

La Turquie Économique

The Demand for Sugar in Turkey

by

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On account of the fact that statistical work has only recently begun in Turkey the application of modern methods of statistical analysis to the economic problems of the country is greatly hampered by the lack of appropriate data. Nevertheless there are already subjects for which fairly adequate material is available. One of these is the consumption of sugar, the production and import of which is in Turkey subject to monopoly. An attempt is made in this paper to throw, by using the data at hand, some light on the factors affecting sugar demand and its elasticity. We begin by giving a general survey of the sugar economy of the country.

1 — The level of consumption and the sugar industry.

The consumption of sugar is in Turkey at an extremely low level. Family budget investigations have shown that in the rural population, forming the vast majority (about 80%) of the total population, the consumption per full man unit varies, according to districts, between 1.4 and 4.4 kgs. yearly (1935). In the urban families it is higher, the corresponding figure for the worker families of Istanbul being 13.8 kgs. (1937). The average annual per capita consumption during the period 1927-39 amounted only to 4.1 kgs. against 44 kgs. in the U. S. and 43 kgs. in Great Britain (1935). But account must be taken of the fact that especially in the rural districts substitutes are in quite extensive use, such as honey and

chiefly various fruit products, the preparation of which is facilitated by the high sugar content of the Turkish fruits.

Until 1926 Turkey had no domestic sugar production and all needed sugar was imported. The experiences of the first world war, during which, imports being largely cut off, the price of sugar rose to about 50 times its original level, induced the Government of the New Republic to bring into existence a sugar industry. The foundation of sugar plants and the culture of sugar beet was furthered by many measures. With a view to regulating imports and adjusting them to domestic production a sugar (import-) monopoly was created. In 1926 the first plant was founded and during the next eight years three other factories followed. Sugar beet production developed parallelly. The now existing four plants seem capable of satisfying the present domestic demand; their annual production amounted in the years 1939-41 to about 90 000 metric tons. Imports decreased regularly since 1926 and from 1934 on, sugar has been in the main only imported when beet production was deficient or for the purpose of forming stocks.

The Turkish sugar industry is essentially a *state industry*. Although private capital had participated in the first plants the industry is now entirely held by three banks: the Sumer Bank, Agricultural Bank and Business Bank, two of which are state banks whereas the third (Business Bank), though private in form, is greatly under state influence.

The sugar industry has also a pronounced *monopolistic character*. The import monopoly shuts out foreign competition completely. A competition between the various plants in the country was excluded from the beginning and after their amalgamation into a single corporation in 1935, has become inconceivable. The industry is to a large extent even secure against the threat of the law of substitution, since the other sweets used (honey, fruit sugar preparations) are not capable of replacing sugar in certain respects — especially as compliment to coffee and tea — and since their production can not be easily increased.

2 — The price policy.

The price of sugar is determined by the Government in so far as it depends, besides the cost of production — principally — on the amount of the sugar tax levied by the State. Up till 1935, in the main because of elevated production costs, it was higher than the

price in many countries. It amounted for example in 1934 to more than three times the price in England. In 1935 with the view to increasing the sales — and also diminishing thereby the production costs — an important reduction took place. The price of granulated sugar was lowered from 36.75 to 25, that of the other sort in use (cube sugar) from 39.50 to 28 piasters the kg. ¹). This reduction had a very favourable effect on consumption, the sales increasing from 52.566 tons in 1934 to 100.620 tons in 1939, in which year the price of 25/28 piasters per kg. still prevailed.

The sugar price policy during the war offers peculiar and interesting aspects. The rise of the general price level which from 1940 on could be observed in every country was in Turkey extremely sharp. The index of wholesale prices had risen in 1943 to almost 6 times its level in 1938. But sugar prices remained in the first years of the war relatively cheap, the price increases in 1940 and 41 being only moderate ²). The international political insecurity together with this relatively low price led in 1941 to hoardings in great extent. The sales attained the record amount of 108.451 tons (6.01 kgs. per capita).

On the other hand, on account of insect and water damage to the crop, and of the fact that beet prices were not raised in time in the same proportion as wheat prices had increased, sugar beet production showed a sharp decline, leading to a corresponding fall in the output of the plants (57.000 tons against 87.000 in 1941).

The Government, judging it impossible under the existing circumstances to ration sugar consumption — and wishing at the same time to secure high treasury returns — proceeded to *drastic price augmentations*. The price of granulated sugar was raised in January 1942 from 45 to 90, in August of the same year to 105 and three months later (November) to the extremely high level of 480 piasters the kg., almost 20 times the prewar price.

But in order to alleviate the social hardships it involved, this last augmentation was combined with the creation of a *cheap sugar*, destined to be distributed to the classes which had suffered most under the extraordinary rise of the cost of living. Thus for the same sort of sugar a second much lower price came into being, amounting

¹) According to the official rate 1 Turkish pound (=100 piasters) is equivalent to about \$ 0.51. (The premium of 40 % paid for the Dollar is taken here into account.)

