

MR. BICKERDIKE'S THEORY OF INCIPIENT TAXES
AND CUSTOMS DUTIES

[THE continuation of "Appreciations" in the *ECONOMIC JOURNAL* for 1908 deals with some interesting conceptions and propositions due to Mr. C. F. Bickerdike.

Any country has the power of securing to itself some net advantage by the imposition of an import tax. For if the tax be moderate, "incipient" in Mr. Bickerdike's happy phrase, the gain accruing from the proceeds of the tax will be greater than the loss incurred by the disturbance of industry. This is deducible from the general principle that in the neighbourhood of a maximum a small change in the conditions—in the values of the independent variables, on which the quantity to be maximised depends—is attended with a *very small* change in the quantity that was prior to the change at a maximum. This argument is to be distinguished from that which Cournot often employs (*Recherches Art, et passim*); the assumption that relations of greater or less which are true of differential increments in the neighbourhood of a maximum will continue to be true of finite differences. The extension practised by Cournot—when he reasons, for instance, that a monopolist will raise his price in consequence of a tax and *ceteris paribus* will raise it more the heavier the tax—is not threatened by any counter argument, as Mr. Bickerdike's paradox is by the ordinary anti-Protectionist arguments. In this respect his paradox is comparable with ours respecting the possibility of both producers and consumers being benefited by differential prices (*D*, Vol. I.). On probable suppositions as to the law of Demand, it has been found that a similar paradox would be verified for rates of taxation as high as $12\frac{1}{2}$ per cent. (Below, §, p. 418.) Experimenting in a similar spirit on probable cases, Mr. Bickerdike has found that his paradox holds good for taxes of about the same order.

Having introduced his theorem by a construction proper to domestic trade, Mr. Bickerdike goes on to the subject of international trade. He employs the useful conception of a currency

special to each country. (It might with advantage be conceived as based on the Labour standard of monetary value (see Index)). There is thus realised what is desiderated by Mangoldt and others, an objective measure of the "virtual exchange" (Pigou, *loc. cit.*) between two nations.

The demand-and-supply curves proper to international trade are at first treated as if they were "primary" or short period contrasted with secondary curves, "supply curves proper," which express the result of external economics (see Index, s.v. *Primary*). But it may be argued that what is true of primary curves is *probably* true of secondaries, especially when the latter retain the shape that is usual with the corresponding primary curves relating to short periods.

My presentation of an argument which shows that it is generally possible to tax the foreigner, concludes with a warning against the practical application of the theory. The practices, based on the new argument, would be peculiarly liable to retaliation; and would be at least as liable as other theoretically admissible arguments in favour of Protection to exaggeration and abuse.]

Continuing my retrospective survey of mathematical papers contributed to the *ECONOMIC JOURNAL*,¹ I come to Mr. Bickerdike's article on the "Theory of Incipient Taxes," published December, 1906. The article should be read with Mr. Bickerdike's review of Professor Pigou's *Protective and Preferential Import Duties*, with Professor Pigou's remarks on that review, and Mr. Bickerdike's rejoinder.²

Mr. Bickerdike has accomplished a wonderful feat. He has said something new about Protection. The novelty is perhaps not conspicuous in the first of the two propositions which constitute his thesis: "That in pure theory advantage is always possible in normal circumstances from either import or export taxation when the taxes are small enough."³ This may seem at first sight to be a repetition of the doctrine which Mill and Sidgwick and Professor Nicholson have made familiar: that under certain circumstances a country may benefit itself at the

¹ See *ECONOMIC JOURNAL*, Vol. XVII. p. 221 and p. 524.

² *Ibid.*, pp. 98, 289, 583.

³ The words which follow in the original, "except in one peculiar and unlikely case," are here omitted; for it will be argued in the sequel that this peculiar case is not merely unlikely but impossible.

expense of the foreigner by a customs duty. But it will be found that Mr. Bickerdike adds to our knowledge of the circumstances. He predicates advantageousness of a new class, "incipient"—or small finite—taxes. There is novelty also in his second proposition: "In the case of incipient import taxes, the tendency to advantage is greater the more elastic the demand of the taxing country for the articles taxed." That demand, it is explained in the context, is more elastic when there is an untaxed home supply, that is, when the tax is protective. This is a division very different from Mill's which expresses a generally received view: "Duties on importation may be divided into two classes, those which have the effect of encouraging some particular branch of domestic industry, and those which have not. The former are purely mischievous both to the country imposing them and to those with whom it trades."¹ . . . "A protecting duty can never be a cause of gain, but always and necessarily of loss, to the country imposing it."²

Observing this contrast, the reader will perhaps modify his first impression, and, not denying that Mr. Bickerdike's doctrine is new, will begin to question whether it is true. But the appearance of extreme paradox will, I think, disappear upon further consideration. The opposition between Mill's received doctrine and Mr. Bickerdike's new thesis is not diametrical, as Mill was not adverting to the particular species of customs duties which Mr. Bickerdike characterises as "incipient." Mr. Bickerdike's second proposition, read with his first, is in keeping with the most recent results of the mathematical method applied to international trade. Thus Professor Pigou, in his *Protective and Preferential Import Duties*—published contemporaneously with Mr. Bickerdike's article—argues that in a certain case, which I might describe as that of an "incipient" tax,³ in Mr. Bickerdike's phrase, "the direct burden [incident to raising an assigned amount of revenue] under a protective can be proved smaller than that under a customs *plus* excise duty." He finds that "there is no general *a priori* presumption either for or against the imposition of protective duties as a means to raising revenue." "This conclusion," he observes, "is of course very different from the sweeping condemnation with which popular Free Trade

¹ *Political Economy*, Book V. ch. iv. § 6, paragraph fifth from the end. Remote consequences such as the development of industries are not here in question.

² *Loc. cit.*, antepenultimate paragraph.

³ Professor Pigou's words, *loc. cit.* p. 31, are: "Where all second powers can be neglected, including the loss of the consumers' surplus on that part of the consumption which the tax destroys."

theory envelops all proposals in any way tainted with Protection."¹ I submit that free traders of the classical school have "the root of the matter," as Ricardo would say. In the balance of advantage they weigh the items of first magnitude. They "take care of the pounds." The pence which they neglect may as often occur on one side of the account as the other. But the balance would seldom be turned by taking account of the pence. Thus, on the one hand, it is little discredit to practical free trade that it neglects mathematical refinements; on the other hand, it is no presumption against Mr. Bickerdike's thesis that it appears unacceptable to free traders of the purely classical school.

As if addressing first those who are least disposed to accept his propositions, Mr. Bickerdike begins with an "attempt . . . to show, by general reasoning, that they are not opposed to common sense."² When he has gone as far as it is possible to go by the highway of purely verbal reasoning, he strikes into a tract which is more arduous indeed, yet not unfamiliar, a mathematical method employed by Dr. Marshall in the *Principles of Economics*. When with the aid of this method our guide has come within sight of his conclusion, he makes for it by a direct path of his own construction. Let us follow him as he proceeds by these convenient stages.

I. *Pace* Aristotle,³ a mathematician's appeal to common sense and ordinary probabilities is not inadmissible when he deals with applied mathematics and the application is to human affairs. Mr. Bickerdike's use of popular arguments would perhaps have been more persuasive if he could have found an illustration less quaint than the group of milkmen who are supposed to "agree that every time one of them sold milk he should make a contribution to a collective fund, in token of the fact that by putting his milk on the market he is doing something to lower the price of milk to the disadvantage of his fellows."⁴ But it is difficult to illustrate by domestic transactions the peculiarities of international trade. It has, indeed, in common with internal trade between non-competing groups, the essential attribute, exchange without mobility. But the *proprium* regional separation is attended with peculiarities that are hard to parallel. How else can we conceive as practicable that monopolistic power which a State exercises by its control of the transit over a boundary in space? Where else shall we observe the phenomenon of a

¹ *Loc. cit.* p. 32.

