

without a text-book, and finally one year with Professor Jeans's book, convey a strong impression that the last, so far as he knows, is the best adapted to the needs of the American student under present conditions. That constant assistance and explanation will be required from the instructor is no defect; these are expected in the class-room, especially in a subject where the best results can only be obtained by outside work on the part of the student in the solution of problems and subsequent demonstration by the instructor. The few criticisms made here are on points not essential for the successful use of the book. Accuracy of statement is one of its chief and most pleasing characteristics. It is also well printed, and there is an absence of the too numerous varieties of type, designed like the headlines of a yellow journal to draw attention, which disfigure so many modern text-books.

The author is to be congratulated on a real advance towards the solution of the problem of introducing a first course in the teaching of mathematical physics in American colleges and universities.

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ECONOMICS.

The Nature of Capital and Income. By IRVING FISHER. New York, The Macmillan Company, 1906. xxi + 427 pp.

The Rate of Interest. By IRVING FISHER. New York, The Macmillan Company, 1907. xxii + 422 pp.

ONE might almost say that, directly or indirectly, consciously or unconsciously, everybody is forced into intimate and vital relation with a large portion of the body of facts with which economics deals, and hence one might infer that the study of economics in one way or another cannot fail to be of interest to most rational beings. As an art, economics is of hoary antiquity; as a domain of thought, recognized, delimited, and dignified with a special name, it is relatively modern; as a science, it is but in its infancy. Strictly speaking, it comes into close relation with mathematics only as it becomes a system of deduction; and in so far as it may have advanced to the deductive stage, it is mathematics. Of the authors who have materially contributed to the inclusion of their chosen science of economics

among the rapidly growing number of mathematical disciplines, Irving Fisher, himself at first a mathematician, is one of the most eminent; and his recent works in economics, *The nature of capital and income* and *The rate of interest*, although written in a style essentially adapted to the comprehension of a wide range of general readers, merit more than a passing notice at the hands of mathematicians.

To us who are professionally accustomed to deduction, who must intuitively feel a definition and a proof even when we do not explicitly state them, who instinctively seize upon an omission or an error in logic and immediately become perplexed and sceptical, the reading of the usual treatises on economics can give but slight logical satisfaction. What are the undefined symbols? What the postulates? What the inferences as distinguished from the presumptions? The authors do not say, perhaps they could not tell, very likely they do not appreciate what those words mean to us, or even feel aggrieved or scornful at our asking. In rare instances, as in the classic treatise of Mill or the brilliant chapters of Hadley, the style of the author will carry the reader along and force at least a temporary conviction, much as a fine poem will convince. It is really not a case of demonstration. An equally habile stylist taking a different, perhaps a contradictory view will produce the same effect. Then if the reader, at a loss between the two, should search for a foundation from which he might build up to sure conclusions to match against those of either side, he would find that the foundations were precisely the only missing parts of all these admirable structures.

So long as the literary attitude prevails, a good style will cover many an economic sin while uncovering a multitude of graces — a bad style will but uncover the sins and mask the graces. Fundamentally there is little difference. Fortunately economics is advancing toward the scientific state and some writers are forcing themselves to adopt a scientific style. We have only to turn the pages of such a treatise as Pareto's *Cours d'économie politique* or his article in our *Encyklopädie* to find a presentation of the subject with definite foundations and clear deductions therefrom. The premises may not be stated, perhaps as yet cannot well be stated, with the completeness and accuracy attainable in the theories of number or geometry — no more are the premises of mechanics or of physics — but the scientific training and attitude are there, and their accom-

plishments are already great. If I might be pardoned a personal observation, I would say that I had read or labored through much economic literature only to become the more bewildered until I came across the writings of Pareto. And now that it is seen that economics can be not merely clear and convincing (a matter of style) but logical as well (a matter of scientific method), perhaps there is still some hope for metaphysics or at any rate for epistemology. One after another the different domains of research seem to be creeping out of the twilight zone of campaign oratory.

