(Q)

QUESTIONS CONNECTED WITH BIMETALLISM

[THE "Thoughts on Monetary Reform" which form the subject of this article (ECONOMIC JOURNAL, 1895) were suggested by contemporary agitation in favour of Bimetallism. In spite of the presumption in favour of an argument on which Giffen and Professor Foxwell agreed, I dispute that there is "a permanent tendency" to appreciation of money, that "a fall in prices may be regarded as the normal condition of things." Some illustrations of the quantity theory, with special reference to what Giffen called the *dynamical* character of the problem, are next offered. The fall of prices, it is argued, is not an unmitigated evil, not an intolerable burden on debtors; on the supposition that the appreciation was due to abundance of commodities (relatively to money)—a supposition not relevant to present (1923) problems. Lastly, the variant form of bimetallism proposed by Marshall, here named "Symmetallism," is discussed at length. As compared with ordinary bimetallism it is found to have the advantage in almost every respect except that of familiarity.]

The following is an attempt to estimate the force of some few out of the many considerations which bear upon proposed monetary reforms.

I. The argument first to be considered is one which is suggested by Mr. Giffen [1] in a passage quoted by Professor Foxwell in his evidence [2] before the Agricultural Commission.

In Mr. Giffen's words, "There is an intrinsic difficulty in the way of an increase of a standard metal used as money proportionate to the increase of the commodities which it moves. As the latter are renewed incessantly, an increase in the means of production increases the whole mass on the market at any given time. As the precious metals in use, however, exist in masses enormously

[1] *Essays in Finance*, Vol. II. p. 30. [2] Questions 23,646 and 23,647

greater than the whole annual production, an increase of the means of production equal to what takes place in other commodities only means, in the case of gold, an increase of a fraction of the whole mass in use. There is accordingly a permanent tendency to change in the relation of commodities to gold." As Professor Foxwell understands, the argument is that "a fall in prices may be regarded as the normal condition of things." [1]

An argument advanced by Mr. Giffen and entertained by Professor Foxwell is not likely to be open to dispute. It is with great diffidence that the following counter-reasoning is submitted.

An increase in the annual production of gold corresponding to the increase in the annual production of commodities implies the increase—not merely of a fraction, but—of the entire mass of gold. For consider that mass as made up of parts distinguished as (1) new, (2) one year old, (3) two years old, etc. And let us at first make abstraction of the circumstance that the mass is continually being diminished by loss and wear. Then in the lapse of a year part (1) by hypothesis is increased in the same proportion as the mass of commodities—a proportion which may be supposed uniform from year to year. Also, in the lapse of a year, while part (1) is freshly created, what was part (1) the year before becomes part (2) of the present year. By parity of reasoning, part (3) of the present or ultimate year is the same as part (2) of the penultimate year—that is, the same as part (1) of the antepenultimate year. Therefore, upon the hypothesis made, part (1) of the ultimate year is to part (1) of the penultimate year in the ratio which expresses the increase of commodities from year to year; part (2) of the ultimate year is to part (2) of the penultimate year as part (1) of the penultimate year is to part (1) of the antepenultimate—that is, in the aforesaid ratio of the commodities of one year to the commodities of the preceding year. By parity of reasoning, the same ratio is found to prevail between all the corresponding parts of the mass of precious metal in the ultimate and penultimate years; and therefore between the whole masses.

This reasoning is not materially affected when we restore the concrete circumstance, that the mass of precious metal is liable to waste. The argument may be made clearer by the subjoined mathematical analysis.

Let G be the amount of gold existing at some remote period, such that the subsequent additions to the precious metal far exceed G. Let g be the amount of gold added to the stock in the course of a year at the initial period. Let W be the amount

[1] *Loc. cit.*

of wealth or wares existing at the beginning of the first year, produced during the preceding year. And let it be assumed that W and g increase from year to year in the same uniform ratio—viz. $1 : (1 + \rho)$. Let it further be assumed that all parts of the stock of gold are diminished by waste annually in the ratio $1 : (1 - \sigma)$, where σ is a proper fraction.

Upon these suppositions the masses of goods at the end of the years 0, 1, 2, and n are W, $W(1 + \rho)$, $W(1 + \rho)^2$, . . . $W(1 + \rho)^n$, respectively. The corresponding masses of gold are

$$G, G(1 - \sigma) + g, G(1 - \sigma)^2 + g(1 - \sigma) + g(1 + \rho), \ldots$$
$$G(1 - \sigma)^n + g(1 - \sigma)^{n-1} + g(1 - \sigma)^{n-2}(1 + \rho) + \ldots + g(1 + \rho)^{n-1}.$$

The first term of the general expression may be neglected in comparison with the remainder; by hypothesis, even upon the supposition that σ were zero; *a fortiori*, if σ is considerable as may be. The expression thus reduced may be put in the form

$$g\frac{(1 + \rho)^n - (1 - \sigma)^n}{(1 + \rho) - (1 - \sigma)}.$$

The mass of gold at the end of the mth year is found by substituting m for n in the above expression. Therefore the mass of the mth year, divided by the mass of the nth year, is

$$\frac{(1 + \rho)^m - (1 - \sigma)^m}{(1 + \rho)^n - (1 - \sigma)^n} = \frac{(1 + \rho)^m}{(1 + \rho)^n},$$

in the limit, when m and n are large. But $(1 + \rho)^m : (1 + \rho)^n$ is the ratio of the masses of commodities in the mth and nth years. Whence it appears that *a constant level of prices, rather than a fall of prices, is to be regarded as "the normal condition of things."*