² *ECONOMIC JOURNAL*, Vol. XVI., *loc. cit.*

³ *Ethics*, Book I. ch. iii.

⁴ *ECONOMIC JOURNAL*, Vol. XVI. p. 530.

level of prices in the transaction between members of a group raised or lowered by regulation of the transactions between members of the group and outsiders, some of the articles of which the price is thus affected being "non-exportable?"¹

Whatever illustration is adopted, we must not expect to find any easy substitute for mathematical reasoning. It is very difficult, as Mr. Bickerdike observes, to give a convincing proof of his propositions by purely verbal reasoning. I have endeavoured, without success, to lighten the difficulty by following the usual method of illustrating problems in international trade, namely, constructing simple cases of such trade. It is worth while describing these tentatives in order to exhibit more clearly the points at which the new theory purports to be an advance on the classical doctrine. In order to minimise the difficulties connected with the use of money, I adopt Professor Nicholson's helpful conception, that of two countries whose mutual dealings are considered, one is large relatively to the other, so large that the level of general prices within that country is not disturbed by changes in the terms of international trade. If the theory in question—which has no connection with the relative size of the trading countries—cannot be proved by ordinary reasoning in this case, neither can it be so proved in general. Let the large country be "England" and the small one "Guernsey," these proper names being used, like Mill's "England" and "Germany," in a conventional sense abstracted from the actual facts of commercial geography. Let us begin by considering an extreme case, that in which one country has such a rigid sort of demand for the commodities imported from the other country, that, in Mill's phrase, "a certain quantity is all that is wanted at any price; and that when that quantity is obtained, no fall in the exchange value would induce other consumers to come forward, or those who are already supplied, to take more."² The conception implies, in virtue of the continuity attributable to laws of demand, that a small rise in the exchange value will not induce the consumer to take much less. We may refer the case to the third of Mill's "three possible varieties in the influence of cheapness or demand."³ Or let us rearrange his three varieties

¹ As to the magnitude of this class the following opinion is expressed by Professor Taussig in his article on "Wages and Prices in relation to International Trade," *Quarterly Journal of Economics*, August 1906). "The quantity of such commodities is very great, and in all countries probably much exceeds that of commodities having a world range of price."

² *Political Economy*, Book III. ch. xviii. § 2, second paragraph from the end.

³ *Ibid.*, § 5.

so as to form two classes, namely, E (elastic), "the demand increased more than the cheapness," and I (inelastic), "less than the cheapness"; the intermediate variety "as much as the cheapness" being treated as a mere limit. Then one of our countries possesses the attribute I in an extreme degree. Let the other country belong to Class E.¹

First let the home country, that is, the country imposing the tax, enjoy the property E. For example, let England have a rigid demand of the sort defined for the early vegetables imported from Guernsey, but not so Guernsey for the metals, hardware, and other miscellaneous articles which she imports from England; what would be the effect of an export duty imposed by Guernsey? England would continue to take the same amount of early vegetables at a money value augmented by the tax; and the balance of indebtedness could only be restored by her sending to Guernsey a larger quantity of her own products (the price of which by hypothesis remains constant).

Now let Guernsey impose an import—instead of an export—duty. The duty will tend to check the amount of imports, and therefore their money value (Guernsey belonging to Class E). But England must pay for her imports of early vegetables, of which she will continue to take the same amount even if she has to pay more for them. The balance will be settled by England sending a greater quantity of hardware, etc., in return for the same quantity of early vegetables. But since the greater quantity of hardware, etc., has a greater money value (prices of English products being constant), the same quantity of early vegetables must have a greater money value; the price of early vegetables must be higher. But the producers of early vegetables being supposed, in abstract theory, to be in industrial competition with the producers of all other articles in Guernsey, the prices of all other articles, and in particular of labour, in Guernsey must rise. In the new equilibrium the national income of Guernsey, both real and nominal, will be greater than before;² the Treasury will obtain a net gain.

Similarly it may be shown that if England belong to Class E, Guernsey to the extreme form of I, England, by imposing either

¹ The case in which both countries belong to Class I is not adapted to popular illustration, as it presents difficulties which can hardly be removed without the use of mathematics.

² It may be supposed that Guernsey has no other foreign customers but England, as Mill at first supposes with respect to Germany, and that the tax is a general one on all imports from England.

an import or an export tax, may draw to herself, as Mill would say, the whole tax.

Now let us reverse the supposition, and, the other data being the same, suppose that the tax is imposed by the country which belongs to Class I. For example, let England, having a rigid demand for the early vegetables of Guernsey, impose an import tax thereon. The whole of the tax would be paid by the English consumer. The result is virtually the same if an export duty is imposed by England, England still requiring the same amount of early vegetables. In exchange for that amount of vegetables Guernsey is willing to take the same amount of hardware, etc., as before. But the prices of exported hardware, etc., will rise by the full amount of the tax (the prices of these English products being constant in England). In the new state of equilibrium the level of general prices in Guernsey will be higher than before. But Guernsey will derive no advantage from this circumstance, since the prices of the articles in her international market have risen in a corresponding degree.¹ The English consumers pay more money for the same amount of vegetables as before. The English Treasury gains as much as the consumer loses. England, as a whole, neither gains nor loses, abstraction being made of the *friction* incidental to manipulation of tariffs.

It might be expected that the proposition thus easily proved for a species of Class I could be extended to the class generally. But, as we recede from the limiting case of rigid demand, there becomes sensible an item which baffles the estimate of advantage to the taxing country, namely, the privation of those who are deterred from consuming the taxed commodity in consequence of the rise in its price.

Nor is the matter any clearer in the case which Mr. Bickerdike seems to regard as typical,² where both the countries belong to Class E, each having an extensible demand for the products of the other. It is evident certainly that the reduction of consumption consequent upon taxation involves privation to the consumer. It may be argued that a country which by a customs duty limits its supply to the foreigner obtains thereby some advantage. But is it visible to the eye of ordinary reason, unaided by mathematical instruments, that for taxes not exceeding a certain magnitude this gain exceeds that loss? Of course, the duty may be so high that, in Mill's words, "the trade and

¹ On the supposition made in the last note.

² *ECONOMIC JOURNAL*, Vol. XVI., *loc. cit.*, p. 532. [Compare Marshall *Money Credit and Commerce*, Book III., chap. vi., a. 5.]

its advantage would cease entirely." The disadvantage certainly preponderates for very heavy taxes; but where is the proof that as we pass from heavy to light and ultimately nominal duties, the gain to the Treasury by the foreigners' contribution exceeds the loss in the way of privation to the consumer? Common sense and ordinary economics can discern nothing about a small tax except that it is small. "The only thing that can be said for it is that it is a very little tax,"¹ as Lowe said about the registration duty on corn, when proposing its abolition. Something more could be

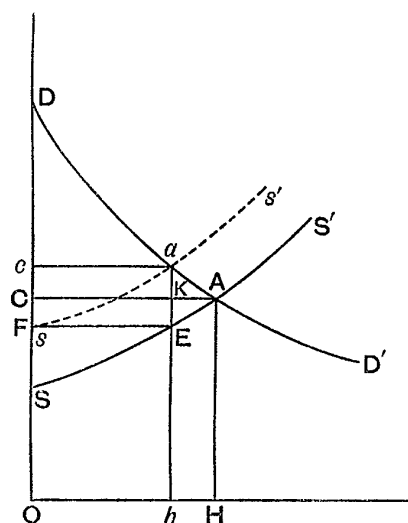


FIG. 1.

said for it on Mr. Bickerdike's theory. But we have hardly begun the proof of that theory while we confine ourselves to verbal reasoning. We have not even got so far as the candidate at an examination in Euclid who pleaded that, if he had not proved the propositions set by the examiner, at least he had made them seem probable.