One of the essential characteristics of the two books under review is this striving for definiteness of hypothesis and definition, for thoroughness of deduction. And that this fact has not been lost to the economists themselves may be illustrated by a few short quotations from as many reviewers. "The most scientific discussion of this subject in any language." "No treatment so lucid, so scientific." "It is characterized by a certain scientific hard-headedness which is not always found now-a-days in writings upon capital and allied subjects;" when was it? "It seems logically impregnable." "Lucid and tenaciously logical." "His concepts and definitions have all the exactness of a textbook on mechanics." This last, as we shall see, is essentially right; but unless its writer had in mind some one of a very few texts on mechanics, his statement will probably not appear to us so unqualifiedly a recommendation for logical perfection as he may have imagined. It is a pleasure to see that entirely apart from the recognition of the excellent economic doctrine which Fisher's new work contains, there is a general appreciation and approbation of the spirit in which the work was accomplished.

The first two chapters of *The nature of capital and income* take up the definitions of wealth and property-rights. According to the author, wealth and property (short for property-rights) are correlative terms; wealth being the concrete material thing owned, property the abstract right of ownership. These definitions are carefully explained and compared with the definitions or lack of definition of other writers. There is the frank acknowledgment that the definitions include more than is sometimes included owing to the fact that no specification that wealth or property shall be confined to exchangeable objects is made. As a partial justification, it is stated that: In definitions, it is usually better to include too much rather than too little. This gener-

ality has some glitter to it and might better have been omitted. What the author meant appeared fairly clear at first blush and in the surrounding context, but even the semblance of meaning vanished some twenty pages later when, to emphasize the word material in his definition, he stated : There is no advantage, but much disadvantage, in including any immaterial elements in wealth. This is perhaps a small point on which to raise an objection and it may be dismissed with the hope that readers will not notice it ; logical purism is a very special art and science, and appeals little to any but the purist himself. The fact is that the author chooses to include in his definitions some things that are usually not included and to exclude from them some things which are not always excluded ; and his choice seems to be happy. Wherever he confines himself to exposition and to marshalling facts, his style is a model of clearness and his array a marvel of tactics.

On pages 26 and 27 there is an illuminating table of a large number of articles of wealth with the correlative property-right. There is also given the name of the corresponding evidence or certificate of ownership. Thus a dwelling, the right of the tenant to use it, and the lease, or a railway, the right to a trip, and the ticket are examples of wealth, property, and certificates. A question, which the text does not seem explicitly to answer, arises to the mind. What is the certificate ? In particular, is it wealth ? Apparently it is material, apparently it is owned, apparently it *is* wealth according to the definition. Is then the evidence of the ownership of wealth to be classed as wealth itself ? Let us take an example. Suppose I carelessly drop a gold double eagle from the deck of a vessel into the mid-Atlantic. A definite amount of wealth is apparently destroyed ; for although the material remains, the ownership by any human being has disappeared. Suppose it had been a treasury gold certificate for \$20 which had fluttered overboard. This material thing has been lost, my certificate of property is gone, but the wealth, namely, the treasury's reserve gold against the certificate, remains. Has any wealth been lost ? If we answer No, then the certificate could not have been wealth except qualitatively : for the quantitative coefficient would be 0. If we answer Yes, then the loss is that of a rectangular piece of paper in which are imbedded a few silk threads and upon which are impressed sundry shades of ink. And this, I take it, contains the answer to the question. The certificate is wealth of a cer-

tain sort and represents wealth or a right to wealth of another sort.

After thus settling our question in a way which is perhaps satisfactory and perhaps not, a reopening of the whole matter appears advisable when the matter of price and value is taken up. To get at a definition of price the author restricts himself, at any rate at first, to wealth. If the quantity of wealth A is exchanged for the quantity of wealth B , the price of A in terms of B is the ratio B/A and the price of B in terms of A is the ratio A/B . Price is therefore a ratio of exchange. Value is the product of price by amount. Price and value as applied to property-rights do not seem to be defined so clearly, but probably all that is necessary is to substitute the word property in the place of wealth in the previous definition. In fact it is doubtless necessary to be able also to substitute partially and thus to have the ratios wealth/property, property/wealth, and property/property in addition to wealth/wealth. It is now interesting to return to the consideration of certificates. The details of the discussion will be omitted. Attention may, however, be called to one of the conclusions, namely, that, technically speaking, value is not a distributive operator even for infinitesimals. For the certificates, being wealth and being constantly exchanged, must possess price and value, whereas the value of a certificate and of the wealth to which it certifies the property-right is by no means to be counted as equal to the value of the certificate plus the value of the wealth represented; symbolically, $v(c + w) \neq v(c) + v(w)$.