Nor is it necessary that the rate of waste should be the same for the new and the old gold (or silver). For consider the fraction of which the numerator is the mass of gold in the mth year, the denominator the mass in the nth year (from an initial epoch); m being greater than n. Let σ, σ_2, and σ_n represent the percentage of waste suffered by a portion of the metal during the first, second . . . nth year of its existence. The diversity of these coefficients does not invalidate the proposition that to each term of the denominator—*e.g.*,

$$g(1 + \rho)^{n-3}(1 - \sigma_1)(1 - \sigma_2)$$

there corresponds a term of the numerator greater in the ratio of $(1 + \rho)^{m-n} : 1$, *e.g.* :—

$$g(1 + \rho)^{m-3}(1 - \sigma_1)(1 - \sigma_2).$$

Accordingly the whole numerator exceeds the whole denominator in that ratio. That is, assuming as before that in n years the

waste is very great. But if this is not assumed, if the rate of waste—like that of cooling—slackens with time, then there may enure to the benefit of the numerator a substantial remainder, a very long *etcetera*. Accordingly *there is some probability that a rise in prices may be regarded as the normal condition of things.*

The argument continues to hold when the law of waste is supposed to be different for gold and silver applied to different uses, *e.g.*, money and the arts. Also there may be different classes of goods not all worn out in one year. The coefficient of waste for goods, say s, may be unity for corn, of which the yearly supply is consumed in the year but three-fourths for boots, agreeably to the supposition that by five years boots on an average will have been reduced to less than $\frac{1}{1000}$ part of their original value: $(1 - \frac{3}{4})^5 = \frac{1}{1024}$.

The argument breaks down only when ρ is not constant, the production of commodities increasing from year to year at an increasing rate. But, as submitted in the next section, this case is not known to be a real one.

Of course it is possible, that while the stock of precious metal increases uniformly with commodities, other things are not uniform: in particular the proportion of precious metal used in the arts and as money, and the factors, described in the next paragraph, which intervene between the quantity of metallic money and the level of prices. And it is possible that the variations of these quantities should counteract each other. The reasoning is very abstract, but so is the reasoning against which it is directed.[1]

This argument, whatever its force, is in the direction of monetary reform. The reformer can no longer be represented as one who pretends to avert a decline which is inevitable—like the charlatan who pretends to have discovered the elixir of life, or, as recently announced, the "microbe of death."

II. If the recent fall of prices cannot be explained as "the normal condition of things," to what cause is it to be attributed? This inquiry forms my second head.

On this point I have little to add to what Mr. Giffen has said about the *dynamical* character of the problem.[2] We must con-

[1] Thus no account is here taken of the argument that the yield of mines, unlike the production of commodities in general, cannot be indefinitely multiplied. The abstraction of this consideration will appear allowable to those at least who hold that predictions about the production of gold in the distant future are, as Newmarch is reported to have said with reference to the statistics of gold-production, not worth the paper they are written on.

[2] *The Growth of Capital*

ceive the masses of both goods and metallic money as continually growing; and in order to account for a change in their relation it is not enough to show that one of the quantities has increased, for both of them are to be conceived as continually increasing.

We might figure the discrepancy between goods and gold which is indicated by a fall in prices as a change in the distance between two moving bodies.[1] It is generally easier to ascertain the fact that such a change has occurred than to assign the cause to one or other of the moving bodies. In an Oxford boat-race Corpus bumps Balliol. That is a plain fact. But it may be a fine issue whether the cause is the acceleration of Corpus, or the retardation of Balliol. It may happen, no doubt, that both cause and fact are equally manifest; as when Ajax Oileus, racing against Ulysses at the funeral games of Patroclus, slipped in the mire, and so was distanced by his rival. But the incidents are not so simple in the race which we have to contemplate. The Homeric chariot-race might afford nearer parallels. When, Diomed having dropped his whip, his rival began to gain upon him, the spectator would naturally connect the two events. So the change of monetary legislation in 1873 being apt to produce a fall of prices, and being followed by a fall of prices, is naturally assigned by some theorists as the cause of the fall. The circumstance which is assigned by other theorists as the cause of the fall—namely improvements in arts of production, attended with an acceleration in the growth of commodities—does not excite belief so readily. The Homeric parallel of this cause is: Pallas inspiring force into the horses of her favourite. The intelligent spectator might require proof that this agency only came into operation just before the distance between the rival chariots began to diminish. Before ascribing an access of spirit and vigour to the team which seemed to be gaining ground, he would require pretty accurate observations of its velocity before and after the alleged inspiration.

But of course it is a very elementary conception to regard prices as the quotient of the volume of goods divided by the mass of metallic money. When we take account of the complicated factors affecting the fall of prices, we shall be still more cautious about locating the cause. It is quite conceivable that neither the monetary legislation of 1873, nor the subsequent rapid augmentation of production, would by itself have sufficed to produce the observed effect. The concurrence of the two was required.

[1] The device of employing a distance to express a ratio is used by Cournot in a cognate inquiry. *Recherches Mathématiques*, ch. ii.

We may conceive prices as representing the relation between the *volume of goods* in a sense which is implicit in most definitions of an index-number, and the *mass of currency* in the sense of metallic money augmented by credit; account being taken both of the number of times each piece of goods is sold, and the number of times each piece of money or instrument of credit effects a purchase. The *volume of transactions*, and the *momentum of circulation*, thus conceived, are not to be regarded as growing like two independently moving masses, but rather like two bodies connected by a link which it requires some violence to shorten or elongate—such is the force of habit resisting a general change in prices. This relation may be preserved constant, in spite of a disparity between the quantity of goods and metallic money, by the accommodating elasticity of other factors, in particular the amount of credit. It is attempted in the annexed diagram to give a rough idea of the relations between the several growing quantities figured as bodies moving along a line.