II. Mr. Bickerdike advances much further by the use of a construction which he borrows from Dr. Marshall. As this construction was originally employed to illustrate the "pure theory of domestic values,"² so the case of international values

¹ Hansard, April 1869, Vol. 195, p. 388.

² Pantalone, *Pure Economics* (translated by T. B. Bruce), p. 190.

to which it may seem most appropriate is that which resembles domestic trade, in not requiring a change of price-level to be taken into account. Suppose, for instance, that the "England" of the preceding section puts a small duty on the imports from "Guernsey," neither party urgently requiring to trade with the other. Let us begin with a supposition of this sort.

(A) It will be sufficient here to reproduce Dr. Marshall's diagram, and to refer the reader to Mr. Bickerdike's use of it in the *ECONOMIC JOURNAL*:¹ "Imagine that the tax is going to be spent for the benefit of the buyers. It is evident that they gain or lose on the whole, according as $CPEK$ is greater or less than AKa . If we imagine the tax to be made very small, $CPEK$ becomes a line, and AKa becomes a point, and there is, therefore, necessarily some advantage, provided that the supply curve SS' is not an absolutely horizontal line."

This reasoning will not commend itself to those who have learnt too well the formulæ of the classical text-books. The common or Cobdenite free trader will object that in consequence of the tax a certain quantity of the commodity will be produced under more unfavourable conditions than before, industry will have been diverted from its "natural" course into less productive channels. If he condescends to look at a diagram, he will fasten attention on ΔH , the amount by which importation is reduced, and triumphantly demand how the deficiency can be made good by the home producer without resorting to inferior methods of production. Nor is it easy to answer this objection without recourse to the theory of "margins." But it ought to be intelligible to those who understand that theory that, as the marginal workman and the marginal dose of capital are only just worth applying, so an additional workman and an additional dose of capital, in excess of the margin of profitableness, are only just not worth applying. Now the added quantity of home production, a quantity of the same order as the amount by which importation is diminished, may be considered as obtained from marginal doses of productive force; corresponding to an amount of profit which is small comparatively, compared with the tribute levied from the foreigner.

To the mathematician, of course, the principle that quantities of the second order may be neglected in comparison with those of the first order presents no novelty. But he is apt hastily to conclude that the whole theory, being *de minimis*, may for

¹ Vol. XVI. p. 533.

practical purposes be neglected. It may be well, therefore, to exhibit the character of the reasoning at some length.

Mr. Bickerdike's theory involves an important principle in that branch of mathematics which is most applicable to human affairs, the Calculus of Probabilities grafted on the Calculus of Variations. The principle may be enunciated with sufficient accuracy as follows:—When a variable magnitude is in the neighbourhood of a maximum, the increment of that variable corresponding to a small finite increment of a variable on which it depends is likely to be particularly small.¹ A familiar example is afforded by the length of the day as dependent on the time of the year. In Whitaker's Almanack you find that, day after day for eight days in the neighbourhood of the summer solstice there is no change in the length of the day measured by the interval between the time of the sun's rising and that of his setting; while in other months there is a difference of two or three minutes from day to day. More precise astronomical examples of the principle may be found in the Nautical Almanack.* Here the following homely illustration may suffice. Let there be a flight of steps shaped like an arch—as an iron bridge is sometimes constructed. If the steps are all of the same length, the height becomes smaller as the summit is approached. Say the radius of the (circular) arch is thirty feet, and the (horizontal) length of each step is a foot; then the (vertical) height of the step nearest the summit will be about a fifth of an inch; at a lower point, where the slope of the arch is 30°, the vertical height of a step will be more than half a foot; it is a whole foot where the slope of the arch is 45°.

The principle may well be of importance in utilitarian philosophy in cases where the very best is the enemy of the very good. The economic application of the principle takes the following form: A *small* change of an economic variable quantity at the margin² commonly causes a *very small* change in the

¹ More exactly: if y is a variable depending on x , both variables being positive, and when $x = x_0$, y has a maximum value, viz. y_0 ; then commonly and probably, a finite positive quantity a can be found, such that for any quantity α not greater than a .

$$y_0 - y_{\Delta x} < y_0 - \Delta x - y_a;$$

where Δx is a small finite difference ($< a$); the ratio of the first member of this inequality to the second becoming smaller the smaller Δx and the greater a is; and this proposition may be extended *mutatis mutandis* to the cases of negative increments and of negative variables, to the case of several variables, to minimum values, and other cognate cases.

* Some instances are given in the ECONOMIC JOURNAL, 1922, p. 439.

As to the sense in which the term is here employed, see the article "Margin" in Palgrave's *Dictionary of Political Economy*.

corresponding surplus. As we are concerned here both with Consumers' and Producers' surplus, we may take an example from a species of the latter class, the profits of a monopolist. The numerical instances given by Cournot¹ at the end of his chapter on monopoly will serve our purpose; for, as he framed them, *aliud agens*, they may be regarded as random specimens with respect to the present object. It is allowable also to substitute in his examples a tax for an increase in the cost of production.

In his first example the price of the article before the tax is 20 fcs., and the profits of the monopolist are the fortieth part of a sum designated by the symbol a ; say, profits = 25,000 fcs., putting $a = 1,000,000$. According to the assigned relation between price and quantity demanded,² when a tax of 2 fcs. per unit of commodity is imposed, the price rises by a slightly greater amount, the new price being nearly 22.1 fcs.³ The loss of profits due to this rise of price—irrespective of the tax, not taking into account that the loss is incurred to avoid a greater loss through the tax—is nearly 124 fcs.⁴ The same change of price at a distance from the point would produce a greater change in profits. A price of 30 fcs., for instance, would afford a profit of 23,077 fcs.; but a rise of 2.1 fcs. in the price will reduce the profits by some 636 fcs., greater than the loss of profits due to the rise of prices from 20 to 22.1, viz. 124 fcs. That loss is small compared with the proceeds of the tax, viz. 2,251 fcs.⁵ The disparity would be greater if the tax and the consequent change in price were less. For instance, let the tax be 0.2 fcs. The additions to the price will then be nearly 0.201. The loss of surplus due to this rise of price is 1.3 fcs.; while the yield of the tax is 247.5 fcs. Similar verifications may be obtained from Cournot's next example.⁶

A case of two variables is presented by an instance of monopoly which I have given elsewhere with a different object in view.⁷ The price of a first-class ticket for passengers on an imagined

¹ *Principes Mathématiques de la Théorie des Richesses*, Art. 34.

² $F(p) = \frac{a}{b^2 + p^2}$, where p is the price, $F(p)$ the amount demanded at the price;

$b = 20$.

³ More exactly $2 + 20 \times 1.004987$. See the English translation, where an arithmetical mistake made by Cournot is corrected.

⁴ $1,000,000 [0.025 - 22.1/(400 + 22.1^2)]$.

