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APPRECIATION AND INTEREST

A STUDY OF THE INFLUENCE OF MONETARY APPRECIATION AND DEPRECIATION ON THE RATE OF INTEREST, WITH APPLICATIONS TO THE BIMETALLIC CONTROVERSY AND THE THEORY OF INTEREST.

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APPRECIATION

AND

INTEREST.

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PREFACE.

The connection between monetary appreciation and the rate of interest has received very scant attention from economists. The writer has been led to believe that this neglect has somewhat retarded the progress of economic science and the successful interpretation of economic history—in particular the monetary history of the last twenty years. The views here put forward were first stated in brief before the American Economic Association at Indianapolis, December, 1895. They differ radically from those expressed by Mr. Giffen and many other eminent economists. For this reason it has been necessary to make a statistical examination of all available facts bearing on the subject. Such a study could not be properly conducted without a definite economic theory as a starting point. The idea on which this theory is founded appears to have occurred independently to several writers, of whom Mr. Jacob de Haas, Jr., of Amsterdam, seems most fully to have realized its importance. To develop the theory in a quantitative form, some simple mathematics have been employed. With numerical illustrations at each step, it is hoped that those to whom mathematics are distasteful will find few, if any, impediments to easy reading. The mathematical reader, on the other hand, may feel that the discussions are too much encumbered by numerical illustration and detail; but these presentations are usually in such a form that they can easily be passed over by those who find them superfluous. The gist of the theory is contained in Chapter II, but its statement would not be complete, nor the apparent objections to it fully answered, without the discussions of Chapters III–VI.

The writer is greatly indebted to the many persons whose names are mentioned in the text, who have supplied him with important facts and references; also to Professor Sumner for the privilege of consulting his collection of works on banking; to Professor Hadley, for valuable suggestions and criticisms; to Mr. Horace White for pointing out the important pamphlet of the eighteenth century mentioned in Chapter I; and to Mr. Sakata for translating several statistical tables from Japanese.

New Haven, August, 1896.

PART I. THEORY.

CHAPTER I.

INTRODUCTION.

§ 1.

The chief issues in the bimetallic controversy center about the question of justice between debtor and creditor. The bimetallic propaganda succeeds just so far as it spreads a belief that an injustice has been done by the adoption of the gold standard, which the re-adoption of bimetallism would correct.

The question therefore arises, does the appreciation of gold necessarily aggravate debts? Are contracting parties powerless to forestall the gains or losses of an upward or downward moving currency? It is clear that if the unit of length were changed and its change were foreknown, contracts would be modified accordingly. Suppose a yard were defined (as once it probably was) to be the length of the king's girdle, and suppose the king to be a child. Everybody would then know that the "yard" would increase with age and a merchant who should agree to deliver 1,000 "yards" ten years hence, would make his terms correspond to his expectations. To alter the mode of measurement does not alter the actual quantities involved but merely the numbers by which they are represented.

§ 2.

Hitherto monometallists have usually replied to the argument "gold has appreciated, therefore the debtor

has been robbed" by challenging, not the inference, but the premise. Thus the discussion has been shunted off from economic theory and turned into a controversy over the fact of "appreciation." This controversy has been, to a large extent, a mere war of words, because, by "appreciation" the monometallists mean one thing and the bimetallists, another. No one has yet provided a meaning for that much abused word acceptable to both parties. The bimetallists prove the appreciation of gold by the fall in prices. The monometallists reply that wages have risen, and hold that the fall in prices is due to progress in the arts. Some bimetallists, *e. g.*, Leonard Courtney,[1] accept the distinction between a fall in prices through causes connected with gold and a fall through causes connected with commodities, but most of them assert that a "fall of prices" and "appreciation of gold" are synonymous expressions, and that, if progress cheapens other commodities, it ought justly to cheapen gold also. Generally speaking, bimetallists set up the "commodity standard" and monometallists, the "labor standard."

Others attempt to find the "just" standard in "marginal utility," "total utility," and so forth. On all sides it is tacitly assumed that a "just" standard must in some sense be an "invariable" standard; that is, a standard such that the principal of the debt when due should be equivalent in some way to the original loan. "All writers on the subject of money have agreed that uniformity in the value of the circulating medium is an object greatly to be desired—a currency to be perfect, should be absolutely invariable in value."[2] Proposals

[1] Report of the Indian Currency Committee, 1893, p. 39; also, *Nineteenth Century*, April, 1893.

[2] Ricardo, "Proposals for an Economic and Secure Currency," Secs. I, II.

to define and secure such invariability have been made by many writers. Within the last few years, the problem has become a favorite one and scarcely an issue of the economic journals appears without discussions on "The ultimate standard of value," "The just standard of deferred payments," "Has gold appreciated?" "The measurement of the value of money," and kindred subjects.[1]

§ 3.

It is not prosposed to deny that the terms appreciation and depreciation may have an "absolute" as distinct from a "relative" meaning.[2] But such definitions and distinctions can throw no light whatever on the question of justice in contracts. We shall see that a standard to be perfect need not be invariable. What is required is simply that it shall be *dependable*, so that contracting parties may be able to forecast all required elements of their economic future in terms of that standard as accurately as in terms of any other. If a standard is thus dependable, the terms of the contract will be as "just" as they could possibly be under any system.

§ 4.

At a later stage the general question of "justice" will be discussed. Here the effort will be to show that losses due to "appreciation," however defined, will tend to be forestalled. For this, it is not necessary to scale the principal of a debt. The principal is not the only or even the chief element in a loan contract. The other element is the *rate of interest.* It is an astonishing fact

[1] See, *e. g.*, the connected discussions in the *Annals of the American Academy of Political and Social Science*, 1892-95, and the *Journal of Political Economy*, 1893-95, by Ross, Merriam, Fetter, Commons, Newcomb, Cummings, Orton and Taylor.

[2] See Chapter XII.

that the connection between the rate of interest and appreciation has been almost completely overlooked, both in economic theory and in its bearing upon the bimetallic controversy.

Of the few writers who have conceived this connection, apparently the earliest was the anonymous author of the remarkable pamphlet entitled: "A Discourse Concerning the Currencies of the British Plantations in America." Boston, 1740 (Reprinted in the "Overstone Tracts," 1857). He writes:

The Arguments current amongst the Populace in favour of Paper Money, are,

I. In most of the Paper Money Colonies one of the principal Reasons alledged for their first Emissions; was, *to prevent Usurers imposing high Interest upon Borrowers, from the Scarcity of Silver Money.* It is true, that in all Countries the increased Quantity of Silver, falls the Interest or Use of Money; but large Emissions of Paper Money does naturally rise the Interest to make good the sinking Principal: for Instance, in the Autumn, *A.* 1737, Silver was at 26 s. to 27 s. per Ounce, but by a large *Rhode Island* Emission, it became in Autumn 1739, 29 s. per Oz. this is 7 per Cent. Loss of Principal, therefore the Lender, to save his Principal from sinking, requires 13 per Cent. natural Interest (our legal Interest being 6 per Cent.) for that Year. In Autumn A. 1733, Silver was 22 s. per Oz. by large Emissions it became 27 s. in the Autumn, *A.* 1734; is 22 per Cent. loss of Principal; and the Lender to save his Principal; requires 28 per Cent. *natural Interest* for that Year. Thus *the larger the Emissions, natural Interest becomes the higher;* therefore the Advocates for Paper Money (who are generally indigent Men, and Borrowers) ought not to complain, when they hire Money at a dear nominal Rate.

If Bills were to depreciate after a certain Rate, Justice might be done to both contracting Parties, by imposing the Loss which the Principal may sustain in any certain Space of Time (the Period of Payment, upon the Interest of a Bond or Price of Goods: but as Depreciations are uncertain, great Confusions in Dealings happen.

John Stuart Mill expresses the same view,[1] as do

[1] "Principles of Political Economy," Book 3, Chapter 23, § 4. [A single paragraph.]

also Jacob de Haas[1] and Professor John B. Clark.[2] A principle which apparently has been independently discovered by each of these economists and quite possibly by others, is likely to be of some importance. It is the object of the present essay to develop the theory in a quantitative form, to bring it to a statistical test, and to apply it to current problems, and to the theory of interest.

[1] "A Third Element in the Rate of Interest." *Journal of the Royal Statistical Society*, March, 1889. [A more extended discussion, with statistics.]

[2] "The Gold Standard in the Light of Recent Theory." *Political Science Quarterly*, September, 1895. [Applied to the current bimetallic controversy.]

CHAPTER II.

ONE YEAR CONTRACTS.[1]

§ 1.

We must begin by noting the distinction between a foreseen and an unforeseen change in the value of money. Only the losses or gains of the former can be forestalled. A sudden and unexpected inflation, as in the United States in 1862, works enormous losses to creditors while an unforeseen contraction is equally harmful to debtors.

How far foresight in such matters actually exists will be discussed in Part II. At present we wish to discover what will happen, *assuming* this foresight to exist.

If a debt is contracted optionally in either of two standards and one of them is expected to change with reference to the other, will the rate of interest be the same in both? Most certainly not. Only a few months ago the Belmont–Morgan syndicate offered the United States government the alternative of taking some 65 millions at 3% in gold or at 3¾% in "coin." Everyone knew that this additional ¾% was due to the mere *possibility* of free silver coinage. If the alternatives had been between repayment in gold and—not possible but actual—repayment in silver, the additional interest would certainly have been much more than ¾%.

§ 2.

To fix our ideas, let the two standards be gold and wheat, and, while today a bushel of wheat is worth a

[1] More properly speaking, in place of "one year" should be put "one interest interval."

dollar, let it be known that one year hence it will be worth but 96 cents. One hundred dollars (gold standard) or its equivalent one hundred bushels (wheat standard) are borrowed today and are to be repaid with interest in one year. If the rate of interest in the gold standard is 8%, what will be the rate in wheat?

We note that the repayment, if in gold, will be, not $100 but $108, and our problem is solved by finding what will be the equivalent of this sum in wheat at the end of the year. This is easily obtained from the expected price of wheat, thus:[1]

	96 cents gold	$\simeq$	1	bushel wheat.	
Hence	1 dollar "	$\simeq$	$\frac{100}{96}$	bushels "	*i. e.*, $1.04\frac{1}{6}$ bu.
	108 dollars "	$\simeq$	$108 \times 1.04\frac{1}{6}$	bushels "	*i. e.*, $112\frac{1}{2}$ bu.

Thus the repayment of $112\frac{1}{2}$ bushels will be equivalent to $108. The alternative contracts would therefore be:

For 100 dollars borrowed today, 108 dollars are due one year hence.
For 100 bushels " " $112\frac{1}{2}$ bushels " " " " "

Hence 8% interest in the gold standard is equivalent to $12\frac{1}{2}$% in the wheat standard.

Now the relative change in the two standards may be spoken of either as an appreciation of gold relatively to wheat or as a depreciation of wheat relatively to gold. We are not compelled to inquire which is the "absolute" change. If we speak in terms of appreciation, we say $1 changes in value from 1 bushel of wheat to 1.04⅙ bushels and hence has appreciated 4⅙%; while we may also say, wheat has depreciated from $1 to $.96 or 4%. Our results can be stated in either of two ways:

1. If the rate of interest in one standard is 8%, then in another, which depreciates 4% relatively to the first, it will be 12½%; that is, a depreciation of 4% is offset by an increase of interest of 4½%.

[1] The symbol "$\simeq$" is used for "are equivalent to."

2. If the rate of interest in one standard is 12½%, in another, which appreciates 4⅙% relatively to the first, it will be 8%; that is, an appreciation of 4⅙% is offset by a decrease of interest of 4½%.

§ 3.

Leaving this numerical case, we may state the problem more generally. Suppose gold is to appreciate relatively to wheat a certain known amount in one year. What will be the relation between the rates of interest in the two standards? Let wheat fall in gold price (or gold rise in wheat price) so that the quantity of gold which would buy one bushel of wheat at the beginning of the year will buy $1 + a$ bushels at the end, a being therefore the rate of appreciation of gold in terms of wheat.

Let the rate of interest in gold be i, and in wheat be j, and let the principal of the loan be D dollars or its equivalent B bushels.

Our alternative contracts are then:

For D dollars borrowed $D+Di$ or $D(1+i)$ dollars are due in one yr.
For B bushels " $B+Bj$ or $B(1+j)$ bushels " " " "

and our problem is to find the relation between i and j, which will make the $D(1+i)$ dollars $\Rightarrow$ the $B(1+j)$ bushels.

At first,	D	dollars	$\Rightarrow$	B	bu.
At the end of the year	D	"	$\Rightarrow$	$B(1+a)$	"
Hence " " "	$D(1+i)$	"	$\Rightarrow$	$B(1+a)(1+i)$	"

Since $D(1+i)$ is the number of dollars necessary to liquidate the debt, its equivalent $B(1+a)(1+i)$ is the number of bushels necessary to liquidate it. But we have already designated this number of bushels by $B(1+j)$.

Our result, therefore, is:

At the end of 1 year $\overset{\text{Dollars.}}{D(1+i)} \fallingdotseq \overset{\text{Bushels.}}{B(1+j)} = \overset{\text{Bushels.}}{B(1+a)(1+i)}$ (1)

which, after B is canceled, discloses the formula:

$$1+j=(1+a)(1+i) \tag{2}$$

or
$$j=i+a+ia \tag{3}$$

or in words: *The rate of interest in the (relatively) depreciating standard is equal to the sum of three terms, viz., the rate of interest in the appreciating standard, the rate of appreciation itself, and the product of these two elements.*

Thus, to offset appreciation, the rate of interest must be lowered by slightly more than the rate of appreciation.[1]

We may introduce depreciation in a similar manner. Instead of saying, gold appreciates at the rate a, relatively to wheat, we may say, wheat depreciates at the rate d, relatively to gold.[2] This means that wheat has sunk in terms of gold in the ratio 1 to $1-d$, and reasoning similar to the foregoing shows that

$$1+i=(1-d)(1+j). \tag{4}$$

Equations (2) and (4) may be conveniently combined, thus:

$$\frac{1+j}{1+i}=\frac{1+a}{1}=\frac{1}{1-d} \tag{5}$$

[1] Professor Clark, (*Political Science Quarterly*, September, 1895), implies that 1 % appreciation is offset by *less* than 1 % reduction of interest. But in making his calculation he has failed to "compound." The numerical illustrations of the eighteenth century pamphleteer (*supra*) are also erroneous. *E. g.*, instead of 28 %, should be 29.32 %. Professor Marshall, ("Principles of Economics," Vol. I, 3rd ed., p. 674), gives a correct example. His example is designed to show the losses from a fluctuating currency and not the effort to offset these losses. He appears, however, to have in mind this effort when he postpones to the next volume the discussion of "the influences which changes in the purchasing power of money do actually exert on the terms on which loans are arranged," (p. 673).

[2] The relation between d and a is $(1+a)(1-d)=1$, which is evident from equation (5) or can be easily shown independently.

Since $\frac{1+a}{1}$ is the ratio of the value of gold at the end of the year to its value at the beginning (all in terms of wheat), that is, the ratio of divergence of the two standards expressed in wheat, while $\frac{1}{1-d}$ is the same ratio of divergence expressed in gold, and since $1+i$ is the "amount" of $1 put at interest for one year while $1+j$ is the "amount" of one bushel; we may state equation (5) as follows:

The ratio of divergence between the standards equals the ratio between their "amounts."

This is, perhaps, the simplest mode of conceiving the relation and stress is laid upon it because it brings into prominence the "amount," or ratio of future payment to present loan, a magnitude which in most questions of interest plays a more important rôle than the rate of interest itself.[1]

Equation (5) gives the relation between i and j in terms of a or d. From it, follows the value of j in terms either of i and a or of i and d, and also the value of i in terms either of j and a or of j and d, thus:

$$\frac{1+j}{1+i}=\frac{1+a}{1}=\frac{1}{1-d} \qquad (5)$$

whence $$j=i+a+ia=\frac{i+d}{1-d} \qquad (6)$$

or $$i=j-d-jd=\frac{j-a}{1+a} \qquad (7)$$

[1] In fact, except for convenience in computation, the conception of the rate of interest might well be dispensed with, giving place to the conception of a year's "amount" or "ratio of accumulation." In his "Positive Theory of Capital," Professor Böhm-Bawerk expresses the same view. (English Translation, p. 296). We should then speak, not of a 6 % rate of interest, but of 1.06 as the "ratio of accumulation." In like manner "rate of appréciation" would give place to "ratio of appreciation." Denoting the ratio of accumulation, $1+j$, by r' and $1+i$ by r, and the "ratio of appreciation," $1+a$, by p, our theorem becomes simply $\frac{r'}{r}=p$.

It follows that j exceeds i by more than the rate of appreciation, which in turn is more than the rate of depreciation, (*i. e.*, $j - i > a > d$).

§ 4.

It is to be noted that we have been regarding money as a standard of value and not as a medium of exchange. In either contract the actual liquidation need not be made either in gold or wheat but in some other medium, as bank notes. The speculator who sells wheat "short," really uses wheat as a standard and not necessarily as a medium. In consideration of value received today (which, though reckoned by the speculator in money, may readily be thought of as measured in wheat) he promises to deliver, at a later date, so many bushels of wheat, it being perhaps understood that he need not actually deliver the wheat so long as he delivers its equivalent in money. This operation, as actually practiced, involves great uncertainties, and therefore occurs as a gambling transaction. Moreover the wheat is not usually paid for in advance. But if wheat were a more reliable standard, selling it "short" in consideration of present advances might be a true method of business borrowing, and would then exactly exemplify the case we have supposed. In fact, such contracts are identical in form with those which would be made under the oft-proposed "multiple standard."

CHAPTER III.

MORE THAN ONE YEAR.

§ 1.

A prominent bimetallist in conversing with the writer on the subject of interest and appreciation, raised the following objection: "Interest and principal are separate; the one is paid regularly in installments; the other remains to the end; hence appreciation must affect them in totally different ways. I do not see how it is possible by a uniform reduction in interest applied to contracts of different periods to offset the appreciation of both interest and principal." This view, as we shall soon see, is quite erroneous and arises from the habit of separating in thought interest and principal.

§ 2.

First consider the case in which no interest is paid until the end of the term of years. Let us suppose, for instance, a savings bank which receives $100, gold standard, and repays the depositor in five years at 5% compound interest. If there were an alternative standard, say wheat, in terms of which gold is known to appreciate[1] constantly by 1% per annum, what would be the rate of interest in this standard? We shall suppose for convenience that at first the price of wheat is $1 per bushel.

[1] Or what is equivalent, wheat depreciates $\frac{100}{101}\%$ relatively to gold. As it will be understood that there are always these two modes of expressing the relative change of two standards, we shall hereafter adhere to "appreciation."

If the repayment were to come in one year, we know from Chapter I, § 3, that the rate of interest in wheat is given by the formula

$$\begin{aligned} j &= i + a + ia \\ &= .05 + .01 + .0005 \\ &= .0605 \\ &= 6\tfrac{1}{20}\% \end{aligned}$$

This result is as truly the answer to our problem for a series of years as for one year. The proof consists simply in separating the contract into several contracts of one year each. Thus, by Chapter II, we know if we deposit today \$100 or its equivalent, 100 bushels, it will amount in 1 year to \$105 at 5% or its equivalent, 106.05 bushels, at $6\frac{1}{20}\%$. We may now regard these equivalent amounts as withdrawn but immediately redeposited for one year. Then, with the same rate of interest in gold and the same rate of relative appreciation, we shall obtain the same rate of interest in wheat, so that \$105.00 or its equivalent, 106.05 bushels, will amount in 1 year to \$110.25 at 5%, or its equivalent, 112.47 bushels at $6\frac{1}{20}\%$. In this way each successive pair of "amounts," including the last, will be equivalent.