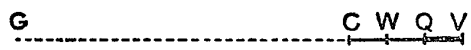

FIG. 1.

Here W is the volume of goods, C is the mass of currency, V is the volume of transactions, Q the momentum of circulation, as above defined; in the region under consideration, say the system of countries having a gold standard. The distance QV represents a ratio measured by an ideal index-number—such a one as the present writer in his third memorandum on variations in the value of money (British Association Report for 1889) has connected with the name of Professor Foxwell.

Say Q and V were coincident at an initial epoch 1867–77, and that now the proportion of the quantity V to the quantity Q is, in round numbers, $1\frac{1}{2} : 1$, corresponding to an index-number 66·6. Then QV—about a quarter of an inch—stands for log 1·5. The distance VW represents the number of times that each piece of goods is sold on an average per unit of time, that is $(1{\cdot}5)^2$, or 2·25, if VW is about half an inch. The distance QC represents the number of times that each piece of money effects a purchase on an average per unit of time, according to the figure, also 2·25.

The quantities W and C are respectively connected, the former with the volume of transactions V, the latter with the momentum of circulation Q, each by a link which, under pressure or tension, is readily shortened or elongated telescope-wise. A similar, or even more yielding, bond connects C, the quantity of

currency, with G, the quantity of gold used as money. But V is yoked to Q more firmly, as it were, by a pole made of some viscous substance which does not easily alter its length. The thick line QV and the dotted line GC are intended to indicate different degrees in the rigidity of connection. The connections between V and W and between Q and C are perhaps of intermediate rigidity.

But really the mechanism of this complicated yoke is very imperfectly known. No one is competent to predict what will be the effect of any assigned stress or strain. (Upon the extent of our ignorance, compare Professor Marshall's evidence before the Precious Metal Commission, Q. 9,629.) It is possible that a slight spurring of W or curbing of C will produce, not a slight effect, but no effect on the length QV. One is free to indulge the following compromise hypothesis. The acceleration of W, due to an increased rapidity in the growth of goods since 1873, would not of itself have sufficed to elongate QV—to depress general prices. That tendency would have been counteracted by the elongation of GC or CQ, or the abbreviation of WV. Nor would the acceleration of W, due to an increase in the amount of goods to be moved by gold upon the demonetisation of silver, of itself have sufficed to alter CW. Both impulses—and perhaps at the same time a certain retardation of G—were necessary to produce the observed effect. Thus both parties in the controversy about the cause of the appreciation of gold may be right—both those who attribute it to the increase of goods, and those who attribute it to a monetary derangement.

It may be observed that this hypothesis, too, forms an argument in favour of monetary reform. For if the recent disturbance of prices would not have occurred without injudicious monetary legislation in the past, it is possible that judicious monetary legislation in the present may prevent future disturbances.

III. But is the fall of prices an unmitigated evil? I submit that a considerable mitigation is afforded by a circumstance which—however its importance as a cause may be disputed—is not denied to be a fact: namely the increased production of goods per head in the civilised world during the last twenty-five years.[1]

This circumstance tends to remove the grievance which con-

[1] It will be noticed that the argument in this section requires only an increase in the quantity of goods per head, not, like the argument in the former section, an *acceleration* in the growth of goods. What is required for the present argument appears to be fully proved by several writers who have supported the former argument: in particular Nasse, Wells, Atkinson, Pierson.

stitutes the strongest motive in favour of monetary reform—namely the pressure of fixed debts upon shrinking incomes. As Professor Foxwell explains in his masterly evidence before the Agricultural Commission (Q. 23,815), "Business is injured when the prices of commodities fall. . . . What depresses trade is the falling in commodities." The entrepreneur is embarrassed when he has to pay his creditors an increased quantity of commodities. But if the production of commodities per head has increased since the debts were contracted, then the average entrepreneur, though he may have to pay his creditors more commodities, will have more commodities out of which to make that payment.

In the words of Professor Taussig,[1] endorsed by the authority of Professor Lexis :[2] "The rise in money incomes and the improvements in production disprove any intolerable burden on debtors, and make it highly improbable that the change has had any general depressing effect on industry."

Where is the great hardship? What does the bimetallist complain of? (*loc. cit.* Q. 23,815).

"If you fix your money by incomes, and allow the prices of commodities to fall, it comes to this, that the creditor gets the whole advantage of the fall in the prices of commodities, to which as creditor he has contributed nothing."

The creditor does not get the whole advantage; the recipients of wages and of profits have their shares increased in proportion to the increase of industrial efficiency. Take the figures for the changes in the national income of the United Kingdom recently given by Mr. Bowley,[3] and compare the average of the years 1874 and (the next year in his tables) 1877 with that of 1886 and 1891 (his last years). Money income has remained almost constant during this period. The average national income for 1874 and 1877, compared with 1860, taken as 100, was $\frac{1}{2}(143 + 142) = 142{\cdot}5$; and in 1886 + 1891 exactly the same—viz., $\frac{1}{2}(138 + 147) = 142{\cdot}5$. Meanwhile the real average income had risen from $\frac{1}{2}(139 + 148)$, or 143·5, to $\frac{1}{2}(198 + 202) = 200$, that is about forty per cent. Also real average wages have increased from $\frac{1}{2}(134 + 139)$ to $\frac{1}{2}(180 + 192)$, that is about thirty-six per cent. Therefore real average income not received as wages must have increased by more than forty per cent. Consider this portion of income as made up partly of fixed payments—say interests and rent—and partly of profits. If all the fixed payments dated from 1874–77—an extreme supposition—

[1] *Silver Question*, Part II. p. 106. [2] *Jahrb. f. Nat. Oekon.*, March, 1894.
[3] *Journal of the Statistical Society*, June, 1895.

the real average income of the recipients would have increased by forty per cent. But, as just concluded, profits + fixed payments have increased by more than forty per cent. Profits then must have increased by more than forty per cent. Profits have had their full share of the increased national wealth, even on the extreme supposition which has been made. The creditor then does not "get the whole advantage." Nor is it true that "he has contributed nothing" to the growth of the national income. But for his saving it would have been smaller.[1]

A diagram may make the argument clearer. Let the gross income of an average or typical entrepreneur, measured in money, at different epochs, be represented by the parallel lines PS and ps, which are divided into proportional parts by four lines meeting in the point O.