The third chapter treats of utility or ophelimity or desirability or whatever one wishes to call that important economic concept. It is pointed out that the desirability corresponds to the fact that some one desires something, without considering the question as to whether he should desire it. The term is to be applied to such "noxious things as opium, alcohol, and degrading literature"—rather bad company for an article of commerce which is among the most useful in the arts, sciences, and industries. Thus far the definitions have been merely preliminary. Capital and income are introduced in the next chapter. The new definitions are: A *stock of wealth* existing at an *instant* of time is called *capital*; a *flow of services* through a *period* of time is called *income*. Subsequently this capital is designated as capital-wealth or capital-instruments and further definitions of capital-property and of capital-value, the latter

being the value of the capital-wealth or capital-property, are given in chapter five. As it does not appear that the words *stock of* prefixed to wealth add anything to the conception of wealth, it seems that capital-wealth is identical with wealth. The important idea is that the wealth is as it exists at a definite instant of time. In mechanics nobody would think of defining mass as material objects and then redefining by saying that capital-mass was a stock of mass existing at an instant of time; but in economics the word capital has stood for so many things or has been used so much without standing for anything definite that the author has to exercise great care, considerable repetition, and a good deal of rephrasing and redefinition to accomplish his ends. He seems to be taking more care than is frequently expended on definitions in mechanics.

The chapters on capital accounts and capital summation are especially valuable in bringing out the connection of the theory of capital with business usages. And the advantages arising from the comparison are not by any means one-sided; added clearness and practicability for the theory go hand in hand with useful illumination as to what are or what might be good methods in accounting. The insistence on relating theory to practice in the treatment of capital and later in the treatment of income furnishes several chapters which are largely novel with the present author. In the course of the investigation there is outlined a double method of accounting, one the method of balances, the other the method of couples; the first gives the distribution of capital among different individuals, the second catalogues the things owned. Applications are given to various points such as the accounts of a real person, the accounts of a fictitious person or company, the matter of taxation.

An extended chapter on income is required to make clear the author's definition and to justify it. To define income as the services of wealth forces the inclusion into that concept of a number of items which are frequently omitted, and the inclusion seems convenient. The development of the subjects of income accounts and of income summation follows. Again the double method is employed. Again there are numerous applications to questions of interest. Frequently the applications are merely hinted at and left either for the reader to think out or for the author to recur to at a later point. There is also a chapter on psychic income; for to stop short with material income is not wholly satisfactory. By carrying the method of income summation by

couples to its logical conclusion, it is seen that no objective items of outgo survive cancellation and that in a comprehensive view of production there is no such thing as cost of production in the objective sense. As we thus ultimately arrive at the necessity or convenience of introducing the psychic element, the query naturally arises as to whether it might not have been more strictly logical to begin with the psychic and introduce the theory of desirability more fundamentally into the work rather than to give so much preliminary space to the material conception of wealth. To have done so, however, would have rendered the book much less readable and might have seriously interfered with its function as a mediator between theory and practice.

The next great section of the book contains what is really the author's main contribution to the theory of capital and income. Nowhere, however, are the essential elements of his theory so vividly and graphically set forth as in the tabular diagram which is taken from the subsequent book on the rate of

	Present capital		Future income
Quantities	Capital-wealth	→	Income-services
Values	Capital-value	←	Income-value

interest and which may appropriately be explained at this point. The idea is this. There exists at any time a stock of material objects in the world which are owned by human beings. These objects will or at any rate are expected to yield services to human beings during a more or less extended period of futurity reckoned from the instant at which the stock is evaluated or rather surveyed. These services may be material in the first instance but ultimately they are psychic. The reason we want the wealth, the reason we put ourselves to pains to acquire the wealth or some property-right in it, is that we are desirous of obtaining the satisfactions due to these services. The income concept, the natural prevision of the human being for the future whether immediate or remote is the vital psychic element in the present theory. Now it is the income, the services from the wealth, which possess value. And finally it is this value which determines the value of the wealth or capital

itself. Without expected services capital would be fruitless, it would be valueless. The actual value which is to be attributed to capital depends not alone on the value of the expected services or income but on the rate of interest.