⁵ $1,000,000 \times 2/(400 + 22.1^2)$.

⁶ It will be found convenient to assign the new *price*, and thence find the tax requisite to produce the rise of price.

⁷ See *F*, Vol. I. p. 132.

railway being £4 10s., for a third-class ticket £2 6s. 4½d. (nearly), a tax of 16s. 10½d. per ticket is put on first-class tickets. The consequent loss of profits to the company through the diversion of travellers from the first to the third class is £200. The yield of the tax is £16,009 12s., some eighty times greater than the loss of receipts. The disparity between the yield of the tax and the loss of receipts is much greater when the tax is smaller. When the tax is (a little more than) 2d. per first-class ticket, the loss of receipts is 1s. 8½d. The yield of the tax is £171 7s. 7d.; nearly two thousand greater than the loss of receipts.

What these illustrations illustrate is the probable smallness of that loss of surplus which is attributable to change of margins consequent on the tax, comparatively with the yield of the tax. But what we have to prove is that the loss of surplus is small comparatively with a part of the yield, namely, that part which is levied on the foreigner. For this conclusion there is required an additional premiss: that the proportion contributed by the foreigner is sensible, considerable as compared with the ratio of the lost surplus to the proceeds of the tax. Thus in the case represented by Fig. 1 $CFEK$ is large relatively to AKa when CF is small.

It follows as a corollary that the privation consequent on the imposition of Customs duties tends to be smaller with respect to the proceeds of taxation the greater (*a*) the number of objects over which the taxation is spread, (*b*) the portion of it contributed by the foreigner.¹

(B) So far the level of prices has been supposed undisturbed.² We go on to the general case, in which the change in the value of money within the home country cannot be neglected. Let us begin with a simple instance already adduced. England, having an urgent—perfectly inelastic—demand for goods imported from Guernsey, while Guernsey has not an urgent demand for English goods, Guernsey imposes a duty on imports from England.

In Fig. 1 the supply curve SS' now becomes a horizontal line, since by hypothesis the price of the English product is constant, the English producer being prepared to supply any amount (that Guernsey can want) at that price. When a tax of so much per cent., or, what comes to the same in this case, a specific tax, is imposed by Guernsey, the level of prices in Guernsey, as above shown, rises by the assigned percentage. A new demand-curve

¹ Proposition (*a*) was stated by me (with reference to taxation in general in an article on the "Pure Theory of Taxation," *ECONOMIC JOURNAL*, 1897 (above, §, p. 118).

² See above, p. 348.

is formed by adding that percentage to each ordinate of the old demand-curve. This new demand curve, say dd' (not shown in the figure), may meet ss' , the supply-curve (now a line), raised to the extent of the tax, in a point which indicates that there is no loss of consumers' surplus, as if the consumers in Guernsey now take as great a quantity of hardware, etc., as before, and pay for it the same price in vegetables—if the expression is allowed—that they would have been willing to pay before, while their willingness to exchange vegetables for hardware, depending on the real relations between the supply of and the demand for things, is not affected by a change in the pecuniary measuring rod. There is then a net gain for the Guernsey Treasury.¹

If the demand of England for early vegetables is not perfectly elastic, we have no longer the datum that the level of prices in Guernsey will rise to the full extent of the tax. Still, it is easy to see that the theory holds in the neighbourhood of the limiting case which has been considered. Advancing from that limit, we may get far on the way to a general proof. We may get further by ascribing to the home country a currency peculiar to itself. But this is to take a leaf from that stricter demonstration for which this method is but a makeshift.²

III. All that precedes may be regarded as merely preliminary to the beautiful mathematical construction on which Mr. Bickerdike mainly rests his theory. In building up this edifice of science he employs certain unessential simplifications, which may be regarded as a sort of scaffolding. I shall first describe, then contemplate in use, then remove, three pieces of this subsidiary apparatus.

First (α) it is supposed that the demand-curve and the supply-curves employed are of the simple kind which Dr. Marshall has defined as curves of constant elasticity.³ Perhaps the relevance of the concept "elasticity" to the present investigation may be made clearer to readers of the classical school by observing that the distinction between elasticity of demand greater or less than unity⁴ corresponds to the distinction between Mill's first

¹ Some modification of these statements is required if it is conceived that the Treasury employs its new purchasing power in obtaining from England hardware, etc., to be distributed in Guernsey.

² Cf. Bickerdike, *Economic Journal*, 1906, p. 531.

³ Bickerdike, *ibid.*, 1897, p. 101; Marshall, *Principles of Economics*, Mathematical Note iii.

⁴ See J. S. Mill, *Political Economy*, Book III., ch. xviii. § 5; and above, p. 345. If the "linen" which the home country imports is denoted by a_1 , the cloth which he exports by a_2 , it may be shown that the home country belongs to Class E or I

and third varieties of demand—the E and I of our first section. This distinction persists, though the levels of price, according to the usual conception of international trade, may alter.

(b) A second simplification is effected by imagining each country to use a money peculiar to itself. This money, as I understand, may be conceived as of the kind which Ricardo usually presupposes, the kind of which he says, “I shall suppose it to be invariable.”¹ We might imagine the national money in Mr. Bickerdike’s system to be an inconvertible (or at least unexportable) currency, regulated, as some theorists have proposed, so that its value should remain constant. Constancy of value might be secured by one of the methods of measuring the value of money which I have elsewhere described, preferably the one called Ricardo’s Method, or the Labour Standard.²

(c) It is further postulated that supply and demand on the part of the community are related in the simplest possible manner to the supply and demand on the part of the individuals which make up the community; the collective demand (at any assigned price) being the sum of the demands of the individuals (at that price); and likewise the community’s supply (at a price) being the sum of the amounts supplied by the individuals (at that

according as $\frac{da_2}{da_1}$ (or $\frac{da_1}{da_2}$) is positive or negative; where a_1 and a_2 are connected by

a Supply-and-Demand curve of the kind proposed by Marshall for the “pure theory of foreign trade” (see Pantaleoni, *Principii di Economia Pura*, or the English translation thereof, for an authorised version of Marshall’s doctrine). The equation to this curve may be written $a_1 f_1(a_1) = a_2 F_2(a_2)$; if with Mr. Bickerdike we put $y = f_1(x)$ for the equation of the home country’s demand for imports, and $y = F_2(a_2)$ for her supply of exports, y denoting price in a money which (as postulated in our text) is peculiar to the country. Accordingly

$$\frac{da_2}{da_1} = \frac{f_1(a_1) + a_1 f_1'(a_1)}{F_2(a_2) + a_2 F_2'(a_2)}$$

(by the usual rule for the differentiation of an implicit function)

$$= \frac{f_1(a_1)(1 - 1/e_d)}{F_2(a_2)(1 - 1/e_s)}$$

in the (slightly varied) notation of Mr. Bickerdike, who after Marshall (*Principles of Economics*, Mathematical Note iii), puts for e_d , the measure or coefficient of elasticity of demand, the *negative* of the (negative) increment of commodity corresponding to a (positive) increment of price, and (without, I think, Marshall’s authority) extends this notation to elasticity of supply. Thus ($-e_s$), e_s being the *negative* of the increment of supply corresponding to an increment of price, is positive, the third of the postulates in the text being granted. Also $f_1(a_1)$ and $F_2(a_2)$, denoting prices, are essentially positive. Therefore $\frac{da_2}{da_1}$ is positive or negative according as $1/e_d$ is less or greater than unity. Therefore the home country belongs to Class E or I according as e_d is greater or less than unity.