§ 3.

The principle employed in § 2 is to resolve the contract into a series of one year contracts. The general case is precisely similar. For the first year we have, by formula (1), Chapter II,

$$\underset{\text{Dollars due.}}{D(1+i)} = \underset{\text{Bushels due.}}{B(1+j)} = \underset{\text{Bushels due.}}{B(1+a)(1+i)}$$

In the second year the same formula applies except that in place of D, the principal is now $D(1+i)$, and in place of B, $B(1+j)$ or $B(1+a)(1+i)$. Making these substitutions in the formula, we obtain

$$D(1+i)^2 = B(1+j)^2 = B(1+a)^2(1+i)^2$$

and similarly in the third year,

$$D(1+i)^3 = B(1+j)^3 = B(1+a)^3(1+i)^3$$

and so on. Each of the results discloses the principle

$$1+j=(1+a)(1+i).$$

§ 4.

In §§ 2 and 3, we began for simplicity with the case in which the debt is allowed to accumulate to the end. The most general case, however, is one in which the repayments are in installments.

Suppose, as in § 2, that the interest in gold is 5% and that gold is known to appreciate 1% per annum relatively to wheat. A farmer mortgages his land for $1,000 or its then equivalent, 1,000 bushels of wheat, and agrees to pay annually the interest and such parts of the principal as he can save, making the repayment complete in 7 years. Our problem is to find that rate of interest in wheat which will make the contracts in gold and wheat equivalent in every respect.

The solution of this problem is precisely the same as that of § 2, viz., $6\frac{1}{2}$%. For, at the end of one year, the farmer's debt amounts to $1050 or its then equivalent, 1000.50 bushels. Let us suppose that he finds himself able to pay, not only the "interest," $50, but also $50 of the "principal," that is $100 altogether. The equivalent of this in wheat is 101.00 bu.

Hence he can either

pay $100.00 on $1,050.00, leaving $950.00

or 101.00 bu. on 1,060.50 bu., leaving 959.50 bu.

and, since the "amounts" $1,050 and 1,060.50 bu. are equivalent and the deductions $100 and 101.00 bu. are

equivalent, the remainders $950 and 959.50 bu. must also be equivalent; and, in fact, this may be seen directly since, with gold appreciating 1%, $950, originally worth 950 bu., becomes worth 1% more, or 959.50 bu.

Thus the farmer's remaining debt at the end of the first year is the same whether measured in wheat or gold and since the same reasoning applies to the second year, third year, etc., the equivalence remains to the end of the contract.

It is worth noting here that the $100 payment in gold will be regarded as consisting of half interest and half principal, whereas the equivalent payment in wheat, 101.00 bu., consists of 60.50 bu., interest and 40.50 bu., principal.

The liquidation of the contract during the 7 years may be supposed to take place in either of the following equivalent ways:

GOLD STANDARD.

	Interest.	Amount.	Payment.	Principal.
At beginning				$1,000.00
In 1 year	$50.00	$1,050.00	$100.00	950.00
In 2 years	47.50	997.50	97.50	900.00
" 3 "	45.00	945.00	145.00	800.00
" 4 "	40.00	840.00	150.00	690.00
" 5 "	34.50	724.50	174.50	550.00
" 6 "	27.50	577.50	277.50	300.00
" 7 "	15.00	315.00	315.00	0.00

WHEAT STANDARD.

	Interest.	Amount.	Payment.	Principal.
At beginning				1,000.00 bu.
In 1 year	60.50	1,060.50	101.00	959.50 "
In 2 years	58.05	1,017.55	99.46	918.09 "
" 3 "	55 54	973.63	149.39	824.24 "
" 4 "	49.87	874.11	156.09	718.02 "
" 5 "	43.44	761.46	183.40	578.06 "
" 6 "	34.97	613.03	294.57	318.46 "
" 7 "	19.27	337.73	337.73	0.00 "

In these two tables every entry in one is equivalent to

the corresponding entry in the other except those in the interest columns.

We thus see that the farmer who contracts a mortgage in gold is, *if the interest is properly adjusted*, no worse and no better off than if his contract were in a "wheat" standard or a "multiple" standard.

§ 5.

The principle involved in § 4 is that equivalent payments subtracted from equivalent "amounts" will leave equivalent remainders. The payment in any year forms the same fractional part of the "amount" in the two standards. We may designate this fraction at the end of the first year by f, the second year by f', etc., and we have the following results:

END OF FIRST YEAR.

	Dollars.	Bushels.	Bushels.
Amount.	$D(1+i)$ $\leftrightarrows$	$B(1+j) =$	$B(1+a)(1+i)$
Paym't	$fD(1+i)$ $\leftrightarrows$	$fB(1+j) =$	$fB(1+a)(1+i)$
R'md'r.	$(1-f)D(1+i)$ $\leftrightarrows$	$(1-f)B(1+j) =$	$(1-f)B(1+a)(1+i)$

In like manner the unpaid remainder at the end of the second year can be shown to be

Dollars.	Bushels.	Bushels.
$(1-f')(1-f)D(1+i)^2$ $\leftrightarrows$	$(1-f')(1-f)B(1+j)^2 =$	$(1-f')(1-f)B(1+a)^2(1+i)^2$

and so on for any number of years. Each result again yields the formula $(1+j) = (1+a)(1+i)$.

This includes, of course, the case of § 1, in which no partial payments are made, f, f', etc., being then zero.

§ 6.

One special case may seem to require separate consideration. Suppose the interest alone is annually paid and the principal redeemed at the end, as in the case of a bond not subject to a sinking fund. What correspondence between the two standards is then possible? The following tables answer this question, the first, for the

case where the wheat interest, the second, where the gold interest is annually paid.

TABLE I.

	Interest.	Amount.	Payment.	Principal.
At beginning (Bushels)	. . . . .	. . . . .	. . . . .	1,000.00
In 1 year . . . "	60.50	1,060.50	60.50	1,000.00
" 2 years . . . "	"	"	"	"
" 3 " . . . "	"	"	"	"
" 4 " . . . "	"	"	"	"
" 5 " . . . "	"	"	"	"
" 6 " . . . "	"	"	"	"
" 7 " . . . "	"	"	"	"
" 8 " . . . "	"	"	"	"
" 9 " . . . "	"	"	"	"
" 10 " . . . "	"	"	1,060.50	0.00
At beginning (Dollars)	. . . . .	. . . . .	. . . . .	1,000.00
In 1 year . . . "	50.00	1,050.00	59.90	990.10
" 2 years . . . "	49.50	1,039.60	59.31	980.29
" 3 " . . . "	49.01	1,029.30	58.72	970.58
" 4 " . . . "	48.53	1,019.11	58.14	960.97
" 5 " . . . "	48.05	1,009.02	57.56	951.46
" 6 " . . . "	47.57	999.03	56.99	942.04
" 7 " . . . "	47.15	989.19	56.43	932.76
" 8 " . . . "	46.63	979.39	55.87	923.52
" 9 " . . . "	46.17	969.69	55.32	914.37
" 10 " . . . "	45.71	960.08	960.08	0.00

TABLE II.

At beginning (Bushels)	. . . . .	. . . . .	. . . . .	1,000.00
In 1 year . . . "	60.50	1,060.50	50.50	1,010.00
" 2 years . . . "	61.10	1,071.10	51.00	1,020.10
" 3 " . . . "	61.72	1,081.82	51.52	1,030.30
" 4 " . . . "	62.32	1,092.62	52.03	1,040.59
" 5 " . . . "	62.96	1,103.55	52.55	1,051.00
" 6 " . . . "	63.59	1,114.59	53.08	1,061.51
" 7 " . . . "	64.22	1,125.73	53.61	1,072.12
" 8 " . . . "	64.86	1,136.98	54.14	1,082.84
" 9 " . . . "	65.51	1,148.35	54.68	1,093.67
" 10 " . . . "	66.17	1,159.84	1,159.84	0.00
At beginning (Dollars)	. . . . .	. . . . .	. . . . .	1,000.00
In 1 year . . . "	50.00	1,050.00	50.00	1,000.00
" 2 years . . . "	"	"	"	"
" 3 " . . . "	"	"	"	"
" 4 " . . . "	"	"	"	"
" 5 " . . . "	"	"	"	"
" 6 " . . . "	"	"	"	"
" 7 " . . . "	"	"	"	"
" 8 " . . . "	"	"	"	"
" 9 " . . . "	"	"	"	"
" 10 " . . . "	"	"	1,050.00	0.00

From Table I, it will be seen that the case in the wheat standard, in which only the interest is annually paid and the principal redeemed in ten years is equivalent, step for step, in the gold standard to a series of small partial payments. Thus, instead of paying merely the annual interest of $50, the sum paid the first year is $59.90 reducing the principal by $9.90. At the end there is due $914.37 of principal and $45.71 of interest, making $960.08 in all, which at that date is, of course, precisely equivalent to the 1,060.50 bushels, the final payment in wheat.

On the other hand, the case in which the gold interest payments are kept up, corresponds to a series of wheat payments *less* than the annual interest, so that the unpaid interest accumulated to the end makes the sum then due, 1,159.84 bu., of which 1,093.67 bu. are principal.

It is thus clear that the case in which in one standard the interest is paid annually and the principal at the end, can be exactly matched in the other standard either by minute partial payments or minute arrears of interest. Without such partial payments or arrears in one of the standards, the two would not be equivalent step for step. We shall see, however, that they would still be equivalent as a whole.

CHAPTER IV.

"PRESENT VALUE."

§ 1.

In practice, of course no such minute partial payments of principal or minute remissions of interest would be made. Any advantages to be derived from such calculations of trifles would not be worth the trouble. But even if we destroy the precise step-for-step equivalence between the wheat and gold tables, we do not destroy their equivalence as a whole. The "*present values*" remain exactly equal.

The ordinary definition of the "present value" of a given sum due at a future date is "that sum which put at interest today will 'amount' to the given sum at that future date." "Present value" and "amount" are thus correlative terms. In fact we may extend the preceding definition to include the present value of *past* sums as the accumulated "amount" today of the past sum put at interest then.

The literal meaning of "present value" implies that it is the actual market price today of a future sum due. This is, in fact, the case. We need not stop to prove it in theory, for we are all familiar with it in practice. Elaborate tables are constructed on this principle for the practical use of insurance companies in calculating their premiums, and for brokers in determining the comparative merits of various bond investments. What we are here concerned with is applying the principle to our problem.

§ 2.

If a debt of $1,000 is contracted today, interest being 5%, the "present value" of all payments, principal and interest, by which that debt is to be liquidated is exactly $1,000.[1] Again, the debt's present value, reckoned at a later date than the time of contract, is the "amount" of $1,000 at interest from the time of contract to that date, and this is true, whether or not any of the debt has already been paid. Thus if the present values at the date of contract are computed for the gold and the wheat debts of the last chapter, they will be $1,000 and 1,000 bushels, which are then equivalent. If the present values one year later are taken they are $1,050 and 1060.50 bushels which at that date are also equivalent, gold having appreciated 1%.

From these familiar principles, it follows that the present values of the two debts, reckoned at any date whatever, are identical whether the individual payments correspond or not. Thus, to take the case first referred to, suppose the wheat debt to be discharged as in Table I and the gold debt, as in Table II. The present value, at the date of contract, of the interest and principal, separately computed, will be:[2]

	Dollars.	Bushels.
Present value of all interest payments	386.09 <	444.24
" " principal due in 10 years . .	613.91 >	555.76
" " total	1000.00 =	1000.00

If the present values (including "amounts" of past

[1] This and the other general theorems on present value are not proved here because their proof is accessible in most treatises on interest, annuities, insurance, etc. See, *e. g.*, the "Encyclopædia Britannica," "Annuities."

[2] The symbol < is here used for "is less than the equivalent of" and > for "is more than the equivalent of."

interest) were computed 5 years after the date of the contract, the items would be:

	Dollars.	Bushels.
Interest	492.75 <	595.88
Principal	783.53 >	745.50
Total	1276.28 ≒	1341.38

We thus see that it would be just as much a hardship to pay the high interest in wheat as to pay the more onerous principal in gold.

§ 3.

The case of a perpetual annuity may be given special consideration. As is well known, the present value of a perpetual annuity is its "capitalized" value. Thus, if the rate of interest is taken at 5%, the present value of a perpetual annuity of $50 per annum is $1,000. Applying the same principle to the wheat annuity of 60.50 bushels and extending the previous reasoning, we find that the two annuities are equivalent.

At first sight this seems impossible since $6\frac{1}{20}\%$ is a higher rate of interest than 5%. This is true in the numerical sense, and it is also true that the early payments of 60.50 bushels are actually more valuable than $50. But after a certain time (in this case 19 years) the reverse is true. The 19th payment of $50 in gold is worth 60.40 bushels while the 20th is worth 61.01 bushels. That is, the recipient of the wheat annuity has at first a slight advantage over the recipient of the gold annuity which ceases and becomes a slight disadvantage after 19 years.

§ 4.

To derive the formula for the time at which the relative values of the two annuities become reversed, let the rate of interest in gold be i, in wheat, j; let the two an-

nuities be Di and Bj, their capitalized values being D and B ($D \eqsim B$ at the beginning) and let x be the number of years in which Bj is as valuable as or more valuable than Di. Then

	Bushels.		Dollars.
At end of x years, - - -	Bj	$\geqq$	Di
At end of $x+1$ years, -	Bj	$<$	Di

and since we know that in x years, $D \eqsim B(1+a)^x$ and hence $Di \eqsim Bi(1+a)^x$; and likewise in $x+1$ years, $Di \eqsim Bi(1+a)^{x+1}$, we see that the previous inequalities become:

	Bushels.		Bushels.
At end of x years, -	Bj	$\geqq$	$Bi(1+a)^x$
At end of $x+1$ years,	Bj	$<$	$Bi(1+a)^{x+1}$

which may be combined in the formula:

$$i(1+a)^x \leqq j < i(1+a)^{x+1}$$

or

$$x \leqq \frac{\log j - \log i}{\log(1+a)} < x+1. \qquad (8)$$

That is, x is the integral part of the number

$$\frac{\log j - \log i}{\log(1+a)}.$$

Thus, if $i = .05$, $a = .01$, and hence also $j = .0605$, then

$$\frac{\log j - \log i}{\log(1+a)} = \frac{\bar{2}.7818 - \bar{2}.6990}{.0043} = \frac{.0828}{.0043} = 19.3$$

Hence $x = 19$.

CHAPTER V.

VARYING RATES OF INTEREST AND APPRECIATION.

§ 1.

Hitherto we have assumed that the appreciation proceeded (during the period of the contract) at a constant percentage rate per annum, and that the rate of interest (in one standard, and consequently in the other) remained constant also. The more general case is one in which these elements are changing.

Beginning with a numerical case, let us suppose that the United States government is offered an alternative loan, not in gold or "coin," but in gold or silver. Let it be known that 100 gold dollars will remain at par the first year, but in two years will be worth 150 silver dollars, that is, gold will "appreciate," in the second year, 50% relatively to silver; also that in the third and fourth years it will appreciate 10% and 5% respectively. We shall suppose that the rate of interest, if the contract be in gold, is 3% for each year of the contract.

Our problem is to discover what will be the interest in silver. It is perhaps already evident that it will be a different rate for each year. If the contract were made for one year only, the rate of interest in silver would also be 3%, since silver remains so far at par with gold. If the contract (or any unpaid part of it) were then renewed for a second year, the rate of interest would be, by formula (3):

$$\begin{aligned} j &= i + a + ai \\ &= .03 + .50 + .015 \\ &= .545 \\ &= 54\tfrac{1}{2}\% \end{aligned}$$

In like manner, we may deduce the rate of interest in each year, with the following results:

	Gold Standard.	Silver Standard.	Appreciation.
1st year	3%	3 %	0%
2d year	3	$54\frac{1}{2}$	50
3d year	3	$13\frac{3}{10}$	10
4th year	3	$8\frac{15}{100}$	5
Etc.			

§ 2.

The question arises, can a single "average" rate of interest be substituted for the above irregular series?

We answer that such an average is not possible if the debtor has the option of arbitrary partial payments. If, for instance, the average were 20%, and the government could pay off at any time, it would evidently be tempted to refund the debt at the end of the second year, to which the lending syndicate would not agree. If, however, the conditions as to repayment are stipulated for in advance, an average can easily be computed on the principle of present values.

Suppose the government agrees to extinguish the debt in four years by paying at the end of successive years 20, 40, 30, and 10 millions (these to include "interest"). The present value of these sums is 66.321 millions, which is therefore the amount of the loan received from the syndicate. This sum is obtained by adding the present values of several payments. The present value of 20 millions, due one year hence, is

$$\frac{20}{1.03} = 19.418 \text{ millions.}$$

and of 40 millions, due two years hence, is

$$\frac{40}{(1.03)(1.545)} = 25.136 \text{ millions,}$$

for evidently if this be put at interest for one year at

3%, and the next at $54\frac{1}{2}\%$ it will amount to 40 millions. Likewise the third and fourth payments have present values of

$$\frac{30}{(1.03)(1.545)(1.133)} = 16.639 \text{ millions}$$

$$\frac{10}{(1.03)(1.545)(1.133)(1.0815)} = 5.128 \text{ millions.}$$

The sum of these four present values is 66.321 millions. Now if we compute the present values of the four payments on the basis of a uniform rate of 20.26% interest, we obtain the same sum, thus

$$\frac{20}{(1.2026)} = 16.631 \text{ millions}$$

$$\frac{40}{(1.2026)^2} = 27.659 \quad \text{“}$$

$$\frac{30}{(1.2026)^3} = 17.250 \quad \text{“}$$

$$\frac{10}{(1.2026)^4} = 4.781 \quad \text{“}$$

$$\text{Total,} \quad = 66.321 \quad \text{“}$$

The separate present values are here fictitious, that is, no one of them is the actual present selling price of the future payment to which it refers, but the deviations so offset each other that their sum is the actual present selling price of the whole set of future payments. It follows from principles already stated that the debt, 66.321 millions, can be liquidated by precisely the same payments (20, 40, 30 and 10 millions) whether the interest is reckoned separately at 3, $54\frac{1}{2}$, $13\frac{3}{10}$, and $8\frac{15}{100}\%$ or uniformly at 20.26%. In fact the details of the bookkeeping in the two cases are:

	At 3, $54\frac{1}{2}$, $13\frac{3}{10}$, $8\frac{15}{100}$ %. (In Millions.)				At 20.26% uniformly. (In Millions.)			
	Interest.	Amount.	Payment.	Principal.	Interest.	Amount.	Payment.	Principal.
Date	. . .	. . .		66.32	. .	.	. .	66.32
In 1 year .	1.99	68.31	20.00	48.31	13.44	79.76	20.00	59.76
In 2 years .	26.33	74.64	40.00	34.64	12.11	71.87	40.00	31.87
In 3 years .	4.61	39 25	30.00	9.25	6.45	38.32	30.00	8.32
In 4 years .	.75	10.00	10.00	0.00	1.68	10.00	10.00	0.00

We thus see that 20.26% is the "average" of 3, $54\frac{1}{2}$, $13\frac{3}{10}$ and $8\frac{15}{100}$%s in the sense that, by it, the same payments will cancel the same debt. It is not identical with the arithmetical average, which is 19.74%.