Let PS represent the incomings before the appreciation of gold;

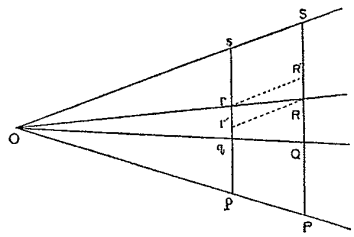

FIG. 2.

PQ, expenses which may be called current, such as outlay on material, which vary with the variation of prices; SR, fixed expenses, such as interest of debts or rents on long leases; the remainder, RQ, the profits of the entrepreneur. And let ps represent the incomings after the appreciation of gold. Then pq, the current expenses, will be diminished in the same proportion as the gross income. Thus PQ : pq : PS : ps. But the fixed expenses will not be thus diminished. The new fixed expenses are the same as the old, viz. sr' (determined by drawing Rr' parallel to Ss). Accordingly the profits of the entrepreneur are reduced by the burden of fixed debt from qr to qr', which may become very small. Hence all these tears.

This reasoning takes for granted that the gross income of the entrepreneur measured in commodities, is the same at the two

[1] See Professor Marshall's weighty remarks on this subject in the discussion on Mr. Bowley's paper in the *Journal of the Statistical Society*, June, 1895.

epochs. But there is reason to believe that the total production per head, and therefore the production of the average entrepreneur, has increased in recent years in about the same proportion as gold has been appreciated.[1]

This case may be represented by the same figure differently interpreted. Let ps now represent the gross income of the typical entrepreneur, measured in commodities, at the initial epoch; and PS his gross income at a subsequent epoch, when labour, so to speak, and gold have both been appreciated with respect to commodities in the same ratio, viz. Op : OP. The shares into which the gross income is distributed are at the initial pq current expenses, sr fixed expenses, and qr profits (all measured in commodities); and at the subsequent epoch (the same measure being employed) PQ current expenses, SR fixed expenses (since the gold which was the equivalent of sr commodities has become the equivalent of SR), and accordingly QR profits.

According to the arrangement that the creditor should receive a constant quantity of commodities Sr′ (determined by drawing rR′ parallel to Ss), a special advantage, to the extent of RR′, is given to the entrepreneur who has debts of long standing, in comparison with one whose expenses are mainly of the current kind. According to the existing arrangement, if the assumptions which have been made as to the increased efficiency of labour are accurate, the borrower is, on an average, as well off as he who has not borrowed; if the assumptions are only slightly exaggerated, the borrower is not much worse off. Is this such a flagrant injustice? Is it one which it is worth making a very great effort to rectify?

Of course all this polemical reasoning is highly abstract; but so is the reasoning against which it is directed. The state of things which forms the second interpretation of our figure is a sort of representative mean from which concrete particulars diverge enormously—for instance the condition of the English agriculturist. But so is the state of things conceived by the bimetallist forming the first interpretation of the figure a mere abstract representation which is not applicable to whole classes of business—for instance the case put by Mr. Pierson (ECONOMIC JOURNAL, Vol. V. p. 110), in which the prices of materials (our "current" expenses) fall sooner than the prices of the finished article (our "gross incomings"). The burden, which is characteristic of the general type, is not felt in this particular case. So the

[1] Consult, in addition to the authorities above cited, those referred to in the ECONOMIC JOURNAL, Vol. IV. pp. 158—165.

general remedy would fail in the extensive case of German agriculture, if Professor Lexis is right in predicting that in this case bimetallism would inflate the expenses of production more than the prices of the product.[1]

IV. Let it be admitted, however, that a currency steadily expanding with commodities, or at any rate steady in some definite sense, is desirable. Let it further be admitted that steadiness is more likely to be secured by the use of two metals than of one only. But bimetallism is not the only method of combining the two metals. The form which bimetallism has most recently assumed presents an additional reason for believing that a more excellent way is that which Professor Marshall has proposed,[2] according to which the standard is not a unit of gold *or* so many units of silver, but a unit of gold *and* so many units of silver—a linked bar on which a paper currency may be based. The arrangement that there should be a *joint demand*[3] for gold and silver money might, perhaps, be called *symmetallism*, to distinguish it from the arrangement that there should be a *composite supply* which is called bimetallism.

The one advantage which bimetallism has hitherto enjoyed over its younger rival is historical precedent, familiarity, and the better fulfilment of Mill's condition for a sound currency, that "it should be intelligible to the most untaught capacity." But this one advantage appears to be impaired in the most recent form of bimetallism. For, whereas the definition of bimetallism used to be "an open mint ready to coin any quantity of gold and silver,"[4] we read now of purchasing gold and silver bullion with legal tender. In Professor Foxwell's clear and authoritative words:—

"According to the views which are very current now in bimetallic circles, the bimetallic mintage would mainly be a mintage consisting of a return of paper or certificates for bars" (Q. 24,334).

"The person tendering the bullion receives legal tender" (Q. 23,751).