¹ *Principles*, ch. i. § 8.

² Vol. I., A.

price). I propose to define this class of curve as *primary*;¹ taking between *primary* and *secondary* the distinction drawn by Mr. Cunyngame between the simpler and the more complicated curves which he has described in a well-known article.² I assume that primary demand-curves are always inclined negatively, and primary supply-curves positively, to the abscissa.

With the aid of these three postulates, by a chaste use of mathematical reasoning, Mr. Bickerdike establishes his two propositions.* Obtaining an expression for the rate at which advantage increases with the increase of a small tax, he infers the first proposition from the *sign* of that expression, and the second proposition from its magnitude.³ "The formula shows only the tendency of a very small tax," as he observes. But we may extend the reasoning from a very small, to a small tax—from an infinitesimal, to a small finite change in the independent variable—by a procedure which Cournot has largely employed in investigating the effects of taxation.⁴ Begin with a very small tax levied by the home Government from buyers of foreign commodities. If every buyer has to contribute to his Government so much on each purchase, his effective demand will be altered much as the demand of a customer for goods sold at a shop might be altered, if, instead of having the goods delivered gratis at his house as heretofore, he had to pay for their carriage. In short, the demand-curve of the home country—the curve which represents the amount of foreign commodity which the home country will take at each price (in the money of that country)—has been disturbed and subjected to a slight variation. There results a new system with a new position of equilibrium. Operating on the new system, let us *de novo* impose a new small tax. And so on. The inferences which were primarily true only of a single

¹ See Index, *Secondary Supply-curves*.

² See *ECONOMIC JOURNAL*, Vol. II. p. 35, and for my interpretation of Mr. Cunyngame's distinctions, Vol. III. p. 138, *et seq.* As I understand, the two kinds of relation between price (y) and quantity of commodity supplied (x) may be symbolised by one form $y = \psi(x, x)$; where x is treated as constant when the curve is primary, is identified with x when the curve is secondary; the dependence of ψ upon x corresponding to the "external economies" varying with the scale of production, or more generally to the influence which the action of all has on the "dispositions and disponibilities" (in M. de Foville's apt phrase) of each. Demand-curves may be similarly divided. For example, $y = x + 1 - \frac{1}{2}x$ represents primary supply-curves inclined positively at an angle of 45° , a secondary supply-curve inclined negatively to the abscissa at an angle of about $26^\circ 34'$. Likewise $y + x = 2 - x$ represents primary demand-curves inclined negatively at an angle of 45° , a secondary demand curve inclined negatively to the abscissa at an angle of about $62^\circ 26'$.

* Above, p. 342.

³ *ECONOMIC JOURNAL*, Vol. XVII. p. 100.

⁴ *Principes Mathématiques*, Art. 32.

step, may now be extended to a whole flight of stairs. We may suppose the stairs to be in a vertical plane; the horizontal length of each step depends on the increment to the tax, and the increment of height corresponding to an increment of length represents an increment of advantage. The steepness of the stairs will in general diminish as we advance, until a point of maximum elevation is reached.¹ In accordance with the theory we perceive (1) that the stairs will be in general of finite length (measured horizontally from the starting-point to the position of maximum elevation); (2) that if the construction be altered by an increase of the elasticity of the home demand, *ceteris paribus*, the first step of the new stairs will be higher than the first step of the old stairs,² the second step of the new higher than the second step of the old, and so on; the comparison, in favour of the new system, being facilitated by the interesting circumstance pointed out by Mr. Bickerdike, that there are, so to speak, the same number of steps in each of the flights of stairs, that the *position* of the maximum elevation remains constant.

The safety of these steps is secured by the condition that the equilibrium of the trade with which we are concerned is stable. The case of failure excepted by Mr. Bickerdike as "peculiar and unlikely"³ is rendered practically impossible by that condition. For it secures that the denominator of the expression for the rate at which advantage (to the home country) increases with the increase of the duty, is always positive.⁴ (The numerator of the expression is positive by the third postulate.)

¹ Compare the illustration given at p. 349, above.

² The curve of supply and that of demand on the part of the foreigners and the curve of supply for the home country are not disturbed; and accordingly their coefficients of elasticity remain constant. The curve of demand for the home country is indeed disturbed; but it appears from Mr. Bickerdike's equation (*Economic Journal*, 1907, p. 100) that at the point defined by the new amount of imports, say a'_1 , the elasticity of the disturbed curve is the same as the elasticity of the old curve at the point defined by the co-ordinate a'_1 . But the elasticity of the old curve at that point is the same as at all other points, viz, the constant e_d . Thus the whole expression for $\frac{du}{dr}$ given by Mr. Bickerdike remains constant.

³ Referred to above, p. 341.

⁴ In order that the equilibrium of trade should be stable there must be fulfilled by the Marshall curves, at their point of intersection, a certain condition (Pantaleoni, *Pure Economics*, p. 207); which may be thus stated. If the abscissa represent exports from the home country (a_2) the ordinate imports into the same country (a_1), then the tangent of the angle which is made with the abscissa by a tangent to that country's Supply-and-Demand at the point of intersection, say the *slope* of the curve at that point, must be greater in *absolute magnitude* than the slope of the foreign country's Demand-and-Supply curve at the same point; whenever the two slopes are either both positive or both negative. Now for the home country the slope is—

The theory may be extended, as Mr. Bickerdike intimates, to duties upon exports; which form what may be called the "external case" of the theory. I follow Mr. Bickerdike in leaving this case to be worked out by the reader. Nor do I enter into the varieties which are presented by the partial taxation of particular imports or exports. For the purpose of this Appreciation it is allowable to lump together the imports, and likewise the exports, under one head, like Mill's "cloth" and "linen."¹

Some parts of the theory may be enunciated with reference to the premiss by which each is principally supported.

(a) Mr. Bickerdike's first assumption affords an easy method of forming a judgment as to the magnitude of a tax which may be consistent with advantage to the taxing country. After the experiments which we have performed above with laws of demand taken at random, we shall not be surprised at Mr. Bickerdike's result:—"Rather strong assumptions have to be made as to the elasticity of foreign supply and demand if the rate of the tax affording maximum advantage is to come below 10 per cent."²

(b) Mr. Bickerdike's second device—a national money of constant value—is no less serviceable. It is free from the dangers to which the use of money in the theory of international trade is liable; while it is not open to the objections which Cournot

$$\frac{F_2(\alpha_2)(1 - 1/e_s)}{f_1(\alpha_1)(1 - 1/e_d)}$$

as follows from note 4 to p. 352. And the slope for the foreign country is

$$\frac{f_2(\alpha_2)(1 - 1/\eta_d)}{F_1(\alpha_1)(1 - 1/\eta_s)}$$

by parity of reasoning, in Mr. Bickerdike's notation.

We have, therefore, if the slopes are either both positive or both negative,

$$\frac{F_2(\alpha_2)(1 - 1/e_s)}{f_1(\alpha_1)(1 - 1/e_d)} \cdot \frac{f_2(\alpha_2)(1 - 1/\eta_d)}{F_1(\alpha_1)(1 - 1/\eta_s)} > 1.$$

Now by Mr. Bickerdike's equation (1) (*loc. cit.*) we have (his "r" being initially = 1)

$$\frac{F_2(\alpha_2)}{f_1(\alpha_1)} = \frac{f_2(\alpha_2)}{F_1(\alpha_1)}$$

therefore $(1 - 1/e_s)(1 - 1/\eta_s) - (1 - 1/e_d)(1 - 1/\eta_d)$ the denominator of the expression for $\frac{du}{dr}$ is positive.