§ 3.

Let us suppose that the rate of appreciation of one standard in terms of the other is foreknown to be a_1 the first year, a_2 the second year, a_3 the third year, and so on; also, to be as general as possible, that the rates of interest in both standards are variable, being in the appreciating standard i_1 the first year, i_2 the second, etc., and in the depreciating standard, j_1, j_2, etc. Let the final settlement occur in n years. Then, as in § 2, we may regard the contract as equivalent to a series of one-year contracts successively renewed in whole or in part, the difference being only that the terms are all made in advance. As equation (2) applies to each of these contracts, we have

$$\begin{aligned} 1+j_1 &= (1+a_1)(1+i_1) \\ 1+j_2 &= (1+a_2)(1+i_2) \\ &\cdots\cdots\cdots \\ 1+j_n &= (1+a_n)(1+i_n) \end{aligned} \qquad (9)$$

§ 4.

To obtain an expression for the average rate of interest in either standard, *i. e.*, i_a (or j_a), we require a given series of payments D_1, D_2, . . . D_n in the gold standard

(or their equivalent $B_1, B_2, \ldots B_n$ in the silver standard). The aggregate present value of these payments, reckoned by the separate rates of interest, $i_1, i_2, \ldots i_n$ (or $j_1, j_2 \ldots j_n$) is

$$\frac{D_1}{1+i_1} + \frac{D_2}{(1+i_1)(1+i_2)} + \cdots + \frac{D_n}{(1+i_1)(1+i_2)\ldots(1+i_n)}$$

(or the corresponding expression in terms of B's and j's). Now the "average" rate i_a must be such that if applied to the same set of payments it will make the same sum of present values; that is, i_a is determined by

$$\frac{D_1}{1+i_a} + \frac{D_2}{(1+i_a)^2} + \cdots + \frac{D_n}{(1+i_a)^n} = \frac{D_1}{1+i_1} + \frac{D_2}{(1+i_1)(1+i_2)} + \cdots + \frac{D_n}{(1+i_1)(1+i_2)\cdots(1+i_n)} \qquad (10)$$

and j_a is determined by the corresponding formula in B's and j's.

This equation has only one real and positive root or value of i_a. It can readily be obtained by Horner's Method.[1] We shall call i_a and j_a the "actuarial average" of $i_1, i_2, \ldots i_n$ and of $j_1, j_2, \ldots j_n$ respectively.[2]

[1] For, by substituting for $\frac{1}{1+i_a}$, the single letter x and for $\frac{1}{1+i_1}$, $\frac{1}{1+i_2}$, etc., the letters x_1, x_2, etc., the equation becomes:

$$D_1 x + D_2 x^2 + \cdots + D_n x^n = D_1 x_1 + D_2 x_1 x_2 + \cdots + D_n x_1 x_2 \ldots x_n.$$

In the example of § 2, the equation becomes:

$$20x + 40x^2 + 30x^3 + 10x^4 = 66\,321,$$

the required root of which is $x = .83155$,

which, applied to $x = \frac{1}{1+j_a}$, gives $j_a = .2026$.

[2] $1 + i_a$ reduces to the "geometrical average" of $1 + i_1$, $1 + i_2$, etc., when $D_1 = D_2 = \ldots = D_{n-1} = 0$.

§ 5.

We may define the average rate of appreciation of one of the two standards in terms of the other as that rate which would connect the two average interest rates if the latter were actual (instead of averages of actual) rates.[1] That is, the average appreciation, a_a, is given by the equation

$$1 + j_a = (1 + i_a)(1 + a_a)$$

or

$$a_a = \frac{j_a - i_a}{1 + i_a} \qquad (11)$$

Thus in the example of §1, the average silver interest is 20.26% and gold interest 3% so that

$$a_a = \frac{.2026 - .03}{1 + .03} = .1676,$$

or 16.76%. This average is not identical with the arithmetical average of 0, 50, 10 and 5%s, which would be 16.25%, nor is it identical with that rate which if uniform would result in four years in the same divergence between silver and gold as was produced by the four successive rates 0, 50, 10 and 5%s; this would be 14.70%. For the statistical purposes of Part II., however, the latter method is adopted for simplicity and is doubtless correct within the limit of error.

§ 6.

It may seem that the subject of this chapter can have no practical application. In Part II we shall see that this is not the case. A government bond, for instance, is a promise to pay a specific series of future sums, the price of the bond is the present value of this series and

[1] It may be proved that this definition of a_a, satisfies the general condition of an average, viz., that a_a reduces to a_1, a_2, etc., when the latter are all equal, whether i_1, i_2, etc. (and j_1, j_2, etc.,) be all equal or not.

the "interest realized by the investor" as computed by actuaries is nothing more nor less than the "average" rate of interest in the sense above defined. Of course the investor puts no specific values on the individual yearly rates of interest of which the "interest realized" is the average, but that this interest is truly an average is attested both by the comparative stability of the rate of interest realized on long time bonds as compared with the fluctuations of the rate of interest in the short time money market (a stability which the rate realized on the bonds does not possess when near maturity[1]) and by the fact that interest realized on a very long bond, say 50 years, is often lower than on a 25 years' bond. This is explainable by the prevailing opinion that interest tends to fall, so that if the 50 years' investment were in two successive bonds of 25 years each, the interest realized in the second would be lower than in the first. The "actuarial average" of the two is equal to the interest realized on the 50 years' bond.

[1] This is abundantly verified by market quotations, as is also the fact that the interest realized to him who buys a bond and sells it again in a short time is even more variable than rates on money. Thus, if in a fortnight (in which no interest falls due) the bond advances ⅛, the speculator realizes at the rate of about 3% per annum; if the rise is ½, he realizes over 12%. The investor who holds a bond a long time realizes an interest which is an "average" of the oscillating rates of those who speculate during the interim.

CHAPTER VI.

ZERO AND NEGATIVE INTEREST.

§ 1.

Having established the truth and generality of the principle $1 + j = (1 + a)(1 + i)$, we next inquire what limits, if any, are imposed on the three magnitudes j, a, i. The foregoing equation seems to require that, when the appreciation is sufficiently rapid, the rate of interest in the upward moving standard should be zero or negative. Thus if $a = j$, the equation gives us $i = 0$. Again if $a > j$ then $i < 0$. For instance, if j, the rate of interest in wheat, is 8% and if gold appreciates relatively to wheat 20% per annum, we have $1 + .08 = (1 + .20)(1 + i)$ whence $i = -.10$; that is, the rate of interest in gold would be *minus* 10%!

Now it is clear that negative interest is impossible. Any possessor of $100 of gold (or its equivalent in goods which can be sold for gold) would hoard the gold rather than lend it at a loss. That is, the relation $i < 0$ is impossible and therefore also $a > j$ is impossible. Thus our magnitudes are restricted within certain limits, viz.,

$$\begin{matrix} i \geqq 0 \\ a \leqq j \end{matrix} \qquad (12)$$

or, in words, the rate of interest in a money which can be hoarded (without trouble, risk or expense) can never sink below zero and the money itself can never undergo an *expected* appreciation (relatively to another standard) greater than the rate of interest in that standard.

§ 2.

This last result will not seem mysterious when we reflect that the same cause, viz., hoarding, which prevents the interest from being negative also checks the expected rate of appreciation. An example will make this clear. It is a familiar fact that the expected rate of appreciation of real estate (relatively to money) can never be more rapid than the rate of interest (in money). If the latter is 5%, the (money) value of land can never advance faster than 5% per annum except when that advance is unforeseen.

The explanation is simple. If it were foreknown that certain land values would rise 10%, owners would be able to make twice as much by holding as by selling and investing the proceeds at 5%. The land would be hoarded. This decreases the supply and sends up the price until it is within at least 5% of the expected selling price one year hence. It thus happens that holding city lots for speculation comes to be regarded as a regular investment from which the same return is to be expected as from investing in a productive enterprise. The same could be said of wheat, cotton, or other speculation. Hoarding money is but a particular form of "holding for a rise." In all cases the process tends to lessen the rise—not to obliterate it but to make it equal to the rate of interest (in the standard in which the rise itself is measured).

In the case of appreciating money we saw that, of the two conditions $i \geqq 0$ and $a \leqq j$, the first was the more obvious, while in the case of appreciating real estate the second was the more obvious. The reason is that in both cases we are accustomed to think in terms of money. We say, "the rate of interest cannot be nega-

tive," "the expected rise of real estate cannot exceed the rate of interest," but, as we have seen, each of these statements implies another. It may strike the reader as a new idea that land speculation presents an actually existing case of zero interest. And yet this is undoubtedly so, if we take as our standard an acre of speculative land. The land speculator is "making money" but not "making land." His 100 acres remains 100 acres. We could even imagine all loan contracts translated from "dollars" into "acres" (though still keeping money as the *medium*). A debt of 100 "acres" would be liquidated one year hence by 100 "acres" and interest would be *nil*. There is no intrinsic reason why this same zero interest (for absolutely safe loans) might not sometime be true of money, and this without implying any change in the abundance of capital.

§ 3.

It is important to emphasize the fact that these limits imposed on the magnitudes i and a come from the possibility of hoarding money without loss. If the money were a perishable commodity, such as fruit, the limit would be pushed into the region of negative quantities. 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.[2] If the weight doubles yearly, such "dollars" cannot be hoarded without growing fewer with time, and if interest was previously 5% it will now be minus 47½%, for he who borrows $100 (2580 grains) to-day

[1] Cf. Böhm-Bawerk, "Positive Theory of Capital," pp. 252, 297.

[2] Such a definition for either the gold or silver "pound" is implied in Professor Foxwell's proposal for a "climbing" ratio.

will pay back $52.50 (2709 grains) one year hence. Again we find a real example by recurring to land speculation. Since to hold land usually involves paying taxes upon it, the rate of interest in terms of such "acres" is often, in actual fact, negative.

§ 4.

In this connection, an apparent difficulty needs to be explained. If gold should appreciate up to the maximum limit so that the interest rate were zero for safe loans, would not all investment cease? What object would a capitalist have in investing when he could gain as much by hoarding? Nothing could be more natural than the fallacy here involved and we ought not to be surprised on finding it among the arguments of certain bimetallists. For example, the Free Coinage Convention at Memphis, Tenn., a year ago, adopted the following resolution: "The demonetization of either silver or gold means a fall in the prices of commodities, a diminution of the profits of legitimate business, a continuing increase in the burden of debts, with consequent hard times, idle labor and *idle capital, the increasing value of money promising a surer return to a hoarded dollar than to an invested one.*"

The error here contained is the ancient confusion of capital and money. It is true that a *limited*[1] amount of gold would be withdrawn and hoarded, but this would not check the investment of capital any more than the similar withdrawal of so much copper. If a hoarded dollar yields a "sure return," a hoarded *dollar's*

[1] As in the case of land, the hoarding would reach its limit when it had raised the value (marginal utility) of present money up to the present value of future money. Hoarding beyond this point would bring loss.

worth of goods as surely brings loss. The possessors of stocks of cotton or grain, machinery or ships, the prices of which are falling, have no disposition to keep them unemployed. A retail dealer fills his store with carpets and gives the wholesale dealer his note for three months. He is said to borrow "money" but he really borrows carpets. He may pay no (money) interest and yet the wholesaler gains by the loan. He is saved a loss in the (money) value of the carpets which he would have incurred had he failed to get rid of them. In terms of carpets he may be making 5%. Similar considerations apply when the loan is negotiated through a third party, as a bank, and apply in fact to all forms of loans and investments. But the case supposed is so highly hypothetical and the error involved has been so often explained[1] that no further treatment of it seems necessary here. However turned or twisted and from whatever point of view examined, lending "money" at no per cent. may under certain circumstances be a very profitable transaction. It goes without saying that the foregoing conclusions apply only to "pure" or "net" interest. That part of market interest representing risk, and that part representing commissions for transacting the business of lending and borrowing would not disappear.

[1] *E. g.* F. A. Walker, "Money," (New York, 1878), p. 94.

PART II. FACTS.

CHAPTER VII.

INTRODUCTION.

§ 1.

No study of the relation between appreciation and interest would be complete without verification by facts. In imaginary illustrations, such as those used in Part I, it is easy to make calculations agree to the last decimal place; but the figures in which we are really interested must come from actual market quotations. Through these alone can we test our assumption that foresight in regard to the appreciation or depreciation of money actually exists.

At the outset the question arises, how can a merchant be said to foresee the appreciation of money? Appreciation is a subtle conception. Few business men have any clear ideas about it. Economists disagree as to its definition, and statisticians as to its measurement. If you ask a merchant whether he takes account of appreciation, he will say he never thinks of it, that he always regards a dollar as a dollar. Other things may change in terms of money, but money itself he is accustomed to think of as the one fixed thing. But though we do ordinarily regard the value of a dollar as a fixed magnitude, this does not really prevent our taking account of its changes. In our daily life we think of the earth as fixed, but we virtually take account of its rotation whenever we speak of sunrise or sunset. During a period of inflation the ordinary man conceives the premium on gold as a rise of

gold not a fall of money. But if he takes account of rising wages and rising prices he arrives at the same results as if he had thought of falling money. We need not ascribe to the practical man any knowledge of "absolute" appreciation, but whatever absolute appreciation is, it is included, though unseparated, in the practical man's forecast in terms of money of all the economic elements which concern him—prices of his product, cost of living, wages of his workmen, and so forth. If he expects falling prices and rising wages, as is often the case, he may be said to foresee an appreciation of gold as defined by the ordinary bimetallist and at the same time a depreciation as measured by difficulty of attainment. What is more, he takes account of the relative importance, as affecting himself, of the various changes which he expects, and not of their relative importance in the elaborate averages of the statistician, averages which may emphasize some commodity or some labor whose fluctuations have absolutely no concern for him. His effort is not to predict the index numbers of Sauerbeck or Conrad, but so to foresee his own economic future as to make reasonably correct decisions, and in particular to know what he is about when contracting a loan. If gold appreciates in such a way or in such a sense that he expects a shrinking margin of profit, he will be cautious about borrowing unless interest falls; and this very unwillingness to borrow, lessening the demand in the "money market," will bring interest down. Further explanation of this process is postponed to Chapter X.

§ 2.

Before proceeding to specific statistics, it is important to emphasize the broad fact that in general, business foresight exists and that the accuracy and power of this fore-

sight is greater today than ever before. It is one of the distinguishing marks of modern business. Multitudes of trade journals and investors' reviews have their sole reason for existence in supplying data on which to base prediction. Every chance for gain is eagerly watched. An active and intelligent speculation is constantly going on which, so far as it does not consist of fictitious and gambling transactions, performs a well known and provident function for society. Is it reasonable to believe that foresight, which is the general rule, has an exception as applied to falling or rising prices? Or, if so, can the academic bimetallist assume himself possessed of a foresight of which he says the practical man is incapable? It is the practical man's business to foresee. It is he who first gathers the facts and statistics on which forecasts must be based. It is he who watches the trend of past price movements and notes the slightest signs of a change. And it is in his trade journals that we find the first discussions of the probable effect of gold discoveries or silver legislation on prices and trade. The theorist can aid in these predictions only by supplying or correcting the principles on which they are constructed.

CHAPTER VIII.

GOLD AND PAPER.

§ 1.

General evidence that an expected change in the value of money has an effect on the rate of interest can be obtained from several sources. Municipalities often find they can sell gold bonds at better terms than currency or coin bonds. The very desire of lenders to insert a gold clause in their contracts is strong proof that they are willing to yield something for it. This was strikingly shown in California[1] during the war inflation period, where for a time, gold contracts could not be enforced and in consequence interest rates were very high.

During a period of progressive paper inflation it is also true that interest is high even when the contract is drawn on a paper basis. As we shall see at a later stage, this was partially true during the civil war, though its effect was not very pronounced owing to the over sanguine hopes of an early termination of the war and a return to a specie basis. It was also true during the currency troubles in the thirties. Raguet wrote:[2] "In the six months before the suspension of '37, although the amount of the currency was greater than it had ever been before in the United States, yet the scarcity of money was so great that it commanded from 1% to 3% per month." It would be unsafe to found much inference on these facts. Their significance may be partly

[1] Bernard Moses, "Legal Tender Notes in California," *Quarterly Journal of Economics*, October, 1892, p. 15.

[2] "Currency and Banking," (1839), p. 139; also Sumner, "History of Banking," (1896), p. 264.

or wholly different. But they raise a presumption in favor of the theory here advanced and against the theory that the rate of interest is lowered by inflation of the currency.

§ 2.

A definite test must be sought where two standards are simultaneously used. An excellent case of this kind is supplied by two kinds of United States bonds, one payable in coin and the other in currency. From the prices which these bonds fetch in the market it is possible to calculate the interest realized to the investor. The currency bonds are known as currency sixes and mature in 1898 and 1899. The coin bonds selected for comparison are the 4%s of 1907. The following table gives the rates of interest realized in the two standards together with the premium on gold.

RATES OF INTEREST REALIZED FROM DATES MENTIONED TO MATURITY.[1]

	Coin.	Currency.	Price of Gold.		Coin.	Currency.
Jan., 1870 .	6.4	5.4	119.9	Jan., 1879 . .	3.7	4.5
July, 1870 .	5.8	5.1	112.2	Jan., 1880 . .	3.8	4.0
Jan , 1871 .	6.0	5.3	110.8	Jan., 1881 . .	3.3	3.4
July, 1871 .	5.8	5 0	113.2	Jan., 1882 . .	3.0	3.5
Jan., 1872 .	5.3	4.9	109.5	Jan., 1883 . .	2.9	3.3
July, 1872 .	5.6	5.0	113.9	Jan., 1884 . .	2.6	2.9
Jan., 1873 .	5.7	5.1	111.9	May, 1885 . .	2.7	2.7
July, 1873 .	5.4	5 0	115.3	Jan., 1886 . .	2.6	2.6
Jan., 1874 .	5.0	5.0	110.3	Jan., 1887 . .	2.3	2.6
July, 1874 .	5.0	4.9	110.7	Mar., 1888 . .	2.3	2.9
Jan., 1875 .	5.1	4 7	112.6	Jan., 1889 . .	2.2	2.6
July, 1875 .	5.1	4.4	117.0	May, 1890 . .	2.1	2.6
Jan., 1876 .	4.7	4.4	112.9	July, 1891 . .	2.4	3.0
July, 1876 .	4.5	4.2	112.3	Jan., 1892 . .	2.6	3.1
Jan., 1877 .	4 5	4.4	107.0	Mar., 1893 . .	2.8	3.1
July, 1877 .	4.4	4.3	105.4	Nov., 1894 . .	2.7	3.5
Jan., 1878	5.0	4.6	102.8	Aug., 1895 . .	2.8	3.6
July, 1878 .	3.9	4.4	100.7	Aug., 1896 . .	3.2	4.3

[1] This table has been obtained by the aid of the usual brokers' bond tables. In the case of currency bonds, it was only necessary to deduct accrued interest (if any) from the quoted price and look in the table for the interest which corresponds to the price so found and the num-

Several points in this table deserve notice. The quotations for 1894, '95, '96 show a considerably higher rate of interest in the currency standard than in the coin standard as well as a higher rate in both standards than in previous years. The difference is between 2.7% and 3.5% in 1894, and between 3.2% and 4.3% in 1896. Both the increase and the wedging apart of the two rates are explainable as effects of the free silver proposal and its incorporation (July 1896) in the platform of the Democratic party. A free silver law would *certainly* reduce the value of returns from currency bonds and *possibly* also of those from coin bonds. If the mere dread of inflation has this effect, it might be supposed that, during the period of actual inflation, the discrimination in favor of coin bonds would be even greater. But we find the exact opposite to be true. In 1870 the investor made 6.4% in gold but was willing to accept a return of only 5.4% in currency. This fact becomes intelligible in the light of the theory which has been explained. It meant the hope of resumption. Just because paper was so depreciated there was a prospect of a great rise in its value. It was not until 1878 when the prospect of a further rise disappeared that the relative position of the two rates of interest was reversed. After resumption in 1879 the two remained very nearly equal for several years until recent fears of inflation again produced a divergence.

ber of years to maturity. In the case of gold bonds, since the quotations are given in currency, it is necessary to divide the quoted price by the price of gold in order to obtain their price in gold (*i. e.*, "coin") and then proceed as above indicated. The quotations of prices of bonds and gold are the "opening" prices for the months named and are taken from the *Financial Review*, 1895, the *Commercial and Financial Chronicle*, the (New York) *Bankers' Magazine* and the *Bankers' Almanac*. After 1884, January quotations were not always available.

