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NOTES ON THE HISTORY OF THE GIFFEN PARADOX

GEORGE J. STIGLER

FOR more than half a century economists have recognized the possibility of a positively sloping demand curve. They have desired a real example, probably to reassure themselves of the need for discussing the possibility, and almost invariably they have used Marshall's Giffen paradox as this example. The present note arose out of curiosity as to the nature of the evidence for the paradox—a curiosity that was and is far from satisfied.

Marshall introduced the paradox in the third edition of his *Principles* (1895),¹ with a paragraph that was not changed in essentials in later editions:

There are however some exceptions. For instance, as Mr Giffen has pointed out, a rise in the price of bread makes so large a drain on the resources of the poorer labouring families and raises so much the marginal utility of money to them, that they are forced to curtail their consumption of meat and the more expensive farinaceous foods: and, bread being still the cheapest food which they can get and will take, they consume more, and not less of it. But such cases are rare; when they are met with they must be treated separately (p. 208).

One suspects that the paradox was a last-minute addition to the *Principles*, for it stands in bold conflict with the law of demand:

There is then one *Law of Demand*, which is common to all demands, viz. that the greater the amount to be sold, the smaller will be the price at which it will find purchasers . . . (p. 175).

Thus the one universal rule to which the demand curve conforms is that it is *inclined negatively* throughout the whole of its length (p. 175 n.).

¹ This and all subsequent works of Marshall to which reference is made are published by Macmillan & Co., Ltd., London.

Already in the fourth edition of the *Principles* (1898), the law of demand was stated more cautiously:

There is then one general *law of demand*, viz. that the greater the amount to be sold, the smaller the price at which it will find purchasers . . . (p. 174);

but the footnote stating the universal rule of negative slope persisted in all later editions.

The paradox is stated again in the *Memorandum on Fiscal Policy of International Trade* (1903),² with somewhat more detail for the parliamentary audience to which it was addressed:

It is, indeed, an almost universal rule that a tax on the importation of a commodity lessens its consumption more or less; and the consequent diminution of demand tends to induce foreign producers to offer it on terms which are lower, although not always perceptibly lower. Wheat has conformed to this rule throughout all history, so far as is known, until about forty years ago. But now nearly the whole of the English people can afford to buy as much bread as they want, and yet have money enough left to buy some more expensive foods: and, as Sir R. Giffen seems to have been the first to observe, a rise in the price of wheat still leaves bread the cheapest food, which they will consent to eat in any quantity; so that, having to curtail their purchases of more expensive foods, they buy, not less bread than they would have done, but more.

In 1909 Edgeworth commented upon the paradox in the course of a review of Russell Rea's *Free Trade in Being*.³ Rea had stated that "a rise in the price of wheat would in-

² Reprinted in *Official Papers of Alfred Marshall* (1926); the passage is on p. 382. The essay was written in 1903 and revised for publication in 1909.

³ *Economic Journal*, XIX (1909), 104-5.

crease rather than decrease the consumption in this country,"⁴ and Edgeworth expressed disbelief on grounds of "a priori unverified probability"—which this time he defines as "general experience and common sense":

Even the milder statement that the elasticity of demand for wheat *may* be positive, although I know it is countenanced by high authority, appears to me so contrary to a *priori* probability as to require very strong evidence.

There could be little doubt of the identity of the "high authority," and Marshall rose to the defense of the paradox:

I have just noticed your review of Rae [*sic*] in the *Ec. J.* [XIX (1909), 102]. I don't want to argue. But the hint that a rather rash and random guess has been made by those who suggest that a (moderate) rise in the price of wheat might increase its consumption in England (not generally) provokes me to say that the matter has not been taken quite at random.

When wheat was dear and men were cheap, the estimate of consumption of wheat per head in England was one quarter: now it is, I believe, between 5 and 6 bushels. And thrifty Frenchmen with all their cabbages are said to consume more than a quarter now. Ever since I saw Giffen's hint on the subject, I have set myself to compare the amounts of bread (and cake, wheaten biscuits and puddings) eaten at first class dinners in private houses and expensive hotels, with the consumption in middle class houses and second-rate hotels; and again with the consumption in cheap inns, including a low grade London hotel: and I have watched the baker's supplies to cottagers. And I am convinced that the very rich eat less than half as much bread as the poorer classes; the middle class coming midway. This proves nothing conclusively: but it is a fair basis, I think, for a surmise as to a probability.