With this perspective of the general theory in mind, we may return to the systematic outline of the text. The ratio of the value of services obtained per unit of time from a certain capital to the value of the capital is designated as the value-return. The rate of interest is then defined as the value-return provided the income is perpetual and flows at a uniform rate. In this procedure it is clear that the author is not yet following out his theory but is merely stating a point of view which is to be abandoned. After some explanatory considerations which are set into intimate relation to investment usage, the foregoing definition of the rate of interest is rephrased as: In the *price* sense the rate of four per cent per annum means that the price of \$100 of capital is \$4 of income per annum for ever. Next the *premium* sense is introduced with the statement: The rate of interest of four per cent per annum in the *premium* sense means that the price of \$100 of goods at a given date is \$104 of goods at the same date a year later. It is then shown that if the rate of interest in either of these senses is constant, it is so in the other and the two rates are equal. If the rate is not constant the two senses give different rates, and the author finds it more convenient to adopt the premium sense as fundamental.

After some words on discount and many an illustration drawn from the world of finance, the author comes to the conclusion or redefinition that the value of capital at any time is the present value of the total expected income discounted according to the rate of interest or rate of discount. One thing that impresses itself on the reader is the obvious difficulty that would have been encountered in developing the present theory in an age in which our financial system was only in a rudimentary form. Conceivably the theory might have been developed any time by any person who wished to take the income concept as fundamental and evaluate present goods in terms of the expected services therefrom, but it would have taken a prodigious genius to do it in the days when it was not safe to look more than a few hours into the future and when one would discount a kingdom for a horse. Even at present it shows great originality, when one can break away from the classical conception of contemporaneous barter and found one's economics

on the future and on a universal system of credit. The next, the fourteenth, chapter is one of the most interesting in the whole work ; it is the one which above all others clinches the theory. In it is discussed the matter of earnings and income. Evidently earnings may exceed or fall below income : for one may encroach on his capital or he may allow it to accumulate. Now, it is very tempting to consider earnings and not income as determining the value of capital and to rank savings as capital. The theory is intricate and consequently the exposition is detailed and replete with illustrations. In the end the reader will be sure to find himself convinced of the author's honesty and correctness, and he will probably recall the bluff remark of the hard-headed old business man who exclaimed "Who ever heard of dividends doing a stock any good !" The financial injustice of taxing earnings instead of income — and the moral injustice, too — in that the conservative and saving person is unduly burdened relatively to the spendthrift, is sharply exhibited.

To complete the work and offer, so to speak, a second approximation to reality there is given a chapter on the element of risk. The simple presentation of the theory of chances, the introduction of the coefficients of risk and of caution, and the application of these matters to determining the value of capital, for instance stocks and bonds, will be of interest to investors and brokers. No treatment of the risk element could be considered as complete without some more or less extended mention of speculation and the use of speculation to the public at large. Most of the author's statements on this subject seem to be in accordance with the best accepted views ; once the risk element has been introduced, his own theories seem to have relatively little bearing on speculation as such. There are two points at which it seems as though the text implies doubtful if not erroneous views. In speaking of the fact that much of the evil of speculation arises from the lack of independence of the views of those who participate in speculation and with especial reference to the participation of the public in speculative markets the author says : How easily they are led is shown by the effect on the stock market in the year 1904, when Thomas Lawson published scare-head advertisements in the newspapers advising the public to sell certain securities. This seems to imply that it was the selling induced by Lawson's advertisements which caused the sharp reaction, sometimes (especially by Mr. Law-