§ 3.

We have found so far that the facts agree with the theory previously laid down. But it is necessary further to inquire *how close* is this agreement. For this purpose, the figures just given are of little value. They represent the rates of interest realized for the periods between the dates named and the times at which the bonds mature. These periods are not the same for the two bonds. As has been explained such a rate of interest is a sort of average of the rates of interest for the individual years of the periods in question. Thus, in the foregoing table, the rate of interest in currency opposite January, 1870, is 5.4%. This is the rate realized between 1870 and 1899. It is a sort of average of, say, the rate realized between 1870 and 1879 and between 1879 and 1899. As we shall see the former was 6.3% and the latter, 4.5%.

It is clear that we must seek the rates of interest in the two standards for the same periods. In the following table the periods selected terminate on Jan. 1, 1879, the date of resumption of specie payments. We may say, to fix our ideas, that the figures represent the rate of interest realized to investors who buy the bonds at the dates mentioned and sell them on January 1, 1879; but it is obviously unnecessary to consider the bonds as actually either bought or sold, but only as owned. This is no new use of terms. Business men reckon securities in their assets at their market prices and if these prices rise or fall they count themselves as gainers or losers. This gain (or loss) added to the annual interest receipts and properly distributed over the time considered gives the rate of interest realized.

RATES OF INTEREST REALIZED FROM DATES MENTIONED TO JANUARY 1, 1879, (DATE OF RESUMPTION[1]).

	Coin.	Currency.	Appreciation of Currency in Gold.	
			Expected.	Actual.
	j	*i*	*a*	
January, 1870. . .	7.1	6.3	.8	2.1
July, 1870	6.2	5.7	.5	1.4
January, 1871. . .	6.7	6.3	.4	1.3
July, 1871	6.4	5.7	.7	1.8
January, 1872. . .	5.9	5.7	.2	1.3
July, 1872	6.2	5.7	.5	2.1
January, 1873. . .	6.5	6.2	.3	2.0
July, 1873	6.2	6.0	.2	2.8
January, 1874. . .	5.6	6.1	—.5	2.1
July, 1874	5.7	5.8	—.1	2.4
January, 1875. . .	6.0	5.4	.6	3.1
July, 1875	6.1	4.2	1.8	4.9
January, 1876. . .	5.4	4.1	1.2	4.3
July, 1876	5.2	2.4	2.7	4.9
January, 1877. . .	5.5	4.0	1.4	3.5
July, 1877	5.7	3.1	2.5	3.6
January, 1878. . .	8.2	6.0	2.1	2.8
July, 1878	4.8	2.6	2.1	1.4

[1] Since the figures in this table represent the rates of interest which will render the "present value," at the date of purchase, of all the future benefits to January, 1879, equal to the purchase price, they can be calculated by Horner's method as indicated in Chapter V. But the method which has been adopted is less laborious, as it enables us to use the bond tables. It can best be explained by an example. The opening price, January, 1870, of currency 6's was 109⅛, and January, 1879, 119½, which require no correction for accrued interest. Our problem is, if a man spends $109⅛ in 1870 and receives $119½ in 1879 with $6 per annum (semi-annually) in the meantime, what rate of interest does he realize? Now it is clear that the answer is the same if all the benefits and sacrifices involved are doubled or halved or increased or decreased in any common ratio. Let us then divide them all by 1.19½. Then $91.3 would be paid in 1870 for $100 due in 1879, and $5.02 per annum in the meantime. That is, the interest realized is exactly as if the bond were a 5.02% bond maturing in 1879 and bought at 91.3 in 1870. This can readily be obtained from the bond tables by interpolating between the figures for a 5% and a 5½% bond purchased at 91.3 and having 9 years to run. For a 5% bond we obtain 6.28%, and for a 5½% bond, 6.81%. Hence for a 5.02% bond the result is 6.30%, or 6.3%, The third column gives what may be called the expected rate of appreciation of currency in terms of gold, that is, that rate of appreciation which would have made the

From this table we see that the interests realized for the period, January, 1870 to January, 1879, were, in coin, 7.1%, and in currency, 6.3%, which, according to the formula $1 + j = (1 + i)(1 + a)$, gives a rate of appreciation of .8%. This may be called the "expected appreciation". The actual rate of appreciation was 2.1%. That is, the estimated appreciation was about two-fifths of the appreciation as it really turned out. Thus those who held currency sixes had the better investment. In fact it is well known that many speculators grew rich by exchanging gold bonds for currency bonds at this time. The table shows the same misjudgment in July, 1870, January, 1871, and July, 1871. From then to July, 1874, the outlook for resumption grew gloomy, due no doubt to the strong greenback sentiment. The inflation bill of 1874 actually produced a prospect of negative appreciation, *i. e.*, depreciation. This bill was vetoed by President Grant, and in December of that year the bill for resumption was passed by the Senate. Accordingly January, 1875, opened with a more hopeful estimate. The bill became law on the 14th of January and there was an immediate rise in the "expected" appreciation which, from then on, averaged 2%. But during the same period the actual appreciation from the dates named

two interest rates equally profitable. It is obtained from the formula $1+j=(1+i)(1+a)$. The last column gives the actual rate of appreciation between the dates mentioned and January 1, 1879. This is calculated from the quoted prices of gold. Thus the opening price of gold January, 1870, was 119.9, and January, 1879, 100. Hence currency appreciated in nine years in the ratio 100 to 119.9, which is at the rate of 2.1% per annum. If the appreciation proceeded uniformly this method would be strictly correct. As it is, a more elaborate method would be required, in accordance with the principles explained in Chapter V, to take account fully of the fluctuations of the annual appreciation. But for our present purposes, and for results worked out to but one decimal place, the simpler method here adopted is sufficiently correct.

to January, 1879, averaged 3.6%, so that even after the government promised resumption, investors and speculators did not put implicit confidence in that promise, the "expected" appreciation being only a little more than half the actual appreciation. This corresponds to the well known fact that the resumption act was then looked upon as a political manœuvre, likely to be repealed.

§ 4.

It should be observed that the method employed to determine the rate of interest realized is open to one danger. It correctly represents the rate of interest actually realized between two dates, but, unless the later of the two dates is maturity, it does not necessarily represent the rate of interest *expected* at the first date. The investor could not know in January, 1870, what the price of bonds would be in January, 1879, unless the bonds matured at that time. To compare, in 1870, the relative advantages of coin and currency bonds for the period 1870–79, a forecast was necessary, not only of the relation of currency to gold, but also of the prices of the two bonds in 1879. These prices in turn depend on a new forecast made in 1879. It follows that a mistake in this forecast of 1879 and embodied in the prices of that year will affect the rate of interest realized between 1870 and 1879 in the same manner as a mistake of the opposite kind in the forecast of 1870.

But in most cases the method given is sufficiently exact. For, although in 1870 it would have been impossible to predict exactly the prices of the two bonds in 1879, yet it can usually be depended upon that any great change in price is apt to affect both alike (provided they have approximately the same time to run) and thus

eliminates itself for the most part in the comparison. For this reason it is clearly better to take bonds whose dates of maturity approximately correspond, in order that any abnormal influence in 1879 may affect both alike, than to take, for instance, currency sixes of 1899 and coin bonds of 1881.

From this table it will be seen that the rates realized to investors in bonds of the two standards differed but slightly until 1875, when the fall of Indian exchange began. The average difference before 1875 was .2% while the average difference since 1875 has been .7%, or more than three times as much.

From 1884 exchange fell much more rapidly than before, and the difference in the two rates of interest rose accordingly, amounting in one year to 1.1%. Since the two bonds were issued by the same government, possess the same degree of security, are quoted side by side in the same market and are in fact similar in all important respects except in the standard in which they are expressed, the results afford substantial proof that the fall of exchange (after it once began) was discounted in advance. Of course investors did not form perfectly definite estimates of the future fall, but the fear of a fall predominated in varying degrees over the hope of a rise.

The year 1890 was one of great disturbance in exchanges, the average for the first six months being 17.6 and for the last six months 19.3. The gold price of the silver bonds rose from an average for the first six months of 73.8 to 83.5 for the last six months, but the rise in their silver price was only from 100.6 to 103.7, showing that the increase of confidence in the "future of silver" was not great and in fact only reduced the disparity in the interest from 1.0 to .8%.

This great rise in exchange and the slight revival in silver securities occurred simultaneously with the passage of the Sherman act of July, 1890, by which the United States was to purchase four and a half million ounces of silver per month. There can be little doubt that the disturbance was due in some measure to the operation or expected operation of that law.

This is not the only case in which the relative prices of rupee paper and gold bonds were probably affected by political action. The smallest difference (since 1874) in the two rates of interest occurs in 1878, which was the year of the Bland act and the first international monetary conference.

After the closure of the Indian mints on June 26, 1893, exchange rose from 14.7 to 15.9, the gold price of rupee paper from 62 to 70 and consequently its rupee price from 101.2 to 105.7.

§ 2.

The preceding comparisons serve to establish the influence of the divergence between the standards on the rates of interest, but afford no measure of that influence. The rates of interest which have been deduced for gold bonds were the rates realized if the bonds were held to maturity. The rupee bond had no fixed date of maturity and had to be treated as a perpetual annuity, although it differed from such an annuity in being terminable by the government at par on three months' notice.

In order to measure the extent to which the fall of silver was allowed for by investors, it is necessary to examine the rates realized during specified periods. The following table gives the rates realized between the first five and the last five years of the period of falling exchange.

RATES OF INTEREST REALIZED ON INDIA BONDS FOR PERIODS SPECIFIED.[1]

	Silver. *j*	Gold. *i*	Appreciation of Gold in Silver.	
			Estimated. *a*	Actual.
1875–91	4.1	3.5	.6	1.6
1876–92	4.3	3.6	.7	1.8
1877–93	4.5	3.6	.9	2.1
1878–94	4.6	3.8	.8	2.6
1879–95	4.8	3.9	.9	2.4
Average	4.5	3.7	.8	2.1

The average estimated appreciation for the periods taken is .8%, which is slightly more than one third of the average actual appreciation, 2.1%. Perhaps to obtain the net estimate of investors as to the fall of exchange we ought to deduct from the .8% another .1% due to the trouble and expense of obtaining English money for Indian exchange, for it will be remembered that even before the fall of exchange began, the rates yielded to investors differed by .2%.[2] We thus obtain .7% as the extent to which, on the average, investors protected themselves against the fall in silver during the period

[1] The methods by which the first column is computed are the same as those explained in the preceding chapter, account being taken of the fact that the price quotations for rupee paper are not "flat," so that no corrections for accrued interest need be applied. For computing the second column a more laborious method was necessary, due to the fact that the quotations are not continuous for the same bond. The earlier ones are for a 4 % bond and the later for a 3 % bond. The buyer of a 4 % bond is regarded as converting it into the 3 % at the current price in 1888, the date of maturity of the earlier bond. As no bond tables apply to such conversions, tables of present values were used and that rate was found by trial (and interpolation) which would make the present value of all benefits equal to the purchase price.

[2] This probably included besides the brokerage and trouble of obtaining and selling "interest bills", the risks even at those early dates of a falling or fluctuating exchange.

named. The remaining fall, 1.4%, implies a relative loss to the holders of rupee paper and a gain to the holders of gold bonds. Had the business world fully foreseen the fall of Indian exchange, rupee paper would have been cheaper or gold bonds dearer than they actually were, or both. The rates of interest realized in the two standards during the periods mentioned would have been spread apart (at most) 1½% further.

§ 3.

The question arises at this point, how is this 1½% to be distributed? Did investors overestimate silver or underestimate gold most? There is nothing in the foregoing investigation to decide this vexed question. Our quantitative result is purely a differential one. But other sorts of evidence point strongly to the conclusion that the major part of the miscalculation was on the silver side. So far as "demonetization" is concerned, the effect on silver must have been, according to any reasonable view, greater than the effect on gold, and in consequence any unforeseen part of these effects would be probably greater in the case of silver than in the case of gold. So far as production is concerned, the disturbance in silver was far greater than that in gold either when reckoned absolutely or in proportion to the total masses whose values would be affected. Finally, since the break-down of bimetallism in 1873–4, the world-wide agitation to "rehabilitate silver" has held out a delusive hope which must have acted to give the silver bonds a higher price than they "were worth." The strength of this agitation need scarcely be dwelt on here. It found expression in many bills in Congress which were never passed and in two which were passed, in numerous pro-

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posals in Germany, in silver commissions there and in England, and in three international conferences. If any further evidence is needed that this agitation contributed to mislead investors as to the future of silver, it can be found by examining the discussions and mistaken prophecies on silver, contributed to the *Economist* and other trade journals. It would seem extremely improbable that these hopes for the "rehabilitation of silver" have acted to depress the price of gold bonds rather than to raise the price of silver bonds.

For these reasons it seems likely that, of the 1½% relative gain or loss, not more than half represents an unexpected gain on the gold bonds. That is, the interest realized on the gold bonds, if higher than it should be, was not higher by more than ¾%. If this be true of one gold investment it was undoubtedly true of all gold investments and of the whole money market in London. This affords therefore, a probable upper limit to the debtor's loss in England for contracts made since 1874. But even if the miscalculation was *twice* as great for gold as for silver, the upper limit becomes only 1%.

Our result therefore, is that the average debtor's loss in London for contracts made since the fall of silver began, was probably less than ¾% and almost certainly less than 1% per annum. In Chapter X we shall attempt to find a lower limit.

§ 4.

A great deal has been written on the loss incurred by India in paying her annual interest to England in gold, but little is said of the interest paid at home in silver. Of India's national debt, about £100,000,000 are in gold and *Rx* 100,000,000 in rupees. This rupee debt was

almost all in force twenty years ago and was then equivalent to £100,000,000, but today it is worth only £60,000,000. The difference may mean an added burden of gold debt, but it may also mean a lessened burden of silver debt and it is by no means impossible that, so far as national indebtedness is concerned, India is better off than she would have been if a bimetallic tie between silver and gold had been maintained.

In this connection it may be worth while to point out a curious oversight in Mr. Elijah Helm's recent book.[1] In Chapter XVI he proposes the conversion of the 4% rupee debt into a 3% gold debt and, assuming very plausibly that the gold bonds could be sold for 99, shows that so long as exchange remained at its present level, there would be an annual saving of interest of *Rs* 160,000. This is correct enough, but he next attempts to show that if exchange should gradually fall there would continue to be a saving until it should sink to 10½d. This is entirely erroneous. It takes account only of the annual interest and not of the deferred principal which if in gold, grows progressively onerous in terms of silver. It is odd that a bimetallist who portrays so vividly the evils to the debtor from an appreciating gold principal should have found himself in the position of deliberately advising a debtor to adopt that standard to lessen his burden of interest. In the same year that Mr. Helm's book was written, the Indian Government converted its 4% rupee debt, not into gold, but into another rupee debt at 3½%.

[1] "The Joint Standard," (London and New York, 1894.)

CHAPTER X.

MONEY AND COMMODITIES.

§ 1.

In attempting to apply our theory to periods of rising and falling prices, we are met by the difficulty that comparison can only be made between *successive* periods. We can learn what the rate of interest has been since 1873, but we cannot know what it *would have been* if bimetallism had been extended or if the world's currency had been so expanded as to have prevented the fall of prices. Without this missing term of comparison, it is difficult to measure the influence of the progressive scarcity of gold, if such there has been, upon the rate of interest. It does not answer the purpose merely to compare the rates of interest before and after 1873. No two periods are so alike industrially that we can say they differ only in the state of the monetary standard. Other influences innumerable affect the "value of money" on the money market. Individual quotations at different times on the same market vary from one half of one per cent. to fifty per cent. while yearly averages vary from one to seven per cent. We can never wholly eliminate all causes but one, and even partial elimination is possible only by taking averages for periods of several years each. In spite of these difficulties however, certain general conclusions can be established.

§ 2.

Our main problem is not concerned with high and low prices but with rising or falling prices. But we

note in passing an important generalization in regard to price levels and the rate of interest. Shall we associate high interest with high prices or with low prices? To answer this question the following table is constructed. Two rates of interest are given for each decade. The

MARKET RATES OF INTEREST IN RELATION TO HIGH AND LOW PRICES.[1]

		1824 to 1831 incl.	1832 to 1841 incl.	1842 to 1851 incl.	1852 to 1861 incl.	1862 to 1871 incl.	1872 to 1881 incl.	1882 to 1891 incl.
London,	High prices	3.8	4.4	3.6	5.4	5.1	3.7	3.0
"	Low prices	3 2	3.2	2.6	3.0	2.6	2.5	2.5
New York,	High prices	. .	. .	.	9.1	7.4	7.0	5.3
"	Low prices	. .	. .	. .	9.1	6.7	5.1	5.1
Berlin,	High prices	. .	. .	. .	. .	4.6	3.7	3.3
"	Low prices	. .	. .	. .	. .	3.4	3.2	2.7
Paris,	High prices	. .	. .	. .	. .	. .	4.1	2.6
"	Low prices	. .	. .	. .	. .	. .	2.4	2.6
[2] Calcutta,	High prices	. .	. .	. .	. .	. .	6,2	5.4
"	Low prices	. .	. .	. .	. .	. .	5.6	6.2
[3] Tokyo,	High prices	. .	. .	. .	. .	. .	12.3	10.1
"	Low prices	. .	. .	. .	. .	. .	12.0	10.1
[4] Shanghai,	High prices	. .	. .	. .	. .	. .	. . .	6.0
"	Low prices	. .	. .	. .	. .	. .	. . .	5.7

[1] This table is constructed from the data given in the Appendix. For New York, the rates for the first decade are averaged from the column in the Appendix headed "60 days," and are not to be compared with those for the remaining decades, which are averaged from the column headed "Prime two name 60 days." The index numbers of prices which have been employed are those of Jevons (1824–51) and Sauerbeck (1852–91) for England, Soetbeer and Heinz for Germany, the Aldrich Senate report for the United States and France, and the Japanese report for India, Japan and China. (See Appendix, § 3). The table ends in 1891 because there are no index numbers for the United States since that year.