In America the waste of cereals is said to be prodigious: I think a rise in price would check

that; also all cereals, including even wheat, are sometimes fed to stock. In Germany it is known that dear wheat and rye increase the always enormous consumption of potatoes. I have never seen evidence that dear wheat has a considerable effect in that direction here.

With bad world harvests for two or three years in succession, I suggest that part of English wheat consumption would come from American and Australian waste. If not, then bread might become so dear that our consumption of wheat would diminish. I don't say I am right: but I am not random.⁵

We do not know Edgeworth's reply; in his rejoinder, Marshall merely reaffirms what is not in dispute—that a positively sloping demand curve can exist.⁶

So far as I know, these are Marshall's only writings on the paradox.⁷ The original

⁵ *Memorials of Alfred Marshall* (1925), pp. 438–39.

⁶ "I am even more perplexed by what you say about elasticity of demand. . . . I object to the phrase negative elasticity, because I think it tempts people to carry analytical mathematics beyond their proper scope. In this case, for instance, it suggests a paradox. And I submit that there is no paradox at all. Take a parallel case. I believe that people in Holland travel by canal boat instead of railway sometimes on account of its cheapness. Suppose a man was in a hurry to travel 150 kilos. He had two florins for it, and no more. The fare by boat was one cent a kilo, by third class train two cents. So he decided to go 100 kilos by boat, and fifty by train: total cost two florins. On arriving at the boat he found the charge had been raised to 1½ cents per kilo. 'Oh: then I will travel 133⅓ kilos (or as near as may be) by boat, I can't afford more than 16⅔ kilos by train.' Why not? Where is the paradox? What but needless perplexity can result from calling this negative elasticity, on the abstract ground that that name is in harmony with mathematical symbols, which are being pushed beyond their proper scope?" (*ibid.*, p. 441). Apparently Edgeworth was not convinced, for he reprinted the disputed review without change in his *Papers Relating to Political Economy* (London: Macmillan & Co., Ltd., 1925).

⁷ But it is worth noticing that in his *Industry and Trade* (2d ed.; 1919), the demand for wheat is described as follows:

" . . . Tooke convinced the Commission on the Depression of Agriculture, 1821, that an exceptional 'principle' applies to staple grain; because a fall in its price cannot generally increase its consumption as human food; and, when it becomes dear, people will still buy enough of it to keep them alive so

⁴ *Free Trade in Being* (London: Macmillan & Co., Ltd., 1908), p. 126. The remark occurs in a letter to Pigou (reprinted from the *Westminster Gazette*). Pigou replied: "I agree that it is possible that the elasticity of the English demand for wheat may be positive. This certainly *used* to be the case; but I doubt if it is appreciably the case now" (Rea, *op. cit.*, p. 131).

statement of the paradox in the *Principles* is modified in two respects by these subsequent writings: first, the letter to Edgeworth states that the paradox holds only for moderate variations of price;⁸ and, second, the parliamentary *Memorandum* implies that the aggregate demand curve for wheat, and not merely that of the poorer classes, will have a positive slope.

A fairly extensive search has not uncovered any explicit statement of the phenomenon by Giffen, or even a hint of it. But I cannot pretend exhaustiveness: Sir Robert was extremely prolific—author of many and long articles; director of many Board of Trade studies; witness before many Royal Commissions; and member of many committees. There are three reasons for believing that, when the hint is found, no detailed evidence for the paradox will be found with it. First, Marshall—who is famous for the generosity of his acknowledgments—refers only to Giffen's "hint." Second, when Marshall was meeting Edgeworth's chal-

lenge for evidence, he relied upon facts of personal observation when more objective evidence would have been most useful. Finally, Giffen continued to treat the demand curve for wheat as negative in slope after 1895.⁹ The following passage is the closest approach I have found to the paradox, and it is hard to believe that Giffen would have written it if he had once gone to the trouble of proving the paradox:

Fears are expressed that this rise in wheat will affect the consumption of the working classes seriously, and be bad for trade, but this is certainly contrary to long experience. Until 30 years ago wheat was always thought cheap when it was anywhere under 50s., and no particular bad effects on consumption were experienced from fluctuations below that figure. It remains to be seen whether there will be any different effect now from an advance to near 50s. when people have become so long accustomed to much lower figures.¹⁰

It may be added that Marshall was wrong in his conjecture that Giffen was the first to allege a positively sloping demand curve for wheat; Simon Gray had done this shortly after the Napoleonic Wars.¹¹

Let us turn now to the empirical evidence. Two tests of the paradox are worth investigating: first, whether observed quantities and prices of wheat indicate a positively sloping demand curve; and, second, whether the income elasticity of demand for wheat is negative, which is a necessary condition for a positively sloping demand curve.