son) called the Lawson panic, of December 5-12 in 1904. Maybe it did ; but we doubt it and believe that the author would have been on much safer ground if he had pointed out that stocks had advanced steadily from the middle of May till the first week of December carrying the average of twenty rails up 26 from 93.5 or toward thirty per cent and of twelve industrials up 26 from 47.5 or toward sixty per cent,* that in all this time there had not been a reaction of three points in the averages, that after the middle of October the daily sales including Saturdays had averaged well over a million and a quarter shares in the New York market, that such a condition almost certainly represented undue speculative activity and growing overconfidence and a large weakly margined bull account, that in the preceding month there had been a pronounced bulge — in short that everything was shaping up for a violent and drastic shake-out. It is by no means certain Lawson did not time his advertisement with the drop rather than that the drop resulted from the advertisement. It is even conceivable that the advertisements lessened instead of accentuated the inevitable break ; stranger things have happened. Perhaps the author knows what went on behind the scenes and may therefore be right ; but his statement unfortunately sounds like the meaningless “ causes ” ground out in haste and from hearsay by the underpaid so-called financial reporters.† The other remark to which we would take exception is : Normally speculative property will gravitate into the hands of those most able to forecast its true income. This is another generality with something of a glitter. It is difficult for us to see why anybody who is best able to forecast the true income of a property should care to allow that property to gravitate into his hands if his forecast leads him to believe that the true income is shortly to be nil. If Homer has nodded, it may be forgiven.

Following the conclusion of the main part of the work there is an elaborate summary of it with ample diagrammatic representation and also a further general summary of the whole book. There is an extensive glossary of definitions with a reference to the appropriate passage of the text. Upon this is added a series of appendices to the various chapters. These appendices

* *Wall Street Journal* figures.

† It may be noted that the explanation here offered as to this panic is just as valid for illustrating and enforcing the author's point as his own ; it is merely more subtle and less obvious — in Wall Street the obvious is seldom right.

contain a variety of matters most of which are of a mathematical nature. The mathematics, however, is not so much that of economics in Pareto's sense as of accounting and interest reckoning under various assumptions, and as such it will probably not appeal very strongly to the mathematician. An exhaustive index concludes the treatise. From the detailed style of the text and the frequent summaries the reader can hardly fail to see clearly what the author's theory is and by the glossary and index he can readily turn to any part of it which he may desire to reread or study with particular care after completing or during the progress of his perusal of the work. Thus to aid the student is always a kindness on the part of any author; it is almost a necessity when so much that is new in theory and novel in illustration has been presented.

The general arrangement of *The rate of interest* is similar to that of *The nature of capital and income*; there are the extended analytical table of contents, the careful summaries, the glossary of definitions, the appendices with mathematical complements of the same sort as before and with a vast array of statistical information, and finally the comprehensive index. In the preface by way of explanation as to why the mathematics is relegated to appendices the author states that: Mathematics can properly claim no place in economic discussions except as they add something not expressible, or at any rate only imperfectly expressible, in ordinary language. Perhaps this is equally true of discussions in mechanics and physics and chemistry, but mathematicians of the present generation might wish to put in a counter claim by rejoining that verbal expositions in any subject are unnecessary except in so far as they serve to explain the meaning of the mathematical results obtained or to treat portions of the subjects which must still be regarded as matters of opinion with the author instead of matters of deduction.

As the present author has an original theory to propound, he devotes nearly a quarter of the main text to a criticism of previous theories. First come the crude theories, then the productivity theories followed by the cost theories, and finally Böhm-Bawerk's theory. To the last, as the most elaborate and thoroughgoing of recent theories, the author gives the larger part of his attention and in this he has had the advantage of the criticisms of Böhm-Bawerk himself. Throughout this crit-

ical introduction there is no attempt to throw out all the elements of all preceding work on the subject of the rate of interest but rather is the effort to eliminate that which is mischievous while retaining that which is good. There is, indeed, here and throughout the book, much reference to and many quotations from John Rae, to whose memory the work is dedicated and on whose theories the author has built his own. We shall take no time in discussing this which is itself a discussion of the work of others, but shall pass on to the remainder of the text.