[2] For Calcutta the rate for the bank of Bengal is employed, no "market" rate being available. The first column is for 1873–81 instead of 1872–81, for the reason that no index number for 1872 is available.

[3] For Tokyo the first column is for 1873–81 for the same reason.

[4] For Shanghai the period is 1885–93 instead of 1882–91, for the reason that the available rates begin in 1885 and the index numbers end in 1893.

first, opposite "high prices," is the average rate for those years of the decade whose price levels, as shown by an index number, were above the average price level for the whole decade; the second is the average rate for the years whose prices were below the general average.

Of the 21 comparisons contained in this table, 17 show higher rates for high-price years than for low-price years, one shows the opposite condition and three show equal rates in the two cases. As the table covers 68 years for London, 40 for New York, 30 for Berlin, 20 for Paris, 19 each for Calcutta and Tokyo, and 9 for Shanghai, or 205 years in the aggregate, the result may be accepted with great confidence that high and low prices are usually associated with high and low interest respectively.

There are two probable reasons for this connection. One is that high general prices usually mean scarcity of capital rather than abundance of money, while low prices generally mean abundance of capital, not scarcity of money. This corresponds to the observations of Jevons on the relation of the rate of discount to the price of wheat;[1] the other reason is connected with periods of speculation and depression and will be discussed in § 12.

§ 3.

The relation of high or low prices to the rate of interest must not be confused with the relation of *rising* or *falling* prices to the rate of interest[2], to which we now turn.

[1] "Investigations in Currency and Finance," (1884), p. XIV.

[2] de Haas appears to have fallen into this confusion both in his criticism of Jevons and in his treatment of statistics. See "A third element in the rate of interest," *Journal of the Royal Statistical Society*, March, 1889.

It was predicted by Mr. Gibbs,[1] formerly a director of the Bank of England, and by other eminent bimetallists that the progressive scarcity of gold would raise the rate of interest. Such a scarcity makes a stringency in the money market, and the banks, each struggling to attract reserves from the others, will raise their rates. This prophecy, however, has not been fulfilled. Scarcely had Mr. Gibbs made his prediction when the rate fell enormously. Some monometallists have argued from this fact that there has been no appreciation of gold[2]. But the *theory* that appreciation raises interest has been confidently affirmed on both sides and has even received the stamp of approval of Mr. Giffen.[3] It is, however, utterly

[1] "The Bimetallic Controversy," (London, 1886), pp. 19, 231, 245–8–9, 373.

[2] Report of the Gold and Silver Commission, (1888), p. 120; also Professor Laughlin in *Quarterly Journal of Economics*, Vol. I., p. 344.

[3] "Essays in Finance," (2d series, 1886), p. 70. "The years of *falling* prices and *rising* prices also correspond as a rule with those years in which high rates and low reserves, and low rates and high reserves are combined." This (so far as prices and interest are concerned) is not only the exact opposite of the truth but it is flatly contradicted by the few figures which Mr. Giffen himself brings forward. Of these he says: " . . in years like 1865 and 1866 with which the Table begins, there is an obvious connection between the low reserve and high rate of discount of those years and the high Index No., leading in the following [!] years 1867–71 to a simultaneous fall in the Index No. and the rates of discount . . " He adds: " . . the low prices rather succeed the high discount rates than exactly correspond . . " Coming to the recent period of gold contraction, he says: "Turning to the rate of discount, we find the facts once more in correspondence. What we find first is a striking disturbance of the money market at the maximum period of high prices, 1871–73 [a period of *rising* prices and high interest], when the contraction of gold begins." Of the period 1875–79 (falling prices and low interest), he writes: "With a minimum average monthly rate of 2 per cent in each year, the following maximum monthly rates were nevertheless touched, viz": [$4\frac{1}{2}$, $4\frac{5}{8}$, $4\frac{3}{8}$, $5\frac{5}{8}$, $4\frac{1}{2}$ %s]. "In the present year (1885) when with dull trade and low prices the reserve should be full and discount rates low, we find that with a minimum of 2 per cent. there is again to be a comparatively high maximum (4 %) within the year."

at variance with facts. That an *abnormally* high or low bank reserve is correlated with low and high interest is abundantly justified in theory and verified in practice.[1] But the *normal* bank reserve itself shrinks with a shrinkage of gold and in consequence the inference that a contraction of the general gold supply will raise interest is fallacious.[2]

When prices are rising or falling, money is depreciating or appreciating *relatively* to commodities. Our theory would therefore require high or low interest according as prices are rising or falling, provided we assume that the rate of interest in the commodity standard should not vary. This assumption would be thoroughly justified only in case the two periods were economically alike in all respects except in the expansion or contraction of credit and currency. In the following

"To sum up—what I have to say of the recent discount rates is that while there has been an undoubted fall in recent years, corresponding to the abundance of capital, yet the market has been fevered by the demands on the reserve . . " "The monetary history of recent years has accordingly been very like what was to be expected on the theory above set forth, assuming a contraction of gold to have occurred, . . finally the money market has been irritable and feverish in a remarkable manner during the period of contraction." Thus, beginning with a statement that years of falling and rising prices correspond to years of high and low interest, Mr. Giffen cites facts which show that the opposite is true, but proceeds complacently to compare the rates of periods of rising (or falling) prices with the prices of the *succeeding* period of falling (or rising) prices. As the period of falling prices in which he writes is unfinished, he can only say of it that the "money market has been irritable and feverish in a remarkable manner." Another monometallist, Clarmont Daniell, objects to bimetallism for India on the ground that it would deplete India of silver and raise the rate of interest. ("The Bimetallic Controversy," p. 257). On this point see § 5.

[1] See, *e. g.*, Giffen's "Essays," *ibid.*, or the diagrams in Clare's "Money-Market Primer," London, 1891; also F. M. Taylor, "Do we want an Elastic Currency," *Political Science Quarterly*, March, 1896, pp. 133–157.

[2] See, however, § 12, note.

table for London the periods are selected to correspond with the main movements of prices. Thus the period 1826–29 was a period of falling prices so that money appreciated in terms of commodities at the average rate of 4.2% per annum. This is indicated in the third column by the figure +4.2. In the period 1836–39 prices rose so that money fell at the rate of 2.3% per annum, indicated by —2.3.

LONDON RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES.[1]

	Bank.	Market. *i*	Appreciation of Money in Commodities, *a*	Virtual Interest in Commodities. (Market.) *j*
1826—29 . .	4.4	3.5	+4.2	7.8
1830—35 . .	4.0	3.2	0.0	3.2
1836—39 . .	4.7	4.2	—2.3	1.8
1840—44 . .	4.2	3.5	+5.9	9.6
1845—47 . .	3.7	4.2	—3.0	1.1
1848—52 . .	2.9	2.5	+1.2	3 7
1853—57 . .	4.1	5.3	—2.4	2.8
1858—64 . .	4.4	4.2	—3.0	1.1
1865—70 . .	3.8	3.6	+1.1	4.7
1871—73 . .	3.9	3.7	—6.2	—2.7
1874—79 . .	3.2	2.7	+4.3	7.1
1880—87 . .	3.3	2.6	+3.8	6.5
1888—90 . .	3.8	2.9	—1.4	1.5
1891—95 .	2.6	1.6	+3.8	5.5
Mean Variation,	.5	.7		2.6

[1] This table is constructed from the data in the Appendix. The third column is based on index numbers, (Jevons' for 1826–52, and Sauerbeck's for the remaining years). The index numbers for two dates, as 1826 and 1829, being given, their inverse ratio gives the relative value of money (in commodities), at those two dates. From these it is easy to calculate the average annual change in its value. Theoretically, since the loans here included run usually, perhaps 30 to 90 days, the quotations averaged should begin at the first of the two dates, and cease, say, 60 days before the second. But the index numbers are not always for definite points of time, nor can the interest quotations be subjected to such minute corrections without an immense expenditure of labor. Hence, the method adopted has been to average the rates for all the years of a period, *e. g.*, for the four years, 1826–29, while the "appreciation" is reckoned between those dates, and thus is an average for only three years. If the index numbers repre-

If this table be examined in successive periods, it will be found, in eleven out of thirteen sequences for bank rates and in ten out of thirteen for market rates, that interest is high or low according to the degree in which prices are rising or falling. Attention is called particularly to the period 1853–57 during which prices rose very fast simultaneously with and presumably because of the great gold production. The market rate of interest averaged 5.3%, which was far higher, not only than in any subsequent, but also than in any previous period, although it can scarcely be supposed that capital was less abundant. This fact has been commented upon by various writers, [1] and is usually attributed to trade activity and speculation. Such a reason, however, is not really explanatory unless the reason for the speculation is also given.

The theory here offerred, that the high rate represented an effort to offset the depreciation of money, not only affords a complete explanation but in connection with another fact soon to be noted, explains the trade activity also.

§ 4.

The following table for Berlin displays the same connection between price movements and interest.

sent the price levels at the middle of 1826 and of 1829, then the average interest rates ought in theory to include only the last six months of 1826, and the first four months of 1829. But it seems better to include too much at both ends, than to omit the averages for 1826 and 1829 altogether, for the reason that an average is the more valuable the greater the number of terms included. The method adopted also seems better than omitting either *one* of the extreme years, partly for the reason just given, and partly because both years usually belong to the same economic movement.

[1] *E. g.*, Sir Louis Mallet. Note to Report of Gold and Silver Commission, (1888) p. 120; and Jevons' "Investigations in Currency and Finance," (1884) p. 95. The latter will be again referred to.

BERLIN RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES.[1]

	Bank. i_1	Market i_2	Appreciation of Money in Commodities. a	Virtural Interest in Commodities. (Bank.) j_1	Virtual Interest in Commodities. (Market.) j_2
1851–52	4.0	. . .	−1.5	2.4	. . . .
1853–57	4.7	. . .	−3.3	1.2	. . . .
1858–64	4.3	3.7[1]	−2.2	2.0	1.4
1865–70	4.7	4.0	0.0	. . . .	4.0
1871–73	4.5	4.1	−4 1	. . . .	−0.2
1874–79	4.3	3.2	+3.1	. . . .	6.4
1880–83	4.3	3.4	−0.1	. . . .	3.3
1884–88	3.6	2.5	+2.9	. . . .	5.5
1889–91	4.0	3.1	−1.4	. . . .	1.7
1892–95	3.4	2.2	+5.2	. . . .	7.5
Mean variation, 1858–91	.3	.4	. . . .	. . . .	2.1

In the foregoing table the relation is observed in six out of nine sequences for bank rates (one being neutral) and in six out of seven for market rates.

For France, index numbers covering a wide range of articles are not available. Using those given in the Aldrich report for sixteen articles, we have :

PARIS RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES.[2]

	Bank.	Market.	Appreciation in Commodities.
1861–64	5.1		− 8.1
1865–70	3.2		+ 3.6
1871–73	5.3	4.6[2]	− 4.5
1874–79	3.1	2.6	+ 4.3
1880–86	3.2	2.8	+ 2.3
1887–90	3.1	2.6	− 5.1
1891–95	2.6	2.0	

[1] This table is constructed from the data in the Appendix. The average in the second column, marked (1), is for the years 1861–64, not 1858–64. The "appreciation" is calculated from the figures of Soetbeer and Heinz, as given in the Aldrich report.

[2] This table is constructed from the data in the Appendix. The average in the second column marked (2) is for the years 1872–73, not 1871–73.

Here the law is observed in five out of six sequences for bank rates and three out of four for market rates.[1]

It will be noted that the course of prices and interest has been very similar in England, Germany and France.

For New York we have the following table:

NEW YORK RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES AND WAGES.[2]

	Call.	60 days	Prime Two name, 60 days.	Appreciation of Money in Commodities.	Appreciation of Money in labor.	Virtual interest in Commodities, (60 days.)	Virtual interest in Commodities, (Prime.)	Virtual interest in Labor, (60 days.)	Virtual interest in Labor. (Prime.)
	i	*i*	*i*	*a*	*a*	*j*	*j*	*j*	*j*
1849–57 . .	6.2	9.2	. . .	−3.8	−1.1	5.1	. . .	8.0	. . .
1858–60 . .	5.0	7.4	. .	+6.4	−1.0	14.3	. . .	6.3	. . .
1861–65 . .	5.9	8.4	6.8	−20.2	−9.3	−13.5	−14.8	−1.7	−3.1
1866–74 . .	5.4	8.4	7.5	+4.7	−0.5	13.5	12.6	7.9	7.0
1875–79 . .	. .	. .	5.1	+7.9	+3.2	. . .	13.4	. . .	8.5
1880–84 . .	. .	. .	5.4	+0.6	−2.0	. . .	6.0	. . .	3.3
1885–91 . .	. .	. .	5.1	−0.2	−1.3	. . .	4.9	. . .	3.7
1892–95 . .	. .	. .	4.6	. . .	. . .	. . .	. . .	. . .	. . .
Mean variation, '66–91	. .	. .	.6	. . .	. . .	. . .	3.8	. . .	2.1

We find here the same association of appreciation and interest in all of the three sequences for call loans, in two of the three cases for 60 days paper (the third being neutral) and in three of the five cases for "prime" paper.[3] This is with reference to commodities. The same holds true in reference to wages. We find in the successive periods that interest is high or low according to the degree in which wages rise or fall. This is true in each of the three sequences for call loans, in two of the three for 60 days paper and in three of the four, for "prime" paper.

[1] Assuming that prices fell, 1891–95.

[2] This table is constructed from the data in the Appendix. The rates of appreciation are calculated from Falkner's figures for prices and wages in the Aldrich Report.

[3] Assuming that prices fell, 1892–95.

Perhaps the most remarkable fact in this table is the extremely low rate for 1875–79. The average is 5.1% which is the next but lowest in the table, the lowest being 4.6% for 1892–95. The extraordinary change in interest rates beginning in 1875 has been observed before; but its connection with the resumption act (as it seems to the writer) has been misconstrued. Thus William Brough referring to that act says:[1] "The mere announcement of our intention to put our money on a sound metallic basis had brought capital to us in such abundance that the resumption was not only made easy, but the normal rate of interest was reduced. . . . This remarkable reduction . . is explainable only on the ground of a large influx of foreign capital." But this explanation would naturally require a still lower rate of interest after resumption had been accomplished. As the facts are the opposite, there seems little room for doubt that the rate of interest was simply accommodating itself in some degree to the rapid appreciation involved in a return to specie payments.

§ 5.

The preceding statistics apply to gold standard countries. Index numbers for silver standard countries are not available prior to 1873. It is, however, *a priori* probable that the relative price movements in gold and silver standard countries before and after the rupture of the bimetallic tie in 1874 presented a strong antithesis. This event marked a change in gold standard countries from rising to falling prices, while in silver standard countries prices began to rise. Unless, therefore, prices in silver countries had been rising previous to 1874, and

[1] "Natural Law of Money," (New York, 1894), p. 124.

rising very fast indeed, the antithesis referred to must have existed. It is, consequently, of much interest to inquire whether the fall in the rate of interest which was so marked for gold countries was shared in equal degree by silver countries. The following table for periods of five years before and after the silver and gold standards began to diverge, throws some light on this problem.

AVERAGE BANK RATES IN GOLD AND SILVER STANDARD COUNTRIES BEFORE AND AFTER THE BREAKDOWN OF BIMETALLISM.[1]

	Calcutta.	Tokyo.	Shanghai.	London.	Berlin.	Paris.	New York.	Average for Silver Countries.	Average for Gold Countries.
1870–74. .	5.1	16.4	10.6	3.7	4.5	4.9	7.5	10.7	5.2
1875–79. .	6.5	14.6	9.2	3.0	4.2	2.9	5.1	10.1	3.8

While the results are not conclusive, they go to confirm our theory. In all gold countries the rate fell after the par of exchange with silver countries was broken, while in India it rose, and this in spite of the flow of capital to India from England and other gold countries. It is true that in Japan and China the rates fell. But this fall was much less than in the gold countries, whereas we should expect it to be much greater if the only influence at work were the migration of

[1] This table is constructed from the data given in the Appendix. Bank rates are selected rather than market rates, as the latter are not available for Calcutta and Shanghai. For New York, however, the rates for "prime two name 60 days paper" are employed. Although the United States and Japan were on a paper basis at the periods given, the premium on gold in the one case and silver in the other moved in opposite directions, affording, therefore, as great or greater antithesis than if the standards had been simply gold and silver. For the American premium see Chapter VIII, § 2; for the Japanese, see Appendix, § 3, note.

capital. Such extraordinary rates as ruled in China and Japan in the '70's must have been extremely sensitive to the influence of an influx of capital. Even though British investment in Japan or China may have been much less than in India, we should expect its tendency to reduce the native rate of interest to be more effective where that rate was 10% or 15% than where it was 5%. An added reason for a fall in rates in Shanghai and Tokyo is the narrowness of the areas affected by foreign capital, which, having little opportunity to penetrate inland, tends to glut the market in the open ports.

Turning to the period for which index numbers are available, we have the following table for India, Japan and China.

RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES IN CALCUTTA, TOKYO AND SHANGHAI.[1]

		Bank.	Market.	Appreciation in Commodities.
Calcutta	1873–75	5.3		+2.6
	1876–78	6.8		−11.0
	1879–85	5.9		+3.8
	1886–89	6.0		−2.6
	1890–93	4.3		−4.7
Tokyo	1873–77	14.0	12.0	−0.2
	1878–81	16.3	12.2	−13.3
	1882–86	12.8	10.3	+10.4
	1887–93	9.3	9.4	−2.8
Shanghai	1874–81	9.1		−1.4
	1882–88	7.5	5.8[1]	+1.3
	1889–93	7.0	5.8	−0.9

Here we find our theory confirmed in three out of four cases for India, two out of three for bank rates in Japan, and two out of three for market rates, one out of two for bank rates in China, while the one case for market rates is neutral.

[1] This table is constructed from the data given in the Appendix. The entry marked (1) is for 1885–88, not 1882–88.

Summarizing the cases for the seven countries examined, we find 57 favorable, and 16 unfavorable, to our theory, distributed as follows:

	England.	Germany.	France.	United States.	India.	Japan.	China.	Total
Favorable . .	21	12	8	8	3	4	1	57
Unfavorable .	5	3	2	2	1	2	1	16

We therefore conclude with great confidence that, "other things being equal," the rate of interest is high when prices are rising and low when prices are falling.

§ 6.

