's analysis of interest is his emphasis on the accumulation of capital. Since this accumulation is merely in anticipation of future income, the emphasis belongs on the latter.

is, of course, the mere vehicle by which the bank acts as an intermediary or broker between borrowers and lenders, and does not represent any independent factor in the case.

We end, therefore, by emphasizing anew the importance of fixing our eyes on income and not on capital. It is only as we look through capital-value, beyond to the income which it represents, that we reach the efficient causes which operate upon the rate of interest. The absence hitherto of a definite theory and conception of income has prevented economists from doing this. Borrowing and lending are in form a transfer of capital, but they are in fact a transfer of income of which that capital is merely the present value. In our theory of interest, therefore, we have to consider not primarily the *amount* of capital of a community, but the income for which that capital stands.

§ 12

Unfortunately for purposes of exposition, the relation between time-preference and income cannot be expressed in a simple schedule or curve, as can the relation between demand and price, or supply and price, or utility and quantity consumed, for the reason that income means not a single magnitude merely, but a conglomeration of a number of magnitudes. As mathematicians would express it, to state that time-preference depends on the character of income, its size, shape, composition, and probability, is to state that time-preference is a function of all the different magnitudes which need to be specified in a complete description of that income. A geometrical representation, therefore, of the dependence of time-preference on the various magnitudes which characterize income, would be impossible. For a curve can only represent the dependence of a magnitude on one independent variable; even a surface can only represent dependence on two; but for our requirements we should need a space of n dimensions. We may represent the relation between time-preference

and income by a "schedule" like the ordinary "demand schedule" and "supply schedule," if we make a list of all possible incomes, specifying for each individual income all its characteristics, — its size, time-shape (that is, its relative magnitude for each successive time-interval considered), its composition (or the amount, at each period, of each individual constituent, as nourishment, shelter, etc.), and the certainty or uncertainty attached to all these elements. Having thus compiled a list of all possible incomes, it would only be necessary for us to assign to each of them the rate of time-preference pertaining to it. Such a schedule would be too complicated and cumbersome to carry out in detail; but the following will roughly indicate some of the main groups of which it would consist. In this schedule we have represented by the three vertical lines three different classes of income, — two extreme types and one mean type, — so that the corresponding rates of time-preference range themselves in a descending series of numbers. We have also represented by the three vertical columns three different classes of individuals, two being of extreme types of individuals, and the third of a mixed or medium type. Thus the numbers in the table descend as we proceed either down or toward the right, the lowest number of all being in the lower right-hand corner.

Sec. 12]

TIME-PREFERENCE

115

DESCRIPTION OF INCOME				CORRESPONDING TIME-PREFERENCE to an individual who is		
SIZE	TIME-SHAPE	COMPOSITION	PROBABILITY	shortsighted, weak-willed, accustomed to spend, without heirs	of a mixed or medium type	farsighted, self-controlled, accustomed to save, desirous to provide for heirs
small	increasing	food scanty	precarious	20%	10%	5%
of a mixed or medium type				10%	5%	2%
large	decreasing	food abundant	assured	5%	2%	1%

Out of the large number of possible incomes represented in such a schedule, of course only one can be the actual income of the individual. The one which exists in any case is to a large extent a matter of choice, as we shall see in the next chapter. Since time-preference may be varied by voluntarily varying the character of the income-stream on which it depends, it follows that the shortsighted, weak-willed spendthrift individual may not have, as a matter of fact, any higher rate of time-preference than his farsighted, self-controlled, abstemious brother. In fact, where a loan market is in full operation, the tendency is for the two individuals to select such income-streams as will bring their time-preference into unison. How this is accomplished will form the subject of the following chapter.