The great complexity of our social and financial organism requires the investigations to advance by successive approximations and the author divides his presentation into a first, second, and a third approximation. Preliminary to the first there is a chapter on appreciation and interest. It was seen in the course of the remarks on the last book that unless the rate of interest is constant it is not the same when expressed in different senses as a price and as a premium. In like manner here, if the price of wheat is rising year by year relatively to the price of gold, one could afford to exchange \$100 now for \$104 to be paid a year hence as easily perhaps as he could afford to exchange 100 bushels of wheat now for 102 bushels to be paid in a year. If commodity prices in general are rising with great rapidity the rate of interest in money may have to be very high in order to keep the rate of interest in commodities above zero. We see, then, what a delightful disregard for economic law our legislators have when they limit the interest rate in money to six per cent. If commodity prices advanced about five per cent from 1905 to 1906 and about as much from 1906 to 1907, then one who loaned at the maximum legal rate during these years was realizing only about one per cent and those who had their money in a savings bank were losing about one per cent. As a matter of fact the advance was, if anything, more rapid. There is another and highly important preliminary chapter on the time-preference, or the willingness of any individual to do without income now for the purpose of having (more) income in the future. The dependence of the time-preference on the expected distribution of income in time is also discussed. Thus if a student is obtaining his education and therefore has reason to expect that his income will be much enhanced in the future he may be perfectly justified in borrowing money even at a considerable rate of interest, for he needs it now and can spare

it later — in this way he may solve the problem of getting the most out of his income in the long run ; but if one looks forward to a diminution of income he may be willing to loan now even at a low rate of interest for the purpose of having income when he needs it more — and in this way he may solve for himself his own maximum problem. Throughout this chapter the text is especially full of delightful and valuable illustration.

We now come to the seventh chapter, the first approximation to the theory of interest, in which the assumption is made that the income is rigid. The chief concern of this chapter is to show how an income which is originally definite and rigid may be modified by the simple process of loaning or borrowing according to the individual's time-preference and the current rate of interest. The amount borrowed is regulated by the theory of marginal desirability. For if one's time-preference is ten per cent and the market rate is five, he will start to borrow and as he borrows his time-preference diminishes until after he has contracted loans for a certain sum his time-preference has sunk to the market rate ; and incidentally unless the available supply of money is infinite, the market rate will be raised. The matter is similar in the case of making loans. Hence if the supply be now considered finite in relation to all the borrowers and lenders, it is possible to get at a determination of the rate of interest by the following principles : First, the rate of time-preference of each individual for present income as compared with remoter income depends on the character of his income stream as modified by his borrowing and lending. Second, there results a state of equilibrium between the time-preference of all individuals wherein those preferences are all equal and equal to the market rate. And third, the market rate is thereby determined as that rate which will throughout each period of time clear the market. We have here what appears to be a perfectly good definition of the rate of interest wholly determined by the statement that an economic state of equilibrium is established.

It will be well to stop a moment and review the logic of the theory. Let us assume with Pareto the existence of the homo œconomicus or the class of homines œconomici. That which these ideal individuals desire are satisfactions spread throughout a period of time, that is, they want income. Some may have more income than they want this year and some may have less

than they want. They therefore set about bartering current income for future income until each is satisfied with his current condition as compared with his future prospects and a state of economic equilibrium is reached in which each homo œconomicus will pay or accept the same premium as any other of his species for the exchange of present and future income. The premium has a definite ratio to its corresponding income, namely, the market rate of interest. Then any income I may be capitalized into the capital C by the equation $C = I/r$, where r is the rate of interest. In this way it would appear as though wealth and property were eliminated from the really vital part of the theory. Indeed it seems as if there were no essential need of the lengthy discussions as to the materiality versus the possible immateriality of wealth and as to the exact correspondence between wealth and property-right. And in view of the fact that we ultimately come to consider psychic income as the only fundamental income, those discussions impress us as rendering the theory more rather than less obscure from the purely logical point of view. But even if it be granted that we are not amiss in these statements, few would seriously contend that the author has not adopted that presentation which will most appeal to the largest number of persons not technically interested either in logic or in mathematics.

Now that we have acquired an insight into the essential elements of the author's theory we must unhappily run somewhat cursorily over the large amount of material which remains or we should prolong this already lengthy review far beyond the limits which may properly be assigned to it. The second approximation regards income as flexible and has important applications of a practical nature to the question of how one may vary his income by choosing among the many different optional forms of investment. An investment in forest lands will clearly give a different distribution of income in time from that obtained by investing in farm lands or mining property. The author gives a special chapter to the consideration of the various classes of options. There are also unknown options which may arise during the course of time by the introduction of new inventions. The discussion of these naturally leads over to the general question which constitutes the third approximation under which the income is treated as uncertain. On page 221 there is an interesting table in which the conditions under the different approximations are compared.