We turn next to the question *how far* the rate of interest has been adjusted to price movements. The formula $(1+j)=(1+i)(1+a)$ or its more convenient form for present purposes, $j=i+a+ia$, enables us to calculate the rate of interest in the *commodity standard* which was equivalent to the money interest paid in each period. Thus in London for 1826–29 the rate of interest (i) in money was 3.5%, but money was appreciating relatively to commodities 4.2% (a), so that the interest actually paid in terms of commodities (*i. e.*, the forty commodities averaged by Jevons) was $j=.035+.042+.035\times.042=7.8\%$. It will be seen from the table in § 3 that the virtual rate of interest paid in commodities usually varies inversely with the rate paid in money. For 1853–57, money interest was 5.3% and for 1891–95, 1.6% but commodity interest for 1853–57 was 2.8% and for 1891–95, 5.5%. Moreover commodity interest fluctuated much more than money interest, the mean variation from the average being for money interest .7%, and for commodity interest, 2.6%. All these facts suggest, —indeed practically demonstrate—that money interest was not adequately adjusted. It is of course not to be

assumed that commodity interest ought to be invariable, but we can be practically certain that its variations ought not to be three and a half times the variations in money interest. Such fluctuations must mean that the price movements were inadequately predicted. If any doubts were possible on this point they must disappear when we find that for 1871–73 commodity interest was *minus* 2.7%. Money lenders would have been better off had they simply bought commodities in 1871 and held them till 1873. Such losses are especially apt to appear in short periods. Thus if we take the period 1824–25, we find that the market rate was 3.7%, the rate of appreciation was *minus* 14.5% and the virtual rate of interest in commodities *minus* 11.3%.

The same observations apply to the rates at Berlin, Paris, New York, Calcutta, Tokyo and Shanghai. In New York during the inflation period 1861–65, commodity interest sank to the fabulously low figure of −14.8 %, though the rate of interest in the labor standard was only −3.1%. This shows in a striking way how thoroughly the greenback inflation upset all business calculations. This fact has generally been recognized, though probably underestimated. It is amply confirmed by examining the predictions as to the termination of the war and the reduction of the gold premium which were recorded from month to month in the "Notes on the Money Market" in the (New York) *Banker's Magazine.* In all probability this is always true of periods of paper money inflation. Our tables show it for the Japanese inflation of 1878–81.

§ 7

We can now understand why a high rate of interest need not retard trade nor a low rate stimulate it. These

facts have puzzled many writers. For instance,[1] "Public inquiry has been of late strongly directed to the reasons for the very low rate of interest upon loanable capital in the year 1875, the more especially as ten years ago the very high rates then prevailing created equal surprise." Again,[2] "The effect of such and many more changes effected during the last twenty years or so, is seen in a general increase in wealth and of mercantile industry and profits. Thus only can be explained the extraordinary high rate at which the interest of money has in the last ten years often stood. During 1854–57 the rate of interest was only for a few months below 5%, but for many months above it. For more than half a year it stood at 6 and 7%, and in the end of 1857 it remained for nearly two months at 10%. Again, in 1861, interest rose to 6 and 8%, and all this, *to the surprise of the elder generation, without the general stoppage of trade, the breach of credit, and the flood of bankruptcy, which has hitherto attended such rates of interest.* It is certainly not to increasing scarcity of capital we should attribute such rates, but rather to a greatly extended field for its profitable employment."[3] But were these rates high? If we turn to our table for London rates we find that the average market rate for 1853–57 does appear to be the highest in the table but, unmasking it of the money element, we find it is equivalent to a commodity interest of 2.8%. This is 1.0% *lower* than the average for the whole period, 1826–95. Should we be surprised that industry did not languish?

[1]Robert Baxter, *Journal of the Royal Statistical Society*, June, 1876.

[2]Jevons, "Investigations," p. 95. The italics are the present writer's.

[3]This view had also been expressed by Tooke and Newmarch, "History of Prices", Vol. V, p. 345.

Professor Bonamy Price[1] writing at a time of very low interest rates says: "Everyone remembers the agitations associated with 7%, the trepidation of merchants, the apprehension of losses in business. . . . If only a moderate rate could be reckoned on as steady, how happy would everyone have been! . . . Yet what are the facts and feelings today? Is every merchant, every manufacturer rejoicing in the pleasant terms on which he obtains the accommodation so necessary for his business? . . . Alas! no such sounds meet our ears. . . . Commercial depression is the universal cry, depression probably unprecedented in duration in the annals of trade, except under the disturbing action of a prolonged war. . . . In the export figures, the writer still fails to see any signs of the long-looked-for revival of trade. Both quantities and values continue to shrink in all save a few cases. . . . What then is the cause? *The explanation will certainly not be found in gold nor in any form of currency whatever. . . . nor has anyone said anything so ridiculous.* . . . That cause is one and one only: over spending."

If we turn back to our London table we find, however, that for 1874–79 the commodity rate of interest was 7.1%! It would be astonishing if trade did *not* shrink under such a burden.

All these writers mistook high or low nominal interest for high or low real interest. Tooke apparently did the same. In his "History of Prices", vol. ii, p. 349, he names as the last of six reasons for the fall of prices for 1814–37, "a reduction in the general rate of interest." This is probably not only an inversion of cause and effect, but also, when the veil of money is thrown

[1] "One per cent", *Contemporary Review*, April, 1877. The italics are the present writer's.

off, a mis-statement of fact. The commodity interest for 1826–29 was 7.8%. It would seem that Tooke, Price, and Jevons all overlooked the fact that interest, unlike prices, is not an instantaneous but essentially a *time* phenomenon.

§ 8.

In order to make our results as certain as possible, the following table is formed in which the longer price movements are selected. It consists of three periods, of ten, twelve, and twenty-one years respectively.

LONDON MARKET RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES, WAGES, AND INCOMES.[1]

	Market interest. *i*	Appreciation of Money in Commodities. *a*	Virtual interest in commodities. *j*	Appreciation of Money in Labor. *a*	Appreciation of Money in Income. *a*	Virtual interest in Labor. *j*	Virtual interest in Income. *j*
1826–35	3.4	+1.2	4.6	. . .	. . .	. . .	. . .
1853–64	4.6	−0.9	3.7	. . .	. . .	. . .	. . .
1874–95	2.4	+2.4	4.9	. . .	. . .	. . .	. . .
1860–74	4.0	. . .	. . .	−2.1	−2.5	1.8	1.4
1874–91	2.7	. . .	. . .	0.0	−0.2	2.7	2.5

In averages covering so many years, we may be sure that accidental causes are almost wholly eliminated. We find that during the period of rising prices, 1853–64, the average rate of interest was 2.2% above the average for the subsequent period of falling prices, 1874–95, and 1.2% higher than in the former period of falling prices, 1826–35. The rates in the commodity standard however vary in the inverse order, the highest interest being for 1874–95 and the lowest for 1853–64. It is a noteworthy fact, in strong contrast with what we have found

[1] The rates of appreciations in labor and income are based on "Changes in average wages in the United Kingdom between 1860 and 1891," by A. L. Bowley, in the *Journal of the Royal Statistical Society*, June, 1895.

true of short periods, that the commodity interest in this table of long periods is less variable[1] than the money interest. Thus the adjustment of (money) interest to long price movements is more perfect than to short.

§ 9.

The foregoing table shows exactly how the English borrower has fared so far as commodities and labor are concerned. During 1853–64 he paid 3.7% in commodities but during 1874–95 he had to pay 4.9%, an increase of 1.2%. In the labor standard, during 1860–74, he paid 1.8%, and during 1874–91, 2.7%, showing an increase of .9%, while in the income standard the rates were 1.4%, and 2.5% respectively, showing an increase of 1.1%. Now it is quite conceivable that *commodity* interest should normally be high during the latter period, if this period can be shown to be one of unusually rapid economic progress.[2] That this was in fact the case has

[1] The mean variation for the three money rates is easily seen to be .8% and for the commodity rates only .5%. The two "labor" and "income" rates differ by .9 and 1.1% while the money rates differ by 1.3%. In the New York table which follows, the money rates differ by 3.0% and the commodity rates by 3.2%, but the labor rates by only 2.2%.

[2] For when the future seems a time of relative plenty, future goods may be discounted at a high rate and profits measured in commodities may be large. Contrariwise during a period of progressive scarcity commodity interest may be normally low. These theories may seem to conflict with current opinion; but only when the fundamental distinction is overlooked between a period of plenty and a period of progressive plenty, and between a period of scarcity and a period of progressive scarcity. During stationary scarcity and stationary plenty, normal commodity interest may be high and low respectively. But during the *transition* from scarcity to plenty instead of running through the intermediate rates, commodity interest may be normally higher than in either of the extreme states. This is a case in which "dynamic" economics differ strikingly from "static" economics.

been pretty thoroughly established by the admirable researches of David A. Wells[1] and others, and by the statistics of wages compiled by Falkner[2] and Bowley.[2] But these considerations can scarcely apply to "labor interest" or "income interest." A man who borrowed the equivalent of a hundred days' income during 1860–74 could pay it back in a year with the equivalent of 101.4 days' income, while during 1874–91, for a similar loan he must return 102.5 days' income. This is the opposite of what we should expect as the influence of progress. It therefore seems safe to ascribe at least 1.1% as the borrower's loss since 1874, *compared* with his gain or loss before 1874. It may well be that part of this comparative loss for 1874–91 represents a gain for 1860–74. If we ascribe half to this gain, there remains the other half, .5% or .6%, as loss during 1874–91. Although this division is quite arbitrary the conclusion that the borrower's loss was at least ½% seems reasonable when we consider that the total comparative loss, 1.1%, was itself a minimum. But even if we suppose the debtor's gain during the former period twice his loss during the latter, (a supposition which, in view of all the facts, must be within the claims of all reasonable monometallists) we still have a minimum (English) debtor's loss since 1874 of ⅓%.

Combining the results just given with those of Chapter IX we see that the average loss to English borrowers during the fall of prices since 1874–75 probably lies be-

[1] "Recent Economic Changes," (New York, 1890).

[2] *Loc. cit.* These statistics, taken in connection with price statistics, show that commodity wages, *i. e.*, money wages divided by the index number of prices (*wholesale* unfortunately), rose in England during 1860–74 at the rate of 1.8% per annum and during 1874–91 at the rate of 2.2%, while in America for 1849–57 they fell 2.7% per annum and for 1875–91, rose 2.4% per annum.

tween ½% and ¾% and almost certainly between ⅓% and 1%. The former result may be stated thus, ⅝ ± ⅛% and the latter, ⅔ ± ⅓%. We may therefore say with considerable confidence that the average debtor's loss in England for contracts made since 1874–75, has been two-thirds of one per cent. per annum with a possible error of one-third of one per cent. In other words, the average debtor's loss could have been corrected by a reduction in the rate of interest of from one-third of one per cent. to one per cent.

§ 10.

For contracts made before 1874, but continued to the present, the loss, since 1874, must have been greater. We may therefore accept the former estimate of ⅔% as a lower limit or, to be safe, ½%. To find an upper limit, we recur to the fact that India gold bonds purchased prior to 1875 yielded very nearly ½% more interest than the average subsequent to that date. Since we have estimated that the average from 1875 was at most 1% too high, the average for periods beginning before but ending after 1875, must have been at most 1½% too high, for it can scarcely be claimed that the rate of interest for the part of the term of the bonds previous to 1875 ought to have been lower than that for the part subsequent to that date. We therefore conclude that, for English contracts made before 1874–75, the debtor's loss since 1874–75 has been between ½% and 1½%, *i. e.*, 1 ± ½%.

It follows that for contracts which were made prior to 1874–75 but subsequently converted or continued at a lower rate of interest, the loss since 1874–75 was 1 ± ½% per annum to the date of conversion and ⅔ ± ⅓% since that date.

It should be observed that the foregoing calculations are based on public prices of bonds and rates on money. Interest on private loans and farm mortgages, although influenced[1] by the same causes which affect the money market, is less flexible and the debtor's losses or gains in these cases are doubtless somewhat greater.

§ 11.

The following table gives the long time averages for New York. The war period is omitted and a nine years' period of rising prices is compared with a seventeen years' period of falling prices.

NEW YORK RATES OF INTEREST IN RELATION TO RISING AND FALLING PRICES AND WAGES.

	Interest Prime Two name 60 days. i	Appreciation of money in commodities. a_1	Appreciation of money in labor. a_2	Virtual Interest in commodities. j_1	Virtual Interest in labor. j_2
1849 – 57 .	8.2[2]	−3.8	−1.1	4.1	7.0
1875 – 91 .	5.2	+2.0	−0.4	7.3	4.8

We find for 1849–57 and 1875–91 that the money rates were 8.2 and 5.2%, the commodity rates 4.1 and 7.3%, but the labor rates 7.0 and 4.8%. We see therefore, that in terms of labor, loans in America have actually been *easier* during 1875–91 than during 1849–57. This fact suggests the conclusion that the debtor's loss in America has not been as great as in England. This, if

[1] See Appendix, § 2, 4th title.

[2] The average of Elliott's figures (which are not for "prime" paper) is 9.2, but 1.0 has been deducted from this average in order that it may be properly compared with the average of Robbins' figures for 1875–91. The correction is based on the fact that 1.0 was the average excess of Elliott's figures over Robbins' during the fifteen years, 1860–74. See Appendix.

true, may be due to a more rapid rate of progress in the United States.[1]

§ 12.

Four general facts have now been established:

(1) High and low prices are directly correlated with high and low rates of interest; (2) Rising and falling prices and wages are directly correlated with high and low rates of interest; (3) The adjustment of interest to price (or wage) movements is inadequate; (4) This adjustment is more nearly adequate for long than for short periods.

These facts are capable of a common explanation expressing the manner in which the adjustment referred to takes place. Suppose an upward movement of prices begins. Business profits (measured in *money*) will rise, for profits are the difference between gross income and expense, and if both these rise, their difference will also rise. Borrowers can now afford to pay higher "money interest." If, however, only a few persons see this, the interest will not be fully adjusted[2] and borrowers will realize an extra margin of profit after deducting interest charges. This raises an expectation of a similar profit in the future and this expectation, acting on the demand for loans, will raise the rate of interest. If the rise is still

[1] See page 72, note 2.

[2] It seems scarcely necessary to add as an independent cause of mal-adjustment the accumulation (or in the opposite case, depletion) of bank reserves, for this is but another symptom of mal-adjustment due to imperfect foresight. An increase of gold supply, as in 1852–53 (see Tooke and Newmarch, "History of Prices," vol. V, p. 345) may first find its way into the loan market instead of into circulation. But if foresight were perfect, this would not happen, or if it did happen, borrowers would immediately take it out (or increase the liabilities against it) to avail themselves of the double advantage of low interest and high prospective profits from the rise of prices about to follow.

inadequate the process is repeated and thus by continual trial and error the rate approaches the true adjustment.

When a fall of prices begins, the reverse effects appear. Money profits fall. Borrowers cannot afford to pay the old rates of interest. If, through miscalculation they still attempt to do this, it will cut into their real profits. Discouraged thus for the future, they will then bid lower rates.

Since at the beginning of an upward price movement, the rate of interest is too low, and at the beginning of a downward movement it is too high,[1] we can understand not only that the averages for the whole periods are imperfectly adjusted but that the delay in the adjustment leaves a relatively low interest at the beginning of an ascent of prices and a relatively high interest at the beginning of a descent. This would explain, in part at least, the association of high and low prices with high and low interest.[2] The fact that the adjustment is more perfect for long periods than for short, seems to be because in short periods, the years of non-adjustment at the beginning occupy a larger relative part of the whole period.

§ 13.

What has been said bears directly on the theory of "credit cycles." In the view here presented periods of speculation and depression are the result of *inequality* of foresight. If all persons underestimated a rise of price in the same degree, the non-adjustment of interest would merely produce a transfer of wealth from lender to borrower. It would not influence the volume of loans (except so far as the diversion of income from one person to another would itself have indirect effects, such

[1] These facts may be verified from the tables in the Appendix.

[2] Cf. § 2.

as bankruptcy). Under such circumstances the rate of interest would be below the normal, but as no one knows it, no borrower borrows more and no lender lends less because of it. In the actual world, however, foresight is very unequally distributed. Only a few persons have the faculty of always "coming out where they look." Now it is precisely these persons who make up the borrowing class. Just because of their superior foresight society delegates to them the management of capital. It is they who become "captains of industry." Their share consists of profits (or losses) while others lend them capital and receive interest or commuted profits.[1] It therefore happens that when prices are rising, borrowers are more apt to see it than lenders. Hence, while the borrower is willing to pay a higher interest than before for the same loan, lenders are willing to loan the same amount for the same interest. That is, the "demand schedule"[2] will rise while the "supply schedule" remains comparatively unchanged. This will of course raise the rate of interest. But it will also cause an increase of loans and investments.[3] This constitutes part of the stimulation to business which bimetallists so much admire.

When prices fall, borrowers see that they cannot employ "money" productively except on easier terms, but lenders do not see why the terms should be made easier. In consequence "entrepreneurs" borrow less, enterprise

[1] Hadley, "Interest and Profits," *Annals of the American Academy of Political and Social Science*, November, 1893; also "Economics," (New York, 1896), pp. 116, 269.

[2] Marshall, "Principles," Vol. 1, (3rd ed.) p. 171.

[3] That this and the corresponding statement in the next paragraph are borne out by facts appears to be confirmed, so far as bank loans and discounts are concerned, by Sumner, "History of Banking in the United States," (New York, 1896) and Juglar, "Crises commerciales," (Paris, 1889).

languishes and, though interest falls in consequence of decrease in demand, it does not fall enough to keep the demand from decreasing.[1]

If lenders, as a class, were possessed of greater foresight than borrowers, we should find trade languishing during rising prices and stimulated during falling prices. In the former case lenders would require high interest for fear, as in 1871–73, they were lending at a loss of real wealth, while borrowers would be afraid of the apparently high rates charged; and in the reverse case lenders would be eager to reap the benefits of an appreciating standard while borrowers, deceived by the apparently low rates, would rush in to profit by them.

We see therefore, that while *imperfection* of foresight transfers wealth from creditor to debtor or the reverse, *inequality* of foresight produces over-investment during rising prices and relative stagnation during falling prices. In the former case society is trapped into devoting too much wealth to productive uses and in "long production processes"[2] while in the contrary case under-investment is the rule. It does not seem possible to decide the question which of the two evils is the greater.[3]

[1] President Andrews in "An Honest Dollar," p. 3, writes: "Interest is low . . not because money is abundant as before, but because it is not, its scarcity having induced fall of prices and so paralysis in industry." But it should be added, the cause of the fall of interest is primarily the *expectation* of small profits. *Cf. infra.*

[2] Professor Böhm-Bawerk, ("Positive Theory of Capital," p. 335), writes: "Now the constant presence of the agio on present goods is like a self-acting drag on the tendency to extend the production period. Extensions which would be harmful as regards social provision are thus made economically impossible." During rising prices this drag presses too lightly and during falling prices too heavily.

[3] Bimetallists usually claim that falling prices are the greater evil. For arguments on both sides see Professor Marshall's evidence, Report on Depression of Trade, (1886), p. 422.

It is believed that the foregoing theories correspond closely with observed facts as to business stimulation and depression, volume of loans, etc., but it is not proposed here to enter upon a special statement of them.[1]

Nor is this the place to treat fully the reaction on prices themselves. But it can scarcely be doubted that the mal-adjustment of interest is a central feature in the whole movement. Professor Marshall, who recognizes fully the distinction between money and commodity interest, says:[2] "When we come to discuss the causes of alternating periods of inflation and depression of commercial activity, we shall find that they are intimately connected with those variations in the real rate of interest which are caused by changes in the purchasing power of money. For when prices are likely to rise, business is inflated, and is managed recklessly and wastefully; those working on borrowed capital pay back less real value than they borrowed, and enrich themselves at the expense of the community. When afterwards credit is shaken and prices begin to fall, everyone wants to get rid of commodities and get hold of money which is rapidly rising in value; this makes prices fall all the faster, and the further fall makes credit shrink even more, and thus for a long time prices fall because prices have fallen."