"The debtor would pay exactly as he pays to-day, by cheques

[1] See p. 281 of the ECONOMIC JOURNAL, Vol. V. 1895. The reference is to an article by Professor Lexis in the ECONOMIC JOURNAL, 1905.

[2] Evidence before the Gold and Silver Commission (1888), Q. 9,837. Compare the proposal made in Dr. Hertzka's *Das Internationale Wahrungsproblem* (1892).

[3] See Marshall's *Principles of Economics*, Book V. ch. vi.

[4] The definition given by the Gold and Silver Commission (Final Report, Part I. par. 116) after Mr. Hucks Gibbs. So Professor Sidgwick in his *Political Economy*, Book III. ch. iv. § 6, speaks of the "plan known as bimetallism, *i.e.*, coining gold and silver freely and making them legal tender." (Cp. *ibid.* II. v. 6.)

and notes, or instruments of that kind which are based upon reserves in the banks; but the debtor would never consider what his note or cheque was based upon, whether upon silver or upon gold, any more than he does in France at the present day" (Q. 23,756).

Now all that is said so truly and persuasively here, and in the context, of bimetallism, is equally applicable to symmetallism. And the doubts and difficulties felt by the monometallist interrogators could not have been greater if the witness had been advocating symmetallism. Referring to this system, an eminent bimetallist has said [1] "The brains of Lombard Street would reel at the vision." Will they not also be affected with a certain vertigo at the prospect of bimetallism in its new form: purchasing bullion, at a fixed rate, with legal tender?

Let it be admitted, however, that the principle of bimetallism is still the more presentable one in virtue of its historical character. Yet against this speciousness of the essential principle is to be set the strangeness of certain incidents, in particular that nations should fix a value in concert; whereas symmetallism can be started by any nation independently, and different nations may fix different rates.

Suppose England alone were to start symmetallism. She would gain in the steadiness of her standard, in that the fluctuation of its value from time to time would be less. She would lose indeed in the steadiness of exchange with gold-using countries. But against this loss is to be set some gain in the steadiness of exchange with silver-using countries; since the discrepancy between silver and the compound would be less than the discrepancy between silver and gold. Suppose England were joined by India. They would gain in steadiness of exchange with each other as well as in diminution of the fluctuations in time. Suppose England with India adopts one symmetallic ratio—say 1 of gold + 25 of silver; and Holland with her Asiatic dependencies adopts another symmetallic ratio—say 1 of gold + 30 of silver; all the four parties will gain in both kinds of steadiness. It is true that there will be no *par* of exchange, as there would be in the case of bimetallism. But the advantage of avoiding the dislocation of value between gold-using and silver-using countries would be secured in almost as perfect a measure as by bimetallism. For a change of the value of silver (with respect to commodities in general, including gold) would be attended with a much smaller change in the relative value of the (Dutch and English) com-

[1] *Nineteenth Century Review*, April, 1883, p. 627.

pounds;[1] a change which might well be inconsiderable in comparison with that fluctuation of the exchanges which is continually being produced by causes unconnected with currency. It is obvious that for the propagation of a reform, this capacity of being independently started by particular communities is a great advantage. In this respect symmetallism is like free-trade, which may be started by any single nation with advantage to itself; while bimetallism is like mutual disarmament, which cannot be safely started without an agreement between the principal nations.

There is also against the introduction of bimetallism the obstinate prejudice of the half-taught, who persist in regarding it as equally absurd for a Government to fix the relative value of two species of money as to fix the relative value of two articles of consumption; whereas the fixing of the symmetallic rate is much more obviously within the powers of Government.

Symmetallism then being not conspicuously inferior to the other species of double standard in plausibility and the possibility of being introduced, it is worth while to compare the working of the two on the supposition that they could be introduced.

We shall best examine this complicated subject by first as it were looking at it with the naked eye of reason, then using successively the magnifying glass of mechanical analogy, and the microscope of mathematical analysis.

In order that bimetallism may be successful the amount of bimetallic money must be of a certain magnitude relatively to the new supplies of precious metal. Otherwise a considerable influx of one metal—or a considerable deficiency in the supply of the other—will cause bimetallism to break down.[2] There are those who think that an influx of silver is particularly likely to be fatal to bimetallism, since the demand for silver in the arts is too weak to carry off a redundant supply of this metal. Now symmetallism is free from this danger. Suppose that an abnormal supply of silver occurs. The worst that can ensue is that the redundant silver will be unable to mate itself with gold. A certain quantity of gold might be forthcoming from the arts in which the metal has not been fixed by manufacture,[3] or from hoards and unsym-

[1] *E.g.*, if the change in the value of silver is a drop of 25 per cent., the ratio of the Dutch to the English standard will be changed from 1·1 to 1·086; if the change in the value of silver is *small*, the change in the relative value of the two compounds will be twenty-two times as small; 1 of gold being initially equivalent to 25 o silver.

[2] Compare Sidgwick, *Political Economy*, 2nd edition, Book III. chap. iv.

[3] I hear of dentists who amass substantial ingots of gold from the washings of teeth restuffed or extracted.

metallic currencies. But at worst the new silver would pine unmated; the production of silver would be discouraged.

Bimetallism then, as compared with symmetallism, is more likely to fall; but, as long as she continues on her feet, is her course straighter? The conception proper to this inquiry is that the value of either double standard with respect to things in general is subject to constant changes. As Professor Sidgwick says: [1] "The number of slight fluctuations ought to be regarded as in any case infinite, since the conditions of both supply and demand are continually varying." A series of index-numbers constructed for either species of double-standard will present a wave-line. The question is, Which line will be more wavy? When it is considered that the value of the symmetallic compound is a mean of the values of its components,[2] there appears to be no

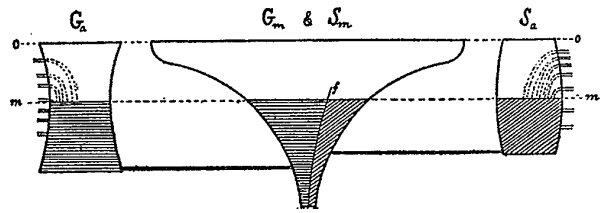

FIG. 3.

general reason why the law of compensation, the principle of a "double reservoir," should not be as effective in the case of symmetallism as in that of the more familiar double standard.