For the case in which the two Supply-and-Demand curves are not both positively or both negatively inclined to the axis, this reasoning is no longer available. But it is no longer required. For the case can only occur when one of the coefficients of elasticity, e_d or η_d , is greater than unity and the other less. And in that case the second term of the denominator to which a negative sign is prefixed is negative. Accordingly the denominator is the sum of two parts, both of which are positive.

¹ *Cp.* Bickerdike, *ECONOMIC JOURNAL*, Vol. XVII. pp. 100, 101.

² *Ibid.*, p. 101.

and others have brought against the classical conception of barter without the use of money. It avoids also a certain danger attending the conception of barter which, in the light of Mr. Bickerdike's theory, has become visible. When demand and supply are expressed in terms of the commodities exchanged (abstraction being made of money), there is a difficulty in representing a money tax on imports in the case of inelastic demand.¹ I must confess to have fallen into the trap which is here, and to have made statements about a tax on imports which are only true of a tax in kind, not in money.²

The use of a peculiar money allows us, with more security than in the preliminary stage,³ to employ the curves proper to domestic trade for the purpose of exhibiting the loss of surplus advantage consequent upon a customs duty. We have only to imagine that in Fig. 1 DD' now represents the demand-curve for imports from abroad in terms of the *national* money; while SS' represents the supply of such imports by the foreigner at prices reckoned in the same money, that of the home country. When the duty is of the kind supposed, the national currency is appreciated with respect to the international money; and accordingly the foreign supply is raised, the curve SS' being thrust

¹ The difficulty may be cleared up as follows. When an import duty of p per cent. *ad valorem* is imposed by the home country the Supply-and-Demand curve becomes transformed to Mr. Bickerdike's equation (1) $ra_1f_1(a_1) = a_2F_2(a_2)$, where $r = 100/(100 + p)$. To exhibit the position of the new curve in relation to the old one let us suppose OE in Fig. 2 (a reproduction of Mr. Bickerdike's first figure) to be the undisturbed Supply-and-Demand curve for the home country; and let us consider with reference to any assigned value of the ordinate a_1 , any point on the perpendicular passing through O , what is the abscissa, the new value of a_2 as compared with what the abscissa would have been if the curve OE had not been disturbed by the import duty. Let a_2 be the old abscissa, $a_2 + \Delta a_2$ the new abscissa (corresponding to the assigned value of a_1). Then to determine Δa_2 , we have, putting $(1 - \tau)$ for (the proper fraction) r ,

$$(1 - \tau)a_1f_1(a_1) = (a_2 + \Delta a_2)F'_2(a_2 + \Delta a_2); (1 - \tau)a_1f_1(a_1) = a_2F_2(a_2) + \Delta a_2(F'_2a_2 + a_2F''_2(a_2)); -\tau a_1f_1(a_1) = \Delta a_2F_2(a_2)(1 - 1/e_2)$$

Now e_2 is positive (by the third postulate). So is τ . Accordingly Δa_2 is negative; the new curve is swung to the left of the old one, the change in OE being, as Mr. Bickerdike has pointed out, of the kind represented in Fig. 3 of my article on International Values, *ECONOMIC JOURNAL*, Vol. VI. p. 430. The foreigners' Demand-and-Supply curve remaining unchanged, we may reason with Mr. Bickerdike (*ECONOMIC JOURNAL*, Vol. XVI. p. 532) that the new position of equilibrium, say Q , is one of increased advantage to the home country.

² See Bickerdike, *ECONOMIC JOURNAL*, Vol. XVI. p. 532, referring to my Vol. IV. p. 432. I had recognised that a distinction which I had drawn between export and import taxes was not applicable to ordinary taxes in money, only to certain customs duties in kind—not a very important exception, I admit. (See Index, s.v. *Imports*.)

³ See above, p. 348.

down. In the limiting case above supposed, where SS' was

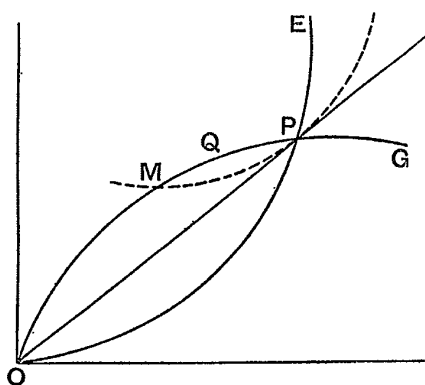


FIG. 2.

originally a right line, it will be lowered in such wise that the whole tax will accrue to the Treasury, without any loss of Con-

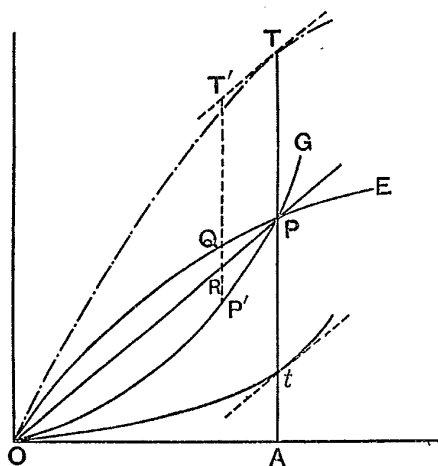


FIG. 3.

sumers' Surplus. In general the preliminary argument becomes *a fortiori* through the change of price-level.

(c) The third postulate allows us to evaluate the advantage obtained by the home country. For this purpose I shall employ another construction, that of Auspitz and Lieben, which, as already suggested, may offer some advantages. It will be remembered that they employ even in domestic trade a construction like that which Dr. Marshall invented for foreign trade. But in their construction the ordinate represents, not an amount of commodity, but an amount of money given in exchange for a commodity, which may at first be supposed to be altogether produced at home. Thus, in Fig. 3, AP represents the quantity of money offered for OA , a quantity of commodity, at the price represented by the (tangent of) the angle POA , $OP\bar{E}$ being the demand-curve. Likewise the dispositions of sellers are represented by the supply-curve OPG . If through the point O is drawn the (collective) indifference-curve (to use my own terminology), OT pertaining to the buyers, the vertical distance between the demand-curve and the indifference-curve measures the Consumers' Surplus, the collective total utility incident to purchasing at a certain price. Thus for the price (tan) POA , PT is that total utility. Likewise the vertical distance between the supply-curve and the corresponding indifference-curve represents the gain of the sellers, *e.g.*, Pt . The total advantage to the community (Consumers' + Producers' Surplus) is Tt . The last proposition remains true even if we suppose that the indifference-curve pertaining to buyers does not pass through O , but through a point at a vertical distance from O ,¹ with a like supposition as to the curve pertaining to sellers.

When a tax is imposed on the commodity the effect is to diminish Consumers' Surplus from TP to $T'Q$, that is (since TT' , the tangent at the point T , is parallel to the line OP) by an amount QR , which is less than the yield of the tax QP' , and than the foreigner's contributions to the yield $P'R$.²

So far with respect to a domestic commodity. We have next to suppose the curve $OP\bar{E}$ to represent the Demand-curve of the home country for imports from abroad; OPG the foreigners' supply of those commodities (at prices reckoned in national money). We are now not concerned with the surplus advantage accruing to the foreign sellers. In estimating the advantage which the home country obtains from the trade, we must take

¹ As sometimes supposed by Auspitz and Lieben; whose terminology I do not follow literally.