The annual per capita consumption of wheat and its price between 1889-90 and 1903-4 are given in Table 1. One is struck

long as they have any means of purchase: in modern phraseology the demand for it is exceptionally inelastic" (p. 794).

"It is of course true that when wheat is scarce, inferior grains, potatoes, etc., may be taken from livestock and used as human food: but Tooke had collected evidence, which has been enlarged recently, that an exceptional cheapness of wheat does not cause the well-to-do working classes to eat more bread; though some wheat is lost through negligent treatment on the farm and in the kitchen and some is fed to cattle, and some stands over for future consumption" (p. 794 n.).

⁸ This interpretation also conforms with the other discussion of the demand for wheat in the *Principles* (8th ed.):

"The case of necessities is exceptional. When the price of wheat is very high, and again when it is very low, the demand has very little elasticity: at all events if we assume that wheat, even when scarce, is the cheapest food for man; and that, even when most plentiful, it is not consumed in any other way. We know that a fall in the price of the quarter loaf from 6d. to 4d. has scarcely any effect in increasing the consumption of bread. With regard to the other end of the scale it is more difficult to speak with certainty, because there has been no approach to a scarcity in England since the repeal of the corn laws" (p. 106).

⁹ See "City Notes," *Economic Journal*, XII (1902), 435. In the foregoing and following references, he spoke of the inverse relationship between harvest and price. Earlier examples are reprinted in *Economic Inquiries and Studies* (London: George Bell, 1904), I, 135-37 (first published in 1879), 215 (1888), and 394 (1883).

¹⁰ "City Notes," *Economic Journal*, XIX (1909), 334.

¹¹ See the article on Gray in R. H. I. Palgrave's *Dictionary of Political Economy* (London: Macmillan & Co., Ltd.). I am indebted to Professor Viner for this reference.

by the narrow range of fluctuation of consumption, which certainly argues for an unusually inelastic demand. But the data do not reveal a positive relationship between quantity and price; in fact, there is a small, statistically nonsignificant negative coefficient of rank correlation between quantity and price ($-.15$). We should like also to have information on income and other-than-port inventories, but it is not available. All

TABLE 1*

PER CAPITA CONSUMPTION AND PRICE OF
WHEAT IN THE UNITED KINGDOM
1889-90 TO 1903-4

Crop Year (September-August)	Per Capita Consumption (In Pounds)	Price of British Wheat (Per Quarter)
1889-90.....	347	31s. 2d.
1890-91.....	343	35 5
1891-92.....	357	33 4
1892-93.....	347	26 8
1893-94.....	344	25 5
1894-95.....	357	21 5
1895-96.....	332	24 10
1896-97.....	333	28 8
1897-98.....	324	36 2
1898-99.....	344	26 0
1899-1900.....	340	26 4
1900-1901.....	334	27 1
1901-2.....	341	28 4
1902-3.....	350	26 5
1903-4.....	363	27 2

* Source: *Report of the Royal Commission on the Supply of Food and Raw Material in Time of War*, Vol. I (1905), Cmd. 2643, p. 14, for prices and aggregate consumption; and *Statistical Abstract of the United Kingdom* for population. Consumption equals domestic production plus net imports minus increase in firsthand stocks (those in the ports) minus seed and grain unfit for milling. The quarter contains 480 pounds of wheat. The rank correlation referred to in the text was computed from consumption data before rounding off to the nearest pound.

that we may state is that the evidence does not confirm the paradox.

If we interpret Marshall to mean only that the working classes have a positively sloping demand curve for wheat, a direct analysis of prices and quantities is not possible. But it is known that the elasticity of demand for wheat equals

$$-k\eta - (1-k)\sigma,$$

where k is the proportion of income spent on wheat, η is the income elasticity of de-

mand for wheat, and σ is the weighted average of all elasticities of substitution between wheat and other commodities (the proportions of income spent on the commodities being the weights) and is necessarily positive.¹² Therefore, it is a necessary, although not a sufficient, condition for a positive demand elasticity for wheat that the income elasticity (η) be negative.