To complete this comparison, let us reproduce the illustration employed [3] by Professor Irving Fisher in his masterly paper on *The Mechanics of Bimetallism*,[4] with a modification adapted to the case of symmetallism, which the reader will be asked to imagine. In both interpretations of these figures the three reservoirs, viz. G_a, $(G_m + S_m)$, and S_a, designate respectively gold used in the arts or for other purposes than double-standard money, gold and

[1] *Loc. cit.*

[2] *E.g.*, if the symmetallic standard is 1 of gold + 25 of silver, then if 113 grains of gold (the amount of pure gold in an English sovereign) becomes worth 22 shillings in symmetallic sterling, 25 × 113 grains of silver will be worth 18 shillings of that sterling.

[3] Readers to whom mechanical analogy—and *a fortiori* mathematical analysis—is distasteful are advised to pass on to page 441.

[4] ECONOMIC JOURNAL, September, 1894, Vol. IV. p. 527.

silver used as double-standard money, and silver used in the arts or other purposes. In both interpretations the distance of the level of a liquid from the zero line *oo* represents the " final utility " of the corresponding article; the contents of the reservoir, the amount demanded at that *price* (price measured in the absolute standard of utility). The pipes which give into the reservoirs G_a and S_a are the sources of supply, the *cost* (in the sense of disutility) being proportioned to the distance of each pipe from the zero line. Accordingly, those pipes only which are above the level of the liquid act, since for others the cost of production is greater than the price. The pipes below the liquid are supposed to be closed by valves.

In the case of bimetallism, the reservoirs G_a and S_a are each connected by a pipe with the reservoir $(G_m + S_m)$; and accordingly the system is not in equilibrium unless the level of the liquids in the three vessels is the same. When equilibrium is disturbed by an abnormal [1] influx of one metal, say silver, some silver flows into the reservoir $(G_m + S_m)$, and some gold is extruded from that reservoir into G_a. For further explanations of the figures as illustrations of bimetallism, the reader is referred to Professor Fisher's paper.

In the case of symmetallism, the gold and silver in the reservoir $(G_m + S_m)$ are divided, not by a movable film ff, as in Professor Fisher's construction, which is here reproduced, but by a fixed diaphragm, which the reader is asked to imagine, dividing the money reservoir into two equal lobes, the one on the right containing (water representing) silver, the one on the left liquid gold, both at the same level.* The condition of equilibrium is—not as before, that the liquid in the three reservoirs should be at the same level, but —that the height of the level of S_a [or G_a] above the level of $(G_m + S_m)$ should be the same as the height of the level $(G_m + S_m)$ above that of G_a [or S_a]. By a proper construction of bars connected with balls floating in the reservoirs, it is arranged that whenever the height [2] of S_a [or G_a] above $(G_m + S_m)$ is greater than the height of $(G_m + S_m)$ above G_a [or S_a], a dose of silver liquid should be transferred from S_a to S_m, the silver lobe of the money reservoir, and at the same time an equal dose of gold

[1] That is, more than is required to keep up the existing level by counteracting leakage.

* This modification of his original design was contributed by Professor Fisher himself.

[2] Measured in the ordinary plan upwards from some horizontal base; if measured *downwards* from the zero line *oo* (*loc. cit.*), *less* must be substituted for " greater " in our text.

liquid from G_a to G_m. In the converse case, two equal doses [1] are transferred from G_m and S_m to G_a and S_a respectively.

Let us now compare the two systems thus figured, in respect of (1) *permanence*, without which all other good qualities must be useless; and (2) that quality which constitutes the characteristic advantage of a double standard, *steadiness*.

(1) As explained by Dr. Fisher, bimetallism breaks down into monometallism as soon as one of the metals, *e.g.*, gold, is completely extruded from the monetary reservoir ($G_m + S_m$). This danger is minimised by the bimetallist, who virtually maintains that ($G_m + S_m$) is so large in relation to G_a that it is nearly impossible for an influx of silver to extrude all the gold from ($G_m + S_m$). But admitting this relation of the magnitudes to be plausible, upon the supposition of bimetallism being generally adopted, I submit that there is some chance of many business men continuing to make contracts payable in gold [2]—answering the defiant question of the bimetallist, "Where will the gold go to?" by employing the gold very much as it is employed at present, namely as a reserve to sustain payment of contracts made in gold, only without the agency of a Government bank. There is also a chance that an international convention may be repudiated.

Thus when the flood of silver comes and beats upon the bimetallic structure, there is some danger of its falling. The film may be pushed to the extreme left, and the monetary reservoir depleted of gold, even if bimetallism is generally adopted, and *a fortiori* if it is not in fact generally adopted. But when the flood comes and beats upon the symmetallic structure there is no danger of its falling. The film is not displaced, the lobe of gold is not depleted; the double standard does not break down into gold monometallism, until silver has become so abundant as to be utterly valueless.

(2) Next let us compare the two plans in respect of steadiness.