² In this reasoning it is taken for granted that the vertical distance between T' and the curve OT' may be neglected in comparison with QR and RP' ; in virtue of the general principle enounced in the last section, above, p. 354.

into account not only the gain of the consumers, but also the loss of the home producers. It will be found that this collective utility is represented by a new curve OT , which has the same relation to the new $OP\bar{E}$ as the old OT had to the old, namely, that if a straight line in any direction through O meets the demand-curve at a point P , and a perpendicular through P cuts the indifference-curve O in T , the tangent to that curve at T is parallel to the line OP . Auspitz and Lieben establish this extension of their construction through the appropriate conception of a certain amount of commodity distributed gratis among the consumers and producers of the home country in accordance with the laws of final utility—a conception pertinent to scientific Socialism.¹

So far as to imports abstracted from their concomitant exports. To represent the interest of the home country in the amount of exports, let OG now represent the home-country's supply of exports. By a parity of reasoning we may show that Pt now represents the net gain in the way of exportation.

The two together are equivalent to the sum-total which Mr. Bickerdike defines as the net advantage of trade.²

Having now shown the use of the scaffolding, I shall proceed to remove it bit by bit.

(a) First it may be remarked that the assumption of constant elasticity is not essential to Mr. Bickerdike's conclusions. The initial rate at which advantage is increasing with a small tax has

¹ We may also reason thus. Let y be the ordinate of the curve (not shown in the figure) which represents the total demand of the home country for the commodity whether home-made or imported. This curve lies *outside* $OP\bar{E}$ (which now represents the demand of the country for imports of the commodity); a vector drawn through O , making an angle θ ($< 90^\circ$) with the abscissa, meets the total demand-curve in a point, say Π (not shown in the figure), such that the distance of Π from O along the vector is greater than the distance of P , the point where the vector meets the demand-curve for imports. For $O\Pi = OP + O\pi$, where π is the point at which the vector meets the home country's supply-curve of the commodity (not shown in the figure, OPG is now the *foreigner's* supply-curve). Let (x, y) be the co-ordinates of Π , (x_1, y_1) of P , (x_2, y_2) of π . Then (for every value of θ) $\Delta x_1 \tan \theta = \Delta x \tan \theta - \Delta x_2 \tan \theta$. Now $\Delta x \tan \theta$ is the pecuniary measure of the marginal utility to the consumers in the home country of an increment of the commodity; $\Delta x_2 \tan \theta$ is the loss to the home producers consequent upon the decrement of production Δx_2 . Accordingly, $\Delta x_1 \tan \theta$ represents the net gain to the home country of an increment of importation Δx_1 . But $\tan \theta = \frac{y_1}{x_1}$, where y_1 is that function of x_1 which forms the equation of the curve $OP\bar{E}$. The curve OT obtained by integrating $\frac{y_1}{x_1} \Delta x_1$ now measures by its vertical distance from a point on $OP\bar{E}$ the net utility resulting from a certain amount of importation, in the same way as it before measured the consumers' surplus for a certain amount of home production.

² The expression for u , *ECONOMIC JOURNAL*, Vol. XVII. p. 100.

the same expression, whether the elasticities be considered as constant or not. The argument by way of steps holds good provided that, as before, in the two compared flights of steps (corresponding to different degrees in the elasticity of demand on the part of the home country for the imported goods), each step of the one is higher than the corresponding step of the other.¹ Even the expression for "the maximum advantage rate" in terms (only) of the elasticities of foreign demand and supply still subsists.² But when these elasticities are not constant, the formula cannot be used for purposes of verification as before. The formula in its generality may be employed to show that the home Government, by means of a customs-duty, may exercise a power of monopoly, and screw up the terms of international trade to the very point which the home country, acting as a Combination, would fix.

(b) When we abandon the supposition of a money peculiar to each country, we must base the theory of foreign trade on a more abstract conception, such as the "unit of productive power,"

¹ A condition which does not now admit of so neat a symbolic statement as before.

² To determine the rate of the tax which affords the greatest advantage to the home country, we have the condition that the disturbed Supply-and-Demand curve for the home country should intersect the (undisturbed) curve for the foreign country, viz. OG (Fig. 2) in a point Q which represents a state of trade of maximum advantage to the home country. In order that this condition should be fulfilled the tangent to OG at Q ought to coincide with the indifference curve pertaining to the home country which passes through Q . (See *Mathematical Psychics*, p. 116.) Now the differential equation to an indifference curve, relating to the home country, is

$$\frac{da_1}{da_2} = \frac{f'_2(a_2)}{f'_1(a_1)}.$$

The expression on the right denotes the slope, at the point (a_1, a_2) , of an indifference curve passing through that point. Also the slope of the foreigners' Demand-and-Supply curve at the point (a_1, a_2) is

$$\frac{f_2(a_2)(1 - 1/\eta_\delta)}{f'_1(a_1)(1 - 1/\eta_\sigma)}$$

Equating the two expressions for the slope and employing Mr. Bickerdike's equation (1) we have

$$r = \frac{1 - 1/\eta_\delta}{1 - 1/\eta_\sigma};$$

which is Mr. Bickerdike's result extended to the general case of variable elasticities.

Considering Fig. 2 to represent a market in the general sense of the term we see that if the dealers on the one side of the market for which the Supply-and-Demand curve is OE were to act as a Combination, the terms which they would force on their customers competing against each other are represented by the point Q in the curve OG ; discrimination between customers being forbidden (*Mathematical Psychics*, *loc. cit.*, and p. 116). The point thus defined is coincident, I think, with the "maximum utility point" investigated by Prof. Pigou in the Appendix A to his *Methods of Industrial Peace*. The analogy between monopoly and the action of a tariff is exhibited by Auspitz and Lieben (*Theorie des Preises*).

which Professor Bastable has found it necessary to introduce,¹ or the "unit of work" which I have employed.² For, I think with the classical writers, it is not in general safe to ignore the change in the level of gold prices within the home country consequent upon a variation in the terms of international trade. How, except by means of a change in the price-level, can we explain the benefit which a country whose exports are in great demand in foreign countries can obtain by imposing a duty on commodities imported from those countries.³ To determine, or at least define, the "unit" supposed to be constant while the level of gold prices is altered, we may have recourse to the principle of the Labour Standard already referred to as the regulator of the money imagined by Mr. Bickerdike. Of that money, as compared with this ideal standard, we may say what Adam Smith says of "a particular commodity" compared with "a quantity of labour": "The one is a plain, palpable object; the other an abstract notion, which, though it can be made sufficiently intelligible, is not altogether so natural and obvious."

(c) The last limitation to be removed is the postulate to which Professor Pigou has objected, that "a supply-curve can be treated as a particular expenses curve,"⁴ together with a corresponding assumption on the side of demand. "This is not legitimate in general," as Professor Pigou observes, "but it may be in special cases." I submit that this is one of the cases in which the assumption may be safely employed.

First, the postulate in question is "the least arbitrary assumption in the absence of special knowledge," a "neutral condition"⁵

¹ *International Trade*, ch. ii. p. 23 (ed. 4).

² "Theory of International Values," above, R, p. 53.

³ The case of the "Guernsey" supposed above, p. 345. But in order that a change of price level should occur and have to be taken into account, it is not necessary that the home country should be very small (in relation to the foreign country); it is sufficient that it should not be large. Of course the amount of trade affected by the tax must be considerable in order to produce a sensible result on general prices in a measurable time.

⁴ *ECONOMIC JOURNAL*, Vol. XVII. p. 290.