The findings of the Board of Trade's 1904 study of workmen's budgets is summarized in Table 2. Consumption is virtual-

TABLE 2*

INCOME AND EXPENDITURES ON BREAD AND
FLOUR BY URBAN WORKMEN'S FAMILIES
UNITED KINGDOM, 1904

WEEKLY INCOME (IN SHILLINGS)	AVERAGE FAMILY INCOME	PURCHASES OF BREAD AND FLOUR	
		Expendi- tures	Quantity (In Pounds)
Under 25.....	21s. 4½d.	3s. 0½d.	28.44
25-30.....	26 11¾	3 3¾	29.97
30-35.....	31 11¼	3 3½	29.44
35-40.....	36 6¼	3 4½	29.99
40 and more....	52 0½	4 3¾	37.76

* Source: Board of Trade, *Cost of Living of the Working Classes*, Cmd. 3864 (1908), p. xxvi. The study covered 1,944 families who reported income and expenditures during one week in the summer of 1904.

ly independent of income except in the highest income class; the income elasticity is small and positive. Again the data are defective (income and consumption expenditure are for only one week), but later English budget studies reveal larger positive income elasticities for wheat.¹³

In this connection, however, it should be mentioned that the first, very unsatisfactory

¹² J. R. Hicks, *Théorie mathématique de la valeur* (Paris: Hermann et Cie, 1937), p. 21.

¹³ See R. G. D. Allen and A. Bowley, *Family Expenditure* (London: P. S. King, 1935), pp. 34 ff. In view of the emphasis Marshall placed upon the high percentage of income spent by laborers on wheat in explaining the paradox, it is curious that he did not attribute the paradox to an earlier period when this proportion was much larger—he sets it at more than 50 per cent at the beginning of the nineteenth century (*Principles* [8th ed.], pp. 189-90).

study of workmen's budgets made by the Board of Trade for the year 1887 displays a very large negative income elasticity for wheat in the lowest income classes,¹⁴ and we know that Marshall thought enough of this study to reproduce one of its tables in the second edition, and this edition only, of his *Principles* (1891, p. 173). It should also be

¹⁴ *Returns of Expenditure by Working Men* (1889), Cmd.-5861. Only 34 families of different size, occupation, and location were included. To ascertain food expenditures, the families were asked to report expenditures on 17 foods (including pickles and treacle, but excluding potatoes), and the Board of Trade then computed total expenditure on the assumption that the list was exhaustive. The pertinent table (IV, p. 28) contains the following averages:

Income Class (In Pounds per Year)	No. of Families	Average Ex- penditure on Bread and Flour
28- 40.....	4	£10 13s. 9½d.
40- 50.....	2	5 4 0
50- 60.....	7	6 14 7½
60- 70.....	3	8 16 2½
70- 80.....	3	9 10 8
80- 90.....	5	8 18 1½
90-100.....	4	13 8 8
100-110.....	4	7 6 3
125.....	1	10 8 0
150.....	1	9 2 0

mentioned that Giffen had a very low opinion of budget studies, as Marshall knew.¹⁵

We must all agree with Edgeworth that experience and common sense are opposed to the idea of a positively sloping demand curve and that the burden of proof rests on the person who claims to have found a real example. Our investigation does not uncover any attempt at a systematic empirical demonstration of the validity of the example of wheat and casts some doubts on the possibility of making such a demonstration. We shall have to find a new example of the positively sloping demand curve or push our discussion of it deeper into footnotes.

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¹⁵ When testifying before the Labour Commission on Jan. 24, 1893, Giffen explained at length his misgivings with such studies, and concluded: "Beyond the fact that the proportion spent for food out of income diminishes as income increases, and that the proportion spent for rent and clothing increases, very little, it seems to me, has been really ascertained by means of these budgets which can be of great utility." (*Minutes of Evidence Taken before the Royal Commission on Labour*, Cmd. 7063-I ["Sessional Papers," XXXIX (1893), 482].) Marshall, a member of the Commission, was present that day, and, indeed, caused Giffen some anguish with his questions on other subjects.