There remains about one hundred pages of the text, which bear the general title *Conclusions*. Herein are found, among other things, some detailed applications of the completed theory to actual conditions, an elaborate inductive verification of the theory from the monetary point of view, an equally elaborate inductive verification from the economic point of view, and the inductive refutation of the so-called money theory of the rate of interest. One of the most interesting applications or verifications of the theory which Fisher sets forth is the discussion of appreciation and interest. If commodity prices are increasing, it may be assumed that money is depreciating and vice versa. As we have seen, a depreciating monetary system ought to imply a high rate of interest part of which may be applied to the amortization of the lessening purchasing power. The text discusses this matter in detail and presents the conclusion that theory and past experience go hand in hand. We have constructed a chart — it is too bad the author did not construct one — which exhibits the average interest rate of the Bank of England from 1846 to 1907,* the annual index number for English commodity prices over the same period, and the annual percentage rate of increase of the world's visible supply of gold from 1851 to date.† Some words on the comparison of these graphs may be worth while.

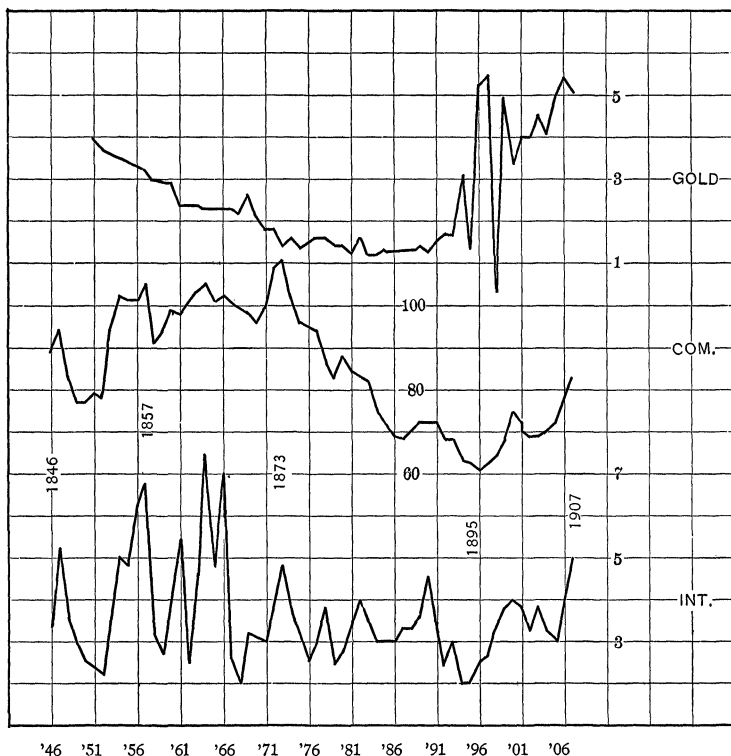
It appears that from 1850 to 1857 commodity prices rose rapidly by about thirty per cent and interest rates rose sharply from under two and a half per cent to over six per cent. In the meantime the average annual increase in the world's visible gold supply was about three and a half per cent. There were unmistakable evidences of gold inflation, great apparent prosperity, and finally an international economic crisis. What the course of commodity prices and interest rates might have been in the years 1858 to 1872 if there had not been such a destruction of wealth by war, it is difficult to say.‡ As it was, prices

* The table given by the author on page 418 apparently contains some misprints in the earlier years.

† It is very difficult to get a reliable estimate of the visible supply from year to year, and the annual addition to the supply may be almost anything between zero and the total amount mined; depending largely upon the competitive demands of the money market and the arts and industries. The chart must therefore be read without the use of a micrometer.

‡ There seems to be a generally accepted theory that war destroys wealth and is therefore equivalent to a call for more gold. This appears to be a curious theory in view of the fact that gold is certainly not destroyed by war, earthquake, and the like. Would it not be more reasonable and more in ac-

remained nearly on a level and interest rates fluctuated widely while maintaining a high average over the whole period. Meanwhile the average annual increase of gold had fallen to about two and a half per cent. From 1873 to 1896 prices fell away from the high mark 111 to the low of 61. If this is to be attributed to appreciation of gold, the appreciation was really



Upper curve. — Percentage annual increase in the visible supply of gold ; scale on the right.