We would add that these effects of credit could not follow if the interest rate were perfectly adjusted. Interest, rather than credit, appears as the chief independent variable, objectively speaking, though behind it all is imperfection of foresight.

[1] See Report on Depression of Trade, 1886; and Report of the Gold and Silver Commission, 1888.

[2] "Principles of Economics", Vol. I, (3rd ed., 1895), p. 674.

PART III. APPLICATIONS.

CHAPTER XI.

THE BIMETALLIC CONTROVERSY.

§ 1.

It is not the purpose here to follow all the arguments for and against bimetallism, but merely to outline the bearing of the foregoing theories and facts upon some of those arguments.

We have seen in theory and in practice that the rate of interest has tended to accommodate itself to the changing value of money. It follows that it is quite erroneous to obtain the amount of the debtor's or creditor's loss by merely reckoning the effect of appreciation or depreciation on the *principal* of the debt.

And yet, after all allowances are made, it is true that there remains a net loss alternating between debtors and creditors according to the varying tides of credit and prices. During the last twenty years it has happened that the debtor was on the losing side. We have estimated his average loss at $\frac{2}{3} + \frac{1}{3}\%$ per annum in England and probably less in this country. This loss is not inconsiderable. When looked at in the aggregate it appears very large indeed. The minimum net indebtedness public and private in the United States is given at 20 billions,[1] on which $\frac{2}{3}\%$ would amount to 130 millions per annum. But when we compare this with the aggre-

[1] G. K. Holmes, Bulletin of the Department of Labor, November, 1895, p. 48.

gate principal involved or with the 14 odd billions[2] of annual product, it does not seem capable of the deep social harm attributed to it. In fact it is always misleading to consider aggregates except in comparison with each other. Applied to an ordinary two months' loan of $1,000, ⅔% amounts to one dollar. In New York city the up-town banks often charge a rate more than ⅔% higher than that of the down-town banks without driving away customers.

§ 2.

The ordinary estimates of the debtor's loss are based on index numbers. From Sauerbeck's tables it appears that between 1873 and 1895 money appreciated in terms of the commodities selected, 79.0%, which is at the rate of 2.7% per annum. This is from three to eight times as much as the estimate we have made. The error of the ordinary calculation does not consist simply in neglecting the matter of interest. The use of index numbers is itself subject to fatal objection.[2] When unchecked by other statistics they are very misleading. Not only do we reach different results according to the number of commodities and the method of averaging,[3] but the very best methods fail to give a trustworthy measure of ordinary domestic purchasing power, both because they are based on wholesale instead of retail prices and because they ignore expenditure for house rent and for labor and domestic service, which, in the family budgets of those who borrow and lend, must form a very large item.

[1] Edward Atkinson, *Engineering Magazine*, December, 1895.

[2] The reader is reminded that, though we have used index numbers to determine "commodity interest," we have not employed them to estimate the debtor's loss.

[3] See articles by Edgeworth, Sauerbeck and Pierson in the *Economic Journal*, March, June, and September, 1895, and March, 1896.

Moreover to know the purchasing power of a dollar does not enable us to know the "subjective value" or marginal utility of money. The number of dollars at command (*i. e.*, money incomes) must also be considered. And even were our knowledge complete as to the marginal utility of money as well as its purchasing power, we should be as far as ever from solving the problem of the debtor's loss. The question is not one of appreciation of gold relatively to commodities or to labor or any other standard. It is, as we have seen, exclusively a question of foresight and of the degree of adaptation of the rate of interest.

§ 3.

It scarcely needs to be pointed out that bimetallism can only affect unpaid debts. We should therefore clearly recognize the fact that the most of the loss which debtors have suffered since 1873 has already passed beyond the reach of remedy. Of the residuum the losses vary with the duration of the debt. On debts three years old the loss in England is probably about two per cent., on those six years old about four per cent., and so on. Moreover, on debts contracted before the fall of prices began, the annual rate of loss was greater, being probably, as we have seen, 1 ± ½%. Most such debts, however, including even national debts, have received part of the benefit of low interest through extensive conversions.

Now bimetallism, if adopted, so far from rectifying gains and losses, would simply increase the inequalities. If it resulted in debasing the standard ten per cent., it might exactly remedy debts fifteen years old, but the correction would be too small for those older and too

large for those younger than fifteen years. The latter form the great bulk of existing indebtedness. The average life of a farm mortgage is 4⅔ years[1] so that the average age of mortgages now in force would be about 2⅓ years. Bank loans run only a few days or months. These and other short time loans make up some sixty per cent. of existing indebtedness.[2] The remainder consists of railway and government loans and few of them extend back to 1873.[3] The chief and dominant effect of debasement would therefore be to defraud the lender of today and yesterday.[4] The older debts, for which the remedy is designed, no longer exist.

§ 4.

But even if bimetallism or any other financial scheme could so scale debts as exactly to counteract the losses connected with the fall of prices, the ethics of such an arrangement ought not to go unmentioned. The fact that debtors have lost does not imply that they have suffered an injustice. If a man insures his house and it burns the next day the insurance company suffers a loss but not an injustice. If the company should ask for legislative relief on the ground that it had not expected so sudden a termination of its policy, that the fire was brought about by causes which it could not possibly foresee or provide against, it would be laughed to scorn. "Keep your contract" would be the reply. It would

[1] Eleventh Census, Bulletin 71.

[2] Holmes, *loc. cit.*

[3] Probably much less than one-fourth for American railways. This estimate is made by looking over all the funded indebtedness whose dates of issue are given in the "Official Intelligencer" for 1894.

[4] For effects on "Social Classes," see article by Professor H. W. Farnam, *Yale Review*, August, 1895, p. 183.

make no difference if the fires were universal, and every insurance company lost. Those who assume the risks must take the consequences. A farmer mortgages his farm and agrees to pay $1,000 and 5% interest. By the terms of the agreement he takes all risks as to what the dollar will buy of wheat or anything else. He may lose and all farmers may lose and the causes may be in India or Australia or in the sun spots, but we can scarcely afford to surrender the ancient principle of the Inviolability of Contracts, through sympathy with the misfortunes of any individual man or group of men. That elements of risk exist in every contract and that this risk implies responsibility are too often ignored. President Andrews writes[1]: "Increase in the value of money robs debtors. It forces every one of them to pay more than he covenanted [!]—not more dollars but more value." But contracts which call for money do not call for "value" any more than contracts to deliver wheat call for money. If a man had agreed a year ago to deliver 10,000 bricks to a builder at a fixed price, he would not be justified in offering only 9,000 on the ground that the price had gone up. A contract to pay "value" would be a legal curiosity, and the court which should attempt to interpret it would hear an interesting assortment of definitions from our leading economists.

Closely associated with the principle of the Inviolability of Contracts is the principle against retro-active laws, and in particular, against laws which alter existing contracts. The world has reached these principles through a long and weary struggle and much costly experience with repudiation and the abuses of legal tender. The burden of proof rests on those who would revert

[1] "An Honest Dollar," p. 2.

to these experiments for the sake of any benefits from bimetallism. Surely the practical reasons against such a course are obvious enough. When once a government has undertaken to "correct" debtor's losses, it will not stop at one attempt. History teaches that a nation once embarked on such a policy never keeps its most solemn word as to where it shall leave off.[1] Creditors will fear to lend except at usurious rates and the debtor of the future will pay dearly for the emancipation of the debtor of the present.[2]

§ 5.

To those who claim that the cause of the aggravation of debts was governmental action in the first instance and that therefore it is now a fit subject for governmental correction, the obvious answer is that this does not apply to the great mass of existing contracts which have been formed since demonetization.

Finally it may be objected that the gold standard as such is on the side of creditors as against debtors because it is an appreciating standard and according to our own statistics the debtor usually wins in rising and loses in falling prices.

Such reasoning, however, is entirely fallacious. The fallacy is of the same kind as that contained in the facetious advice to young speculators: "Buy when stocks are low and sell when they are high." It is easy to prophesy after the event; investors in India silver bonds have lost for twenty years but this does not prove that the present price of rupee paper is still too high. If it did, London brokers would be the first to know it and

[1] Shaw, "History of the Currency," (1895); also Sumner, "History of American Currency," p. 331.

[2] See the writer's "Would Bimetallism benefit the 'Debtor Class'?" *The Bond Record*, April, 1896.

correct it. We cannot therefore say the "present arrangement is all in favor of the creditor and against the debtor." What bimetallist will risk his reputation in predicting the course of prices and interest in the next twenty years? *If* prices rise, we may with great probability predict that the debtor will win. *If* they fall, he will lose. But who knows which is the true "if"?

§ 6.

Legislation to offset the effects of a fall of prices in the past is wrong, because retro-active. Legislation to offset the effects of a fall in the future is absurd, because we cannot know there will be a fall, and if we could, there would be no need of legislation.

There remains to be considered legislation for the purpose of making the monetary unit less variable, that is, not to prevent something which we can foresee but to prevent something which we cannot foresee. Such a reason for monetary legislation must be recognized at once as thoroughly sound. But it applies equally well to "symmetallism"[1] and other plans[2] for monetary reform.

That bimetallism (as long as it lasted)[3] would be

[1] Edgeworth, "Thoughts on monetary reform", *Economic Journal*, September, 1895.

[2] *E. g.*, the multiple standard propounded by Lowe, 1822, and Scrope, 1833, and advocated by Jevons, "Money and the Mechanism of Exchange", p. 328, and "Investigations", p. 123, and by Marshall, Report of the Commission on Depression of Trade, p. 423; also the various forms of double standard suggested by Marshall, *ibid.*, Edgeworth, *ibid.*, Hertzka "Das internationale Währungsproblems," 1892, and Stokes, "Joint Metallism," (1895); also the various forms of elastic currency suggested by Professor Walras, "Theorie de la Monnaie", (Lausanne, 1886), by Secretary Windom and others.

[3] See the writer's "Mechanics of Bimetallism," *Economic Journal*, September, 1894.

more dependable than monometallism is probable on *a priori* grounds, but the statistics which we have given seem to reveal as great uncertainty in price movements before 1873 as since. It is indeed a large question how far any sort of monetary reform could remedy the matter; for the expansion and contraction of credit might be almost as violent and mischievous as ever. It may be however, that "the evils . . are so great that it is worth while to do much in order to diminish them a little."[1] If a more stable and less expensive[2] monetary standard can be found, it will be an inestimable boon to the civilized world. As an improvement on the two single standards now existing, bimetallism, launched at the market ratio, may be worth serious consideration. But the proposal now before the world is bimetallism at 15½ or 16 to 1. Such bimetallism means debasement of the standard of any single country which attempts it. If international, it means debasement in gold standard countries, and a violent contraction and appreciation in silver standard countries. In no other way could the influence of the legal ratio on the market ratio be felt. We should witness not only losses to creditors in the former countries but losses to debtors in the latter, and these losses would be far in excess of those which we have found to follow from the slow and half foreseen appreciation of the last twenty years.

[1] Marshall, "Principles of Economics" Vol. I, 3rd ed., (1895), p. 674.

[2] Jevons, "Investigations," p. 104; ". . the very scarcity of gold is its recommendation . . in itself gold digging has ever seemed to me almost a dead loss of labor as regards the world in general." Also Lexis, *Economic Journal*, June, 1895, p. 276.

CHAPTER XII.

THE THEORY OF INTEREST.

§ 1.

The relation existing between interest and appreciation implies that the rate of interest is relative to the standard in which it is expressed. Economists, from Hume and Adam Smith down, seem to have considered the money element entirely eliminated from the rate of interest by the simple fact that, in the last analysis, it is capital, not money, which is loaned and returned. But, as has been seen, we can identify the rate of interest in terms of capital with the rate of interest in terms of money only when the price ratio between money and capital remains constant.

The first thought suggested by this fact is to distinguish between "nominal" and "real" interest in the same way that we distinguish between "nominal" and "real" wages. This seems to be the thought of all the writers who have touched on the subject. Professor Marshall in fact uses the words "real" and "nominal."[1] de Haas speaks of the effect of the appreciation or depreciation of money as introducing a "third element"[2] into the rate of interest. This "element" is to be added to or subtracted from the sum of the other two elements, which are a payment for capital (or the rate of interest proper) and a payment for insurance. John Stuart Mill

[1] "Principles of Economics," Vol. I, 3rd ed. (1895), p 674.

[2] *Journal of the Royal Statistical Society*, March, 1889. It will be seen from the formula $1 + j = (1 + i)(1 + a)$ that the "third element" is not a mere additive term.

and the eighteenth century pamphleteer [1] were evidently thinking of a normal rate of interest in coin to which a certain extra charge is to be added if paper depreciates in reference to coin. Finally the article of Professor John B. Clark [2] is devoted chiefly to a search for an absolute standard to which we may refer any monetary appreciation or depreciation and in which therefore "real" interest could be expressed. It is not denied that the words "real" and "nominal" are very convenient terms and for a rough and ready expression may serve a useful purpose. But the mere distinction between "real" and "nominal" is quite inadequate for a true and accurate statement of the case.[3]

If we seek to eliminate the money element by expressing the rate of interest in terms of real "capital," we are immediately confronted with the fact that no two forms of capital maintain or are expected to maintain a constant price ratio. There are therefore just as many rates of interest on capital as there are forms of capital diverging in value. Even if we could find an ideal index number for capital in general or for commodities, there are other kinds of interest which might also claim the title of "real"; we refer to "labor" and "income"[4] interest. It cannot even be claimed that relative changes in prices, wages and incomes are abnormal phenomena, or incident only to a dynamic society. Even in the most ideal stationary state, the mere changes in seasons would make interest between summer and winter

[1] See Chapter I, § 2.

[2] *Political Science Quarterly*, September, 1895.

[3] Professor Edgeworth ("Variations in Value of Monetary Standards", *Report of the British Association for the Advancement of Science*, 1889, p. 163), exhibits seven kinds of standards for deferred payments.

[4] See Chapter X, §§ 8, 9.

low in terms of summer products such as fruit, and high in terms of winter products such as ice. The rate of interest is, as Professor Böhm-Bawerk shows, an agio on present goods exchanged for future goods of the same kind. It is a simple corollary of this theorem, though Professor Böhm-Bawerk does not express it, that this agio may be in theory and must be in practice a different agio for each separate kind of goods.

§ 2.

But, it may be urged, surely there is some invariable standard conceivable in theory if not determinable in practice, which may serve for a base line of appreciation and depreciation for all goods and money, and in terms of which we may express a "real" rate of interest. This brings us to the question of an absolute standard of value. But here we encounter another difficulty. Such an absolute standard will differ with each individual.[1] The fact that a dollar 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, however defined, will be constantly appreciating and depreciating in different degrees among different men and classes. In fact the phenomenon of borrowing and lending is to some extent itself a consequence of the different degrees in which money appreciates or depreciates to borrower and lender.

[1] Marshall, "Principles," Vol. I, (3rd ed.), p. 198, and Royal Commission on Depression of Trade, 1886, p. 423; also the writer's "Mathematical Investigations in the Theory of Value and Prices," *Transactions of the Connecticut Academy*, (New Haven, 1892).

§ 3.

In addition to the differences already mentioned, there is a different rate of interest for each period of time considered. The rate in any given goods for a loan contracted to-day and payable one year hence is the agio of this year's over next year's goods; the rate for a loan to be contracted one year hence and payable two years hence is the agio (reckoned to-day) of next year's goods over the goods of the succeeding year and so on. The rate for a loan contracted to-day and payable two years hence is the "actuarial average"[1] of the two previous rates. There is no reason why these three rates and others constructed in the same manner should not be all different.[2]

§ 4.

We thus reach a *multiple* theory of interest. Our results are, first, that different standards have in general different rates of interest; secondly, that of the numerous standards thus possible a different one is "absolute" for each individual; thirdly, that in each standard there will be a different rate for different periods of time.[3]

[1] See Chapter V, § 4.

[2] Professsor Böhm-Bawerk ("Positive Theory," p. 280), in showing how "arbitrage transactions" tend to equalize rates, tacitly assumes that the first two rates above mentioned are equal and only proves that in that case the third will be equal to the first.

[3] Besides these three sorts of variations there are others due to uncertainties of various kinds. In the theory of Part I, we have only considered the case where the relative divergence of two standards is foreknown with certainty. To complete the picture it is necessary to introduce the theory of probabilities as applicable to economics. (See Marshall's "Principles", p. 198, note, and 211, note.) When this is done it will also explain the different terms for call loans, 30 days, 60 days loans, etc., as well as for different degrees of security. Although in the latter case we may distinguish pure interest as the rate for perfect security, yet the surplus above this sum is not simple insurance. It is not a certain sum paid for a contingent loss but it is itself con-

In actual business experience none of these three sorts of differences attract attention. The third is usually very slight in amount.[1] The second is not reducible to statistical measurement; while the first escapes notice because of the habit of reckoning always in money. In a few cases, as for Indian and Chinese bonds, London brokers must have occasion to note the fact that 3% in silver is usually not equivalent to 3% in gold, but even in such cases the gold rate is thought of as "the" rate. So also speculative contracts in wheat, land, etc., and ordinary loans, which are really advances of stock, materials, and other forms of capital, are always translated into money and their essential nature as involving independent standards is concealed. But the economist, who so often finds it necessary to forsake the language of money and speak in terms of the things which money measures, must here also recognize the fact that the rate of interest in terms of money is simply a common representative of multiform rates in other standards.

These rates are mutually connected and our task has been merely to state the law of that connection. We have not attempted the bolder task of explaining the rates themselves. Such an explanation constitutes the "theory of interest" in the more usual sense and forms the subject of Professor Böhm–Bawerk's masterly treatise. The relation between the two branches of the subject may be pictured as somewhat analogous to that between the theory of relative prices and the theory of price levels.

tingent; and, what is more important here, it is not a present sum but a series of deferred sums and as such is itself subject to the principles of pure interest. It follows that we cannot strike out the "insurance element" as a mere additive term with which the theory of interest proper has no concern. A complete theory has yet to be written.

[1] For a supposable case of great variation, see Chapter V, §§ 1, 2.

APPENDIX.

STATISTICAL DATA.

§ 1.

The writer has found so much difficulty in securing a long series of yearly averages for rates on "money", that the results are here presented in the hope that they may be of use to others.