Suppose that the sectional area of ($G_m + S_m$) is large comparatively to that of G_a and that of S_a; and let an abnormal influx of silver occur. In the case of symmetallism the level of the liquid in the silver lobe S_m tends to rise considerably. But this tendency is checked by the difficulty of raising the liquid in the gold lobe to the same level. So the silver which is not wanted in S_m will regurgitate into S_a; the gold which is wanted for G_m

[1] The cubic inch of liquid, as in Professor Fisher's construction, representing a unit of gold and as many units of silver as are equated to a unit of gold.

[2] An objection urged by many eminent monometallists.

will be somehow pumped out of G_a; and since both S_a and G_a are narrow—shaped like the vessel which the crane in the fable offered to the fox—the level of the former will be considerably raised, while the level of the latter will be considerably depressed. Therefore the mean of the two levels will in general be considerably disturbed, except upon the improbable supposition that G_a and S_a are identical in size and shape. Contrariwise, when S_a and G_a are large, $S_m + G_m$ small, symmetallism is particularly steady; but it is not clear that bimetallism is particularly unsteady, except in the sense that it is particularly liable to break down. I do not think it is possible to get much further in the investigation of comparative steadiness without the use of mathematics.*

Let us suppose a quantity Q of one metal, say silver, to be introduced; and let us examine to what extent the value of each species of double standard will be disturbed.

Let A, B, C be the respective areas of the section which the surface of the liquid makes with each of the three vessels, G_a, $(G_m + S_m)$, S_a. And first let Q be small. Put $Q = Cv$, where v is the height above the undisturbed level to which the liquid in S_a would be raised by the influx of Q, upon the supposition that S_a, was disconnected from $(G_m + S_m)$—that is, the change in the value of silver upon the supposition that the (double-standard) mints are closed to silver.

In the case of bimetallism, the increase in the height of $(G_m + S_m)$, the diminution in the value of the double standard, say y, is given by the equation—

$$y = \frac{Cv}{A + B + C}; \text{ or}$$

$$(1)\ y = v\frac{1}{1 + \frac{A}{C} + \frac{B}{C}}.$$

In the case of symmetallism, the level in the three reservoirs is not in general the same before the introduction of the new silver, nor are the changes in the levels equal. Let v, as before, represent the height to which the new influx of silver would have raised the silver level if there had been no connection between the reservoirs. Let z be the actual increment of S_a, y that of $(S_m + G_m)$, and x the increment ($-x$ the decrement) of G_a (v, x, y, z all supposed small). Then we have the following three equations :—

(i) $C(v - z) = -Ax$ (since equal quantities are taken from each reservoir).

* The general reader may be advised to pass on to p. 441.

(ii) $C(v - z) - Ax = By$ (since the liquid which is taken from G_a and S_a is added to $(G_m + S_m)$.

(iii) $y = \frac{1}{2}(x + z)$ (since the value of a unit of gold, say 113 grains—the weight of pure gold in a sovereign—added symmetallically to a unit of silver—say 25×113 grains—ought to make up two units of legal tender sovereigns, two pounds sterling). Eliminating x and z we have—

$$(2)\quad y = \tfrac{1}{2}v\frac{1}{1 + \frac{1}{4}\frac{B}{A} + \frac{1}{4}\frac{B}{C}}.$$

Comparing (1) and (2), we see that in the case of bimetallism y cannot exceed v, while it may have any value between o and v; in the case of symmetallism y cannot exceed $\frac{1}{2}v$, while it may have any value between o and $\frac{1}{2}v$. Thus *the fluctuation of the value of the standard in the case of symmetallism is confined to a range half as small as what it is in the case of bimetallism.*

The proof which has been given of this property relates primarily to small disturbances; but it may be extended with great probability to disturbances of a finite magnitude.

The advantage on the side of symmetallism which has just been indicated is somewhat reduced when we introduce a condition which is usually taken for granted by bimetallists: namely that there is a certain parity in the fluctuations of the supply of gold and silver, such that the double standard will be steadier than either gold mono-metallism or silver mono-metallism.

The case is that of two "reservoirs" fed from independent sources; now underfed, now overfed, at random. If the fluctuations before the connection are much more violent in one reservoir than in the other, the union will not be an advantage to the gentler partner. In order that both reservoirs should gain in respect of stability, it will be found that the following condition must be approximately fulfilled. The measure, or *modulus*, of fluctuation (see the writer's "Methods of Statistics," *Journal of the Statistical Society*, 1885) per unit of area must be approximately the same in both reservoirs before the connection. In other words, the "probable error" of the (small) increment or decrement of volume to which each reservoir is subject must be proportioned to its sectional area.

The reservoirs of which we have just spoken with Jevons in mind are of course to be regarded as compounded according to the conception of Professor Fisher; say $(G_a + G_m)$ and $(S_a + S_m)$, where

G_m is the part of the vessel ($G_m + S_m$), which is on the left of the partition ff (a movable film in the case of bimetallism, a fixed diaphragm in the case of symmetallism), and S_m the part on the right.

Let B_a be the sectional area of G_m, B_c of S_m. Then $B_a + B_c = B$ for both double standards; and $B_a = B_c = \frac{1}{2}B$ in the case of symmetallism.

In order that the double standard should be steadier both than the previously existing gold monometallism and the previously existing silver monometallism, we must have the modulus for the fluctuation of value in the two composite reservoirs ($G_a + G_m$) and ($S_a + S_m$) identical, say w; the disturbance being regarded as a small quantity assuming independently in each system and at random a variety of values, according to a law of error of which the central point is zero and the probable error $\pm$ ·47..w. Accordingly, the increment in the volume of gold is $(A + B_a)$ w; and the increment in the volume of silver $(B_c + C)$ w.