Middle curve. — English commodity prices ; scale in the center.

Lower curve. — Average interest rate of the Bank of England ; scale on the right.

remarkable. At any rate interest was low and for two years at the end of the period was at two per cent. It will be ob-

cord with the theories of these books to claim that such calamities were equivalent to an increase rather than a decrease in the gold supply? The whole matter, however, is so complicated and so bound up with the question of credit that it cannot be answered by any off-hand query or reply.

served that the fall in interest was not continual as in commodity prices. The exigencies of the money market may change within fairly wide limits within tolerably short periods of time, and it is these rapid changes which must be smoothed out before the relation of appreciation to interest can be even approximately determined. In fact while prices were falling most rapidly, the rate of interest was swinging about the value three and a half. During all this period the percentage increase in the gold supply was also low and equal to about one and a half per cent.

If, then, one may assume that the long-time variations in prices and rates of interest are determined largely by the question of appreciation, it seems clear that an annual one and one half per cent increase in the gold supply was by no means sufficient to keep pace with the increase of the world's population, the rapid development of new country, as in Africa and North and South America, and the increase of business; it might have fallen still further short if the world had then been so unanimously committed to the gold standard as at present. Since 1895 commodity prices have risen sharply and interest rates have advanced. Coincident with this is a violent jump in the annual percentage increase in the world's visible gold supply; the present average of that rate may be taken as a little under five per cent. The author's theory seems to fit pretty well with the facts of recent history; and it is only history which is recent as economic cycles go that is available for a detailed statistical comparison with the theory. At present there are large numbers of financial writers and of economists who have a leaning toward the practical side of their subject who are crying gold inflation with all their might, are predicting very sharp advances in commodity prices, much higher rates of interest, lower prices for bonds and other securities with a fixed rate of income, great speculative activity, and finally, in perhaps five or six years, a panic as in 1857 and 1907. This would appear to match very well with Fisher's theory. The next decade promises to be an interesting affair. The world's visible gold supply is now estimated at something like \$7,200,000,000 and we are adding to it at the rate of about 5 per cent per annum (the actual amount mined is about six per cent), which seems high. Unless we mine a progressively increasing amount each year, the percentage increase per annum in the supply will surely diminish; it will diminish unless the mining rate increases more rapidly

than it has in the last three years. It is by no means impossible that a somewhat smaller annual percentage increase in the visible gold supply or even the present high rate may not be required for the proper opening up of new territory, for the increasing business and population of the earth, for the modernization of the civilization of such a country as China, and especially for the imperative fortification of the gold reserves of our own and other countries.* It may well happen that 1907 and not some later year will ultimately be compared with 1857 as containing a great panic due to gold inflation. If the fact that gold is depreciating is widely recognized and allowed to influence speculation and prices according to sane economic laws, the disastrous effects which would follow ignorance will be much mitigated.

In closing this review we would express the hope that not only economists and mathematicians and business men may read these volumes — it is almost essential to read both, so closely are they interrelated — but that those of our actual or would-be legislators who may be interested in something more than holding their ears to the ground to catch a rumble that will indicate some wild popularistic “vital” issue upon which they can conduct a campaign at least orally successful, will take the pains to study Fisher’s work in detail, that they may legislate with as much wisdom as possible; we are in great need of a decent currency system.

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SHORTER NOTICES.

Vorlesungen aus der analytischen Geometrie der geraden Linie, des Punktes und des Kreises in der Ebene. By OTTO HESSE. Vierte Auflage, revidiert und ergänzt von S. GUNDELFINGER. Leipzig, Teubner, 1906. 8vo. viii + 251 pp.

THIS little book of the great geometer is so well known that it would seem almost absurd to review it at any length. For a generation it has been considered a model of elegance, and the

* On the question of the gold supply reference may be made to Thomas Gibson’s special market letters on “The Increasing Gold Supply,” New York, 1908. Of the contributors to this symposium, Muhleman alone seems to regard the present supply as possible of absorption without serious inflational effects.