YEARLY AVERAGE RATES OF INTEREST ON "MONEY."[1]

	London		Berlin.		Paris.		New York.			Calcutta.	Tokyo.		Shanghai.	
	Market.	Bank.	Market.	Bank.	Market.	Bank.	Call.	60 Days.	Prime 2 Name 60 Days.	Bank.	Market.	Bank.	Market.	Bank.
1824 . . .	3.5	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1825 . . .	3.9	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1826 . . .	4.5	5.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1827 . . .	3.3	4.5	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1828 . . .	3.0	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1829 . . .	3.4	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1830 . . .	2.8	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1831 . . .	3.7	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1832 . . .	3.1	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1833 . . .	2.7	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1834 . . .	3.4	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1835 . . .	3.7	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1836 . . .	4.2	4.4	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1837 . . .	4.5	5.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1838 . . .	3.0	4.1	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1839 . . .	5.1	5.1	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1840 . . .	5 0	5.1	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1841 . . .	4.9	5.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1842 . . .	3.3	4.3	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1843 . . .	2.2	4.0	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1844 . . .	2.1	2.5[2]	. .	4.3	. .	4.0	. .	. .	. .	. .	. .	. .	. .	. .
1845 . . .	3.0	2.7	. .	4.4	. .	4.0	. .	. .	. .	. .	. .	. .	. .	. .
1846 . . .	3.8	3.3	. .	4.7	. .	4.0	. .	. .	. .	. .	. .	. .	. .	. .
1847 . . .	5.9	5.2	. .	4.8	. .	4.9	. .	. .	. .	. .	. .	. .	. .	. .
1848 . . .	3.2	3.7	. .	4.7	. .	4.0	. .	. .	. .	. .	. .	. .	. .	. .
1849 . .	2.3	2.9	. .	4.0	. .	4.0	4.5	7.8	. .	. .	. .	. .	. .	. .
1850 . . .	2.2	2.5	. .	4.0	. .	4.0	4.8	7.2	. .	. .	. .	. .	. .	. .
1851 . . .	3.1	3.0	. .	4.0	. .	4.0	5.9	8.3	. .	. .	. .	. .	. .	. .
1852 . . .	1.9	2.2	. .	4.0	. .	3.2	5.1	7.3	. .	. .	. .	. .	. .	. .
1853 . . .	3.7	2.7	. .	4.2	. .	3.2	6.9	10.1	. .	. .	. .	. .	. .	. .
1854 . . .	4.9	2.1	. .	4.3	. .	4.3	7.7	12.5	. .	3.9	. .	. .	. .	. .
1855 . . .	4.7	2.9	. .	4.1	. .	4.5	6.6	9.3	. .	9.7	. .	. .	. .	. .
1856 . . .	5.9	6.1	. .	4.9	. .	5.5	7.0	9.9	. .	6.5	. .	. .	. .	. .
1857 . . .	7.1	6.7	. .	5.8	. .	6.1	6.9	10.4	. .	7.0	. .	. .	. .	. .
1858 . . .	3.1	3.2	. .	4.5	. .	3.7	3.8	6.7	. .	6.1	. .	. .	. .	. .
1859 . . .	2 5	3.7	. .	4.2	. .	3.5	5.0	7.2	. .	4.9	. .	. .	. .	. .
1860 . . .	4.1	4.2	. .	4.0	. .	3.6	6.1	8.4	7.7	4.2	. .	. .	. .	. .
1861 . . .	5.5	5.3	3.0	4.0	. .	5.5	5.4	9.0	6.6	4.2	. .	. .	. .	. .
1862 . . .	2.4	2.5	3.0	4.0	. .	3.8	5.6	6.8	5.4	5.1	. .	. .	. .	. .
1863 . . .	4.3	4 4	3.5	4.1	. .	4.6	5.0	6.7	5.8	5.5	. .	. .	. .	. .
1864 . . .	7.4	7.4	5.1	5.3	. .	6.5	7.2	9.3	8.0	8.7	. .	. .	. .	. .
1865 . . .	4.6	4.8	4.6	5.0	. .	3.7	6.1	10.2	8.2	6.9	. .	. .	. .	. .
1866 . . .	6.7	6.9	6.2	6.2	. .	3.7	5.9	7.8	6.3	9.1	. .	. .	. .	13.
1867 . . .	2.3	2.6	2.9	4.0	. .	2.7	5.9	8.7	7.2	5.1	. .	. .	. .	11.
1868 . . .	1.8	2.1	2.5	4.0	. .	2.5	5.8	8.8	7.3	5.8	15.	18.	. .	12.
1869 . . .	3.0	3.2	3.2	4.1	. .	2.5	6.0	10.8	9.1	6.0	18.	18.	. .	12.
1870 . . .	3.1	3.1	4.5	4.8	. .	4.0	5.1	8.1	7.2	5.7	18.	18.	. .	11.
1871 . . .	2.7	2.9	3.8	4.2	. .	5.7	4.5	6.0	6.1	4.7	14.	18.	. .	12.
1872 . . .	3.8	4.1	4.0	4.3	4.2	5.1	5.6	9.0	8.0	5.0	14.	18.	. .	10.
1873 . . .	4.5	4.8	4.5	5.0	5.0	5.2	6.3	9.8	10.3	3.9	14.	14.	. .	10.
1874 . . .	3.5	3.7	3.3	4.4	4.0	4.3	3.9	6.4	6.0	6.2	12.	14.	. .	10.
1875 . . .	3.0	3.2	3.7	4.7	3.2	4.0	. .	. .	5.5	5.7	12.	14.	. .	9.
1876 . . .	2.2	2.6	3.1	4.1	2.3	3.4	. .	. .	5.2	6.8	12.	15.	. .	9.5
1877 . . .	2.3	2.9	3.3	4.4	1.8	2.3	. .	. .	5.2	8.4	10.	13.	. .	9.5
1878 . . .	3.5	3.8	3.4	4.3	2.0	2.2	. .	. .	4.8	5.3	11.	15.	. .	9.
1879 . . .	1.8	2.5	2.7	3.7	2.2	2.6	. .	. .	5.0	6.3	11.	16.	. .	9.
1880 . . .	2.2	2.8	3.1	4.2	2.5	2.8	. .	. .	5.2	4.6	13.	17.	. .	8.5
1881 . . .	2.9	3.5	3.4	4.4	3.7	3.9	. .	. .	5.2	5.3	14.	17.	. .	8.
1882 . . .	3.4	4.1	3.9	4.5	3.4	3.8	. .	. .	5.7	6.6	10.	17.	. .	8.
1883 . . .	3.0	3.6	3.1	4.1	2.6	3.1	. .	. .	5.5	6.8	7.9	11.	. .	8.
1884 . . .	2.6	3 0	2.9	4.0	2.4	3.0	. .	. .	5.2	6.4	12.	16.	. .	8.
1885 . . .	2.0	2.9	2.9	4.1	2.5	3.0	. .	. .	4.1	5.4	13.	11.	4.6	7.5
1886 . . .	2 1	3.0	2.1	3.3	2.2	3.0	. .	. .	4.7	6.0	8.8	9.2	6.1	7.
1887 . . .	2.4	3.3	2.3	3.4	2.4	3.0	. .	. .	5.7	5.6	9.0	8.8	6.5	7.
1888 . . .	2.4	3.3	2.1	3.3	2.8	3.3	. .	. .	4.9	5.5	10.	9.7	6.0	7.
1889 . . .	2.7	3.6	2.7	3.7	2.6	3.1	. .	. .	4.8	7.0	10.	10.	6.2	7.
1890 . . .	3.7	4.5	3.7	4.5	2.6	3.0	. .	. .	6.0	5.8	11.	11.	7.2	7.
1891 . . .	2.5	3.3	3.0	3.9	2.6	3.0	. .	. .	5.7	3.1	9.4	9.4	3.5	7.
1892 . . .	1.5	2.5	1.8	3.2	1.8	2.7	. .	. .	4.3	3.5	8.3	8.4	5.0	7.
1893 . . .	2.1	3.1	3.2	4.1	2.2	2.5	. .	. .	7.1	4.9	7.8	7.8	6.9	7.
1894 . . .	1.0	2.1	1.7	3.1	1.8	2.5	. .	. .	3.4	5.4	9.3	. .	3.8	7.
1895 . . .	.8	2.0	2.0	3.1	1.6	2.1	. .	. .	3.8	4.3	9.6	. .	2.8	6.5

Before 1868, 10 to 12 Per Cent.

[1] The London, Berlin and Paris market rates are on first class merchants'

All the rates are entered in the foregoing table as rates of "interest," though the rates for the Banks of England, Germany and France are rates of discount. The two are not quite equivalent but, for the purposes of the foregoing work, the distinction between them is unnecessary because, in a continuous series, the error, if any, affects all items nearly alike and thus cancels itself out in the comparisons.

Had it been necessary, some of the tables could have been extended back. Thus the Bank of England rate could be given to 1696 but it was too inflexible to be of use. The Berlin and Paris bank rates could also be extended and the Paris market rate could be given from 1861 (except for 1870 and 1871) from data in the *Economist.*

bills. The figures for 1824–58 are from the evidence of D. B. Chapman before the Committee on the Bank Act, 1857, Sess. 2, X, pt. I, p. 463, (also reprinted in *Hunt's Merchants' Magazine.* Vol. 41, (1859) p. 95). The remaining figures are compiled from the *Economist.* For those for 1884–94, the writer is indebted to Professor F. M. Taylor of Michigan University, who had collected them from the *Economist* for a different purpose. The Bank of England rates for 1824–43 are reduced from Burdett's "Official Intelligencer," (1894), p. 1,771. The remaining ones for England, Germany and France are reduced from those given in the Report of the Royal Commission on Depression of Trade, 1886, p. 373, and the *Economist.* They represent the bank "minimum." The New York rates are taken, the first two columns, from a table by E. B. Elliott (afterward government actuary) in the (New York) *Banker's Magazine*, 1874. The quotations given as "60 days" apparently included single name paper. The third column to 1890 is compiled from a diagram of highest and lowest monthly rates prepared at Yale college by Mr. G. P. Robbins of the class of 1891, and has been completed from the *Financial Review*, by averaging the highest and lowest weekly rates. It has been found impossible to extend the table back beyond 1849, as the rates are not systematically reported. The Calcutta rates are the minimum of the Bank of Bengal and have been kindly furnished by Messrs. Place, Siddons and Gough, brokers, of Calcutta. The market rates of Tokyo are averages of the highest and lowest rates of each year, furnished by Mr. Ichi Hara of the Bank of Japan, Tokyo. The bank rates are for the Tokyo and Yokohama Co-operative Bank and were translated by Mr. Sakata, student at Yale, from a history of Japan by Zenshiro Tsuboya. The tables for Shanghai have been procured through the kindness of Mr. F. W. Williams of the department of Oriental History of Yale University, who obtained them from Mr. J. F. Seaman of Shanghai. The first column contains the rates ruling in the native market, and the second, those of the Hong Kong and Shanghai bank (under English control) on overdrawn current accounts, a species of demand loans and the ordinary form of lending in Shanghai. Mr. Seaman was told that the market rates cannot be extended back beyond 1885, as the books of the Chinese banks for previous years are burnt.

[2] This rate is only from September when the operation of the Bank Act began. Previous to this the custom of the bank was to have a uniform rate for all loans.

Many of the sources from which the table has been drawn also contain other information such as the rates for Vienna, Amsterdam and other money centres, the weekly or monthly rates, the variation with the seasons, the number of changes of the Bank Minimum, etc.

§ 2.

Of sources not mentioned in the above note, the chief which the writer has encountered are:

Adolf Soetbeer, "Materiallen zur Währungsfrage," (Berlin, 1886), p. 78.

Covers 1851–85 for Banks of England, France and Germany, and market rates of Hamburg and Vienna.

Austrian Government, "Tabellen zur Währungsfrage," (Vienna, 1892), pp. 204–6. (A second edition has just appeared, 1896).

Covers 1861–91 for banks of Italy, England, France, Germany, Austria, Belgium and Holland, and market rates in Vienna, 1869–91.

W. Stanley Jevons, "Investigations in Currency and Finance," (London, 1884).

Contains diagram for prices of consols and 3 per cent. stock from 1731, and minimum rate of interest in London from 1824; also monthly variation in rate of interest, p. 10. The diagram for the price of consols shows that during the middle and first half of the eighteenth century the interest realized was almost as low as in the present generation. This was a period of falling prices.

Eleventh Census of the United States, Bulletin 71 (on real estate mortgages, 1880–89).

This is probably the most elaborate series of interest averages ever constructed. If these averages be compared with the course of prices during the average term of the contracts (five years), it will be found in nearly every case that interest is high or low according to the degree of the rise or fall in prices.

Viscomte G. D'Avenel, "Histoire économique de la proprieté, des Salaires, des Denrées et de tous les Prix en général depuis l'an 1200 jusqu'en l'an 1800," (Paris, 1894), vol. II, p. 882.

This work contains also tables of the purchasing power of money, but neither the interest nor price statistics are sufficiently exact or detailed for use in the foregoing study.

Tooke, "History of Prices," and

Tooke and Newmarch, "History of Prices from 1793 to 1856."

G. Winter, "Zur Geschichte des Zinsfusses in Mittelalter," *Zeitschrift für Social und Wirtschaftsgeschichte*, (Weimar), 1895, IV, 2.

Arthur Crump, "English Manual of Banking," (4th ed., London, 1879), pp. 141–4.

Gives Bank of England rates for 1694–1876.

Alph. Courtois fils, "Histoire des Banques en France," (Paris, 1881).
Gives rate of interest at the Bank of France, 1800–1880.

Wilhelm von Lucam, "Die Oesterreichische Nationalbank während der Dauer des dritten Privilegiums," (Vienna, 1876), p. 121.
Gives rates for Bank of Austria, 1817–75.

"Jahrbücher für Nationalökonomie und Statistik," February, 1896, pp. 282–83.
Gives bank and market rates for London, Paris, Berlin, Amsterdam, Brussels, Vienna and St. Petersburg, 1841–80 by decades, and 1881–95 by years.

"Handwörterbuch der Staatswissenschaften," Article "Banken."
Gives rates for Bank of Prussia and Germany, 1847–89; [illegible] for Bank of Austria, 1878–89; Switzerland, 1883–88.

A. N. Kiaer, "Om seddelbanker," (Kristiania, 1877).
Contains diagram of bank rates at Kristiania, Stockholm and Kjobenhavn, 1853–76.

M. G. Mullhall, "Dictionary of Statistics," (London, 1892), pp. 76, 607.
Gives rates for countries of Europe by five and ten year periods since 1850.

William Farr, "On the valuation of railroads, telegraphs," etc., *Journal of the Royal Statistical Society*, September, 1876, pp. 464–530.

"Report of the New England Mutual Life Ins. Co.," Boston, 1890.
Gives rates realized by twenty representative insurance companies for 1869–88, and for Massachusetts savings banks for 1877–89, and bank dividends in Boston, New York and Philadelphia. The rates realized by the insurance companies for the twenty years, 1869–88, inclusive, were 6.0, 5.9, 6.1, 6.2, 6.5, 6.2, 6.5, 6.1, 5.6, 5.1, 5.0, 4.8, 4.8, 5.1, 5.1, 4.7, 4.7, 4.9, 4.7, 4.6, respectively. These represent (if the writer mistakes not) the average rates earned on the par value of investments of all ages, some old, some new, some terminable soon and others having many years to run. For this reason they are of little or no use for the foregoing study.

Robert Giffen, "Essay in Finance," second series, (London, 1886), p. 37.
Seasonal variations of interest in connection with bank reserves, etc.

F. M. Taylor, "Do we want an Elastic Currency?" *Political Science Quarterly*, March, 1896, pp. 133–157.
Gives diagram showing the relation of surplus reserves and rates of discount; also seasonal variation of rate of discount.

R. H. Inglis Palgrave, "Analysis of the Transactions of the Bank of England," (London, 1874).
Gives rates, 1844–72, and seasonal variation, 1844–56 and 1857–72. Shows dependence of rate on ratio of reserve to liabilities.

R. H. Inglis Palgrave, "Bank-rate in England, France, and Germany, 1844–78; with remarks on the causes which influence the rate of interest charged; and an analysis of the accounts of the Bank of England," (London, 1880).

R. H. Inglis Palgrave, (London) *Bankers' Magazine*, March, April, May, 1878.
Number of changes in bank rates of England, France, and Germany.

Theodor Hertzka, "Währung und Handel," (Vienna, 1876).
Gives the number of weeks each rate lasted for the Banks of England, France, Germany, and Austria during 1844–73.

George Clare, "Money Market Primer," (London, 1891).
Diagrams for seasonal variations of interest, bank reserves, etc.

Commercial and Financial Statistics of British India. Second issue, (Government Printing Office, Calcutta), 1894, pp. 354–64.
Monthly Discount, Bank of Bengal, 1861–94, and average quotations of government securities held in London.

Report of the Secretary of the Treasury, 1893, p. 401.

Report of the Comptroller of Currency, 1894, p. 179.

H. W. Farnam, "Some Effects of Falling Prices," *Yale Review*, August, 1895.
The last three references contain statistics of rates of interest realized on some United States Government bonds.

R. A. Bayley, "National Loans of the United States", (Government Printing Office, Washington, 1882).
Gives rates of interest and price of issue of all United States loans from July 4, 1776, to June 30, 1880.

"Dictionaire des Finances," Article "Interêt."
Gives rates at which France has borrowed.

§ 3.

The following tables of index numbers are appended in order that the reader may verify the periods of rising and falling prices which have been discussed in Chapters X and for the reason that many of the tables, notably those for India, Japan and China, have not hitherto been accessible to most readers.

INDEX NUMBERS IN SEVEN COUNTRIES.[1]

	England.		Germany.	France.	United States.		India.	Japan.	China.
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[1] For England, the figures for prices are from Jevons and Sauerbeck. Those

from Sauerbeck begin in 1852. They are taken from the Aldrich report (I, 247) and from the *Journal of the Royal Statistical Society*, March, 1896. Those from Jevons are from 1824 to 1852 inclusive, and are taken from his "Investigitions in Currency and Finance." In order to make the tables of Jevons and Sauerbeck continuous, Jevons' number for 1852 is called 78 (*i. e.*, Sauerbeck's for that year) instead of 65 as given in the "Investigations," and all the other numbers are raised in the ratio 78:65. Jevons' figures are for forty commodities; Sauerbeck's for forty-five. The index numbers for English wages are from the article by Bowley in the *Journal of the Royal Statistical Soceety*, June, 1895.

The German numbers are from Soetbeer, Heinz and Conrad. Those for 1851–91 inclusive, are from Soetbeer, continued by Heinz, and given in the Aldrich report (I, 294); those for 1891–95 inclusive, are from Conrad, as given in his *Jahrbücher*, 1894–6, but are all magnified in the ratio 109:98 in order to make the series continuous, since Heinz's figure for 1891 is 109, and Conrad's 98. The statistics of Soetbeer and Heinz cover 114 commodities.

The French numbers are from the Aldrich report (I, 335) founded on the figures of the *Commission permanente des valeurs*. They cover only sixteen articles.

The figures for the United States are those of Professor Falkner in the Aldrich report (I, 9, 13), the weighted averages (last method) being employed.

Those for India, Japan and China are from the Japanese Report of the Commission for investigation of monetary systems, 1895. The writer is under great obligations to Mr. Ichi Hara, of Tokyo, for a copy of the report, and to Mr. Sakata of Yale University, for translating the tables.

That for India is an average of three tables which cover respectively twenty-one articles of export, sixteen articles of export priced at Calcutta and Bombay, and eight grains at Bombay. That for Japan is an average of three tables, of forty-two articles at Tokyo, sixteen at Osaka and thirty.one articles of export. That for China is an average of three tables, of twenty inland commodities, seventeen articles of export and fifteen food-stuffs in Shanghai.

The tables for India were based on official statistics, those for Japan on information from guilds and merchants, and those for China on the reports of the consuls of Japan and England (Mr. Jameson) in China.

In the Japanese report the prices for Japan are reduced to a silver basis. As silver was at a premium up to 1885 it has been necessary in constructing the above table to reconvert into currency by applying the premium for 1873–85, viz.: 4, 4, 3, 1, 3, 10, 32, 48, 70, 57, 26, 9, 5 per cent. respectively.

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