⁵ If, as above (p. 354), the supply-curve is designated by the equation $y = \psi(x, x)$, the conditions are co-operative or anti-co-operative, according as $\left(\frac{d\psi}{dx}\right)$ is negative or positive. Like distinctions apply to the demand-curve $y = \phi(x, x)$.

It may be observed that $\left(\frac{d\psi}{dx}\right)$ —the partial differential with respect to x only—is always positive, $\left(\frac{d\phi}{dx}\right)$ always negative; $\frac{d\psi}{dx}$ —the complete differential when $x \equiv x$ —and likewise $\frac{d\phi}{dx}$, may be either negative or positive, but $\frac{d\phi}{dx}$ cannot (in stable equilibrium) be positive while $\frac{d\psi}{dx}$ is negative.

between two conditions of which neither is known to prevail. These outlying conditions are described, with special reference to supply, as "Co-operative" and "Anti-co-operative," conditions correlated to, but not coincident with, Increasing and Decreasing returns as usually understood. I accept this presumption, based, as I understand, on the principle of what I have called *a priori*, or unverified Probability.¹ The presumption is confirmed by an appeal to authority evidencing that the assumption has worked well. Mr. Bickerdike claims the authority of Professor Pigou² on the ground of his admission respecting Consumers' Surplus, to which I have already adverted. I may add that in his mathematical reasoning about Arbitration,³ Professor Pigou explicitly abstracts complications of the kind here called "secondary." A similar abstraction has been unconsciously practised with good effect by other authorities. Many a humble votary of pure science has been edified by the truth as it is in Jevons, without having so much as heard whether there be a superadded complication.

Altogether there seems to be a considerable probability that the third postulate may be taken for granted; and accordingly that the theory holds good.

Such being the proof of the theory, what is its application? May we not answer in the words employed by Hume with reference to his theory of Interest? "Besides that the speculation is curious, it may frequently be of use in the conduct of public affairs. At least, it must be owned that nothing can be of more use than to improve by practice the method of reasoning on these subjects, which of all others are the most important, though they are commonly treated in the loosest and most careless manner." It is the latter sort of advantage—light rather than fruit—which I principally expect from Mr. Bickerdike's speculations. He has improved by practice a method of reasoning which may be brought to bear on other questions of more direct practical importance.

The direct "use in the conduct of public affairs," to which the theory is applicable, is "making foreign countries contribute something to its [the home country's] revenue," in Mill's phrase, and more generally to its Real Income, in excess of the gain which it would enjoy under a free trade. The feasibility of such projects is considered by Dr. Marshall in his judicial observations

¹ See Index.

² ECONOMIC JOURNAL, Vol. XVII, p. 585.

³ *Methods of Industrial Peace*.

respecting an Export Duty on Coal.¹ His careful statement of the *pros* and *contras*, alike in the case of export and import duties, dispenses me from the necessity of treating the subject generally. I need dwell only on those considerations which are special to Mr. Bickerdike's particular scheme for taxing the foreigner.

Mr. Bickerdike's plan has the advantage of dispensing with a detailed inquiry into the conditions of demand and supply. It really looks as if it were sufficient for his purpose that the relevant elasticities of demand and supply should not be of an extreme character—extremely small for the home country or extremely great for the foreigner; that there should be nothing peculiar and exceptional in the conditions of the trade. A *datum* of this sort, the ascertainment of which cannot be considered chimerical, seems, in the light of Mr. Bickerdike's theory and experiments, to justify the imposition of small customs duties, say from $2\frac{1}{2}$ to 5 per cent., on a great number of articles. The objection that industry is thereby directed into less advantageous channels is not admissible; for by the theory the disadvantage in the way of production is overbalanced by the gain accruing to the Treasury. Abstracting the practical difficulties to which we are coming, on the platform of pure theory the Free Trader must abandon his hectoring tone with respect to the defence of a Protectionist tax on the ground that it is a little one.²

It may be added that Protection, in losing its evil, would not lose its attractiveness. It could not be objected to this, as to many ingenious schemes hatched by students, that it could never be started. It would be only too easy to start this scheme.

These considerable advantages are counterbalanced by weighty objections. At best, and even in the abstract, the theory is but probable. In the computation of the chances in its favour there is largely involved what I have called *a priori*, or unverified, probability. But it is yet to be seen how far such probabilities—though countenanced by their use in the treatment of physical observations—are available in the conduct of human affairs. It may be suggested that the evidence is good enough to afford a regulative idea for the adjustment of indispensable taxation, but not good enough to justify the imposition of taxes for the express purpose of putting the foreigner under contribution. The distinction might be illustrated by a comparison with the principle

¹ In a letter to *The Times* published April 22, 1901; reprinted in the *ECONOMIC JOURNAL*, Vol. XI. p. 205.

² The tone of Robert Lowe, for instance, in the speech referred to above, . 347.

of equal (or least) sacrifice, which is generally considered good enough to regulate the distribution of indispensable taxation, while only Socialists propose increasing taxation expressly for the purpose of carrying out that utilitarian principle. Upon this view Mr. Bickerdike's theory might have that limited application which Professor Bastable allows to the presumption in favour of small taxes in general which I have based on the theory of small quantities.¹ There are in practice much more important considerations; still, the presumption is worth mentioning.

Of course, the general presumption may be overridden by positive evidence that, with reference to any proposed customs duty, the contribution of the foreigner is likely to be smaller than the theory requires. There is some ground for believing that the conditions of British trade are particularly unfavourable for levying a contribution on foreigners.

Among practical considerations particularly relevant to the scheme before us is the danger of retaliation. The novelty in the scheme, that it may be practised by a country which has no special advantages, nothing like a "monopoly" as producer or consumer, no doubt increases the home country's power of hitting the foreigner. But it equally increases the power of the foreigner to hit back. Practised on the grounds peculiar to this theory, the scheme of taxing the foreigner is peculiarly open to Mill's objection: "it would be a means which it would seldom be advisable to adopt, being so easily counteracted by a precisely similar proceeding on the other side."² The mathematical method shows rather more clearly than appears in Mill's discussion, that, short of the case in which "the trade and its advantage would cease entirely,"³ bilateral taxation would damage both parties.

Again, the system of many small taxes minimises, indeed, the loss incident to changes in the course of industry; but it does not minimise the amount of trade-hampering constraint that taxation, high or low, involves. On the contrary, that sort of *friction* in proportion to the proceeds of taxation is likely to be greater the more numerous the taxes.

Thus the direct use of the theory is likely to be small. But it is to be feared that its abuse will be considerable. It affords to unscrupulous advocates of vulgar Protection a peculiarly specious

¹ *Public Finance*, ed. 3, p. 353 referring to *ECONOMIC JOURNAL*, Vol. VII. p. 568, above, §.

² J. S. Mill, *Political Economy*, Book V. ch. iv. § 6, ante-penultimate paragraph. *Loc. cit.*, penultimate paragraph.

pretext for introducing the thin edge of the fiscal wedge. Mr. Bickerdike may be compared to a scientist who, by a new analysis, has discovered that strychnine may be administered in small doses with prospect of advantage in one or two more cases than was previously known; the result of this discovery may be to render the drug more easily procurable by those whose intention, or at least whose practice, is not medicinal. It was thus that the "drama of poison" perpetrated in the reign of Louis XIV. was initiated by one whose baleful receipt was obtained from Glaser, a chemist of eminence, the discoverer of a new substance.¹ Let us admire the skill of the analyst, but label the subject of his investigation POISON.

¹ Funck-Brentano, *Le Drame des Poisons*.