The fluctuation of the compound standard is found by cumulating the fluctuations of the component reservoirs according to the rules of Probabilities. In the case of bimetallism, the joint area $A + (B_a + B_c) + C$ is affected by the gold increment with a fluctuation $\frac{A + B_a}{A + B + C}$w, and by the silver increment with a fluctuation $\frac{B_c + C}{A + B + C}$w. Therefore the (modulus of the) compound fluctuation is

$$\sqrt{A^2 + B_a^2} + \sqrt{B_c^2 + C^2} \div (A + B + C).$$

In the case of symmetallism, each of the component fluctuations affecting the joint area may be calculated from equations (i), (ii), (iii), *mutatis mutandis*: for instance, the v of those equations (pertaining to silver) becomes now $\frac{C + B_c}{C}$w. The compound fluctuation resulting is

$$\tfrac{1}{2}w\sqrt{(A + B_a)^2C^2 + (C + B_c)^2A^2} \div [AC + \tfrac{1}{4}(A + C)(B + B_c)].$$

In this expression B_a must be equal to B_c after the establishment of the (symmetallic) connection; and therefore just before it, if the establishment of the connection is supposed to cause no disturbance. Thus for B_a and also for B_c we may substitute $\frac{1}{2}B$, and B for $B_a + B_c$. It will now be apparent that the fluctuation in the value of the symmetallic, as well as of the bimetallic, double standard is, as it ought to be, less than the fluctuation

in the value of either the single gold standard or the single silver standard.

To compare the extent of the two fluctuations, put them on opposite sides of an inequation—say the bimetallic modulus on the left side, and the symmetallic modulus on the right side—and clear of fractions. Let the resulting expression be of the form

$$K_1 w > \text{or} < K_2 w.$$

It will be found that when $A = C$, $K_1 = K_2$; accordingly one double standard has no advantage over the other. To effect the comparison when A and C are not equal, put $A = P(1 + q)$, $B = P(1 - q)$, where q is a proper fraction; and expand. It will be found that $K_1 - K_2 =$

$$8P^6q^2\left[q^4 - 2\left(1 + \frac{B}{2P}\right)q^2 + \left(1 + \frac{B^2}{2P}\right)\left(1 - \tfrac{1}{4}\frac{B^2}{P^2}\right)\right].$$

The expression within the square brackets equated to zero has always real roots; one of which is always positive, and one is positive or negative according as B^2 is less or greater than $4P^2$. When B^2 is greater than $4P^2$, the above written expression for the coefficient of the bimetallic *minus* the symmetallic fluctuation is always negative. For one root of the quadratic lies below zero, and the other root above $1 + \frac{B}{2P}$. Accordingly for all values of q between 0 and 1—the only values with which we are concerned—the expression is negative. When B^2 is less than $4P^2$ the expression is positive for values of q^2 between 0 and $1 - \frac{B^2}{4P^2}$. Therefore symmetallism is steadier for values of q less than $\sqrt{1 - \frac{B^2}{4P^2}}$; for greater degrees of inequality bimetallism has the advantage.

For example, if the demand for gold for the double standard is small in comparison with its demand for other purposes (surviving gold monometallism, war chests, and the arts); and if the demand for silver is not entirely for the double standard, but partly for other purposes; then, $\frac{B}{2P}$ being small and q not very great, symmetallism has the advantage. The case supposed seems most likely to be the real one, so far as we can predict from data very imperfectly ascertained even in the present, a future rendered unlike the present by the introduction of a double standard.

This presumption in favour of symmetallism arises on the supposition that the condition above stated holds. But if that

condition does not hold—if, as many competent authorities believe, silver is liable to greater drops in value than gold—then the presumption arising from the comparison of equations (1) and (2) recurs.

In the latter case an additional advantage—*valeat quantum*—may be pointed out on the side of symmetallism. Suppose it could be proved that one metal, say silver, was considerably less steady than the other, bimetallism would cease to be desirable for both parties, both the originally gold-using and the originally silver-using countries. Whereas the principle of symmetallism might be still usefully employed to produce a compound more steady than either of the components. Just, as according to the theory of *errors*, two observations, though very unequal in weight, may yet be so weighted that the combination of the two is better than either singly, so silver in the case supposed may be combined with gold in a proportion so small—say that of the ancient *electron* (see Ridgeway, *Currency and Weight Standard*, ch. xi.)—that the compound will be slightly steadier than the components.

Thus, *from three points of view, there seems to be some advantage in respect of steadiness on the side of symmetallism.*

In short, symmetallism, is not only not much more difficult to introduce, but if introduced, would be more permanent and steady. Both species of double standard may be compared to the rope by which mountain climbers are mutually secured, upon the principle that two parties are not likely to slip at the same time. Both the monetary cords are difficult to attach; but the bimetallic species has the further disadvantage, that, when one of the parties falls over a precipice, the rope is cut. Again, both double standards may be compared to those packet boats in the service between Calais and Dover to which the law of compensation was applied to correct the evils of fluctuation. Both species of monetary craft are difficult to launch. But the bimetallic ship is not only launched with difficulty, but is also liable to be wrecked in harbour, and never is quite safe from storms. Whereas the symmetallic vessel, once launched, rides secure upon the waves, and fulfils more perfectly the purpose for which it was constructed.

To sum up: it appears from the last section that there may exist a form of double standard better than bimetallism in almost every respect, except that it is less familiar. That disadvantage may be diminished by time. For it appears from the third section that the necessity for immediate action is not so very urgent. Accordingly it seems advisable to wait, keeping on the look out for the best form of double standard. That is supposing

that a double standard is to be aimed at. But the general question whether, upon a balance of relevant considerations, a double standard is desirable is not considered here. It has been attempted only in the first section to remove one slight objection to this kind of monetary reform, and in the second section to slightly strengthen one argument in its favour.

END OF VOL I.