²) The price of granulated sugar was raised in March 1940 to 35 and in April 1941 to 45 piasters the kg.

to 120 piasters the kg. for granulated sugar and to 140 piasters for cube sugar (market price 480 and 500 piasters respectively). The beneficiaries of this cheap sugar are the so called "receivers of fixed income", in reality mainly, acting and pensioned employees of the state, the local authorities, and of the governmental enterprises and works. Cheap sugar is given furthermore to hospitals, boarding schools and similar institutions, and (with the aim of encouraging beet production) to sugar beet farmers at the delivery of their products. The quantities of cheap sugar thus distributed and the amount of sales of free (expensive) sugar in the years 1942-44 are as follows :

	<i>Amount of cheap sugar distributed</i>	<i>Amount of Sales of free sugar</i>	<i>Total Amount</i>
	(Metric tons)		
1942	1.773	60.281	62.054
1943	13.891	29.041	42.932
1944	22.597	52.448	75.045

The price of free sugar could not for long be maintained at the level of 480/500 piasters the kg. Having almost led to a cessation of the sales it had to be reduced in May 1943 to 235/240 and in November of the same year to 180/200 piasters. This last price is still in force, while the price of cheap sugar has always been kept at the initial level.

3 — Period of the investigation and nature of basis data.

We based our investigations upon the period 1927-39. This was done for the following reasons:

As some important data are unavailable, the years before 1927 could not be taken into consideration. On the other hand, after 1939, in connection with the world war, abnormal factors begin to affect sugar demand and some data lose their reliability. The index of wholesale prices, due to the existence of official as well as of black market prices, no longer reflects correctly the fluctuations of the general price level, and from 1942 on, as a result of frequent price modifications and of the creation of a second price for sugar, it becomes, as will be explained later, impossible to compute an accurate annual average price. Last but not least we have for the

years 1940-44 no series capable of representing purchasing power. But although we draw our inferences from the period 1927-39, we shall examine, at the end, also the development of sugar demand during the war years in order to ascertain as far as possible if our results are belied by this development or not. We give, therefore, among our basic data (table on page 223) not only the figures for the period 1927-39 but also those for the subsequent years.

In column 2 of the table are shown the quantities of *sugar sales* (metric tons, all sorts of sugar). These quantities are not quite homogenous and free from error. Whereas the figures for 1936 and the following years express the real quantity of sales (to wholesalers) the items for the previous years represent simply the *aggregate of sales of domestic sugar and of imports*. In fact the amounts of foreign sugar marketed in the years 1927-35 are unknown and for this period only import figures are available. As all imported sugar need not be sold in the same year and as it is possible, conversely, by utilizing existing stocks to sell more than the amount imported, the quantities in question are certainly not accurate. But a comparison of the sale figures obtained by this method for the years 1936, 37 and 38 with the real sales in the same years, as well as the result of inquiries, lead to the conclusion that any errors our quantities for the years 1927-35 may contain cannot be important.

While our sale figures comprise both kinds of sugar used in Turkey, our *prices* (column 1 of the same table, piasters per kg.) relate only to the more important sort, *granulated sugar* (about 60 % of total consumption). The quantities sold of each sort in the years 1927-35 not being known, a weighted average covering the two could not be computed. But this is possible for the subsequent years and it is seen that the correlation between the average prices of the two kinds and the prices of granulated sugar was in 1936-43 almost perfect ($r = +0.9996$). This fact legitimates the procedure of taking only into account the price of the one sort.

Our prices are furthermore *wholesale prices* and their *averages* figuring in the table have been found in the following way:

The mean prices for the years 1927-41 are *simple arithmetic averages*, i. e. averages of the monthly mean prices (of granulated sugar) which in turn represent nothing else than the arithmetic means of the prices having prevailed on the different days of each month.

As in November 1942 there was created a second sugar price, the mean prices for 1942, 43 and 44 had to be computed by supple-

menting and combining this simple arithmetic average with a weighted average for cheap and expensive sugar ³⁾.

To use instead of these averages the ordinary *weighted mean* ($= \frac{\sum (pq)}{\sum q}$), where p represents the different prices which prevailed during the year and q the quantities sold at each price, treating the cheap sugar distributed in 1942-44 as regular sales at the price of 120 piasters the kg., would certainly have been preferable. But the weighted mean prices of granulated sugar could neither be obtained from the Sugar Corporation nor computed, the necessary items being unavailable.

Nevertheless, as no very important price changes occurred during 1927-41 and as the simple arithmetic mean does not depart materially from the weighted mean when this is the case, our average prices for these 15 years can be looked upon as quite reliable. But this is untrue of the average for 1942, 43 and to some extent of that for 1944:

a) The price of sugar has undergone very *sharp modifications* in the course of the years 1942 and 43. The monthly mean rose in 1942 from 57 to 480 piasters to fall in the next years from 480 to 180 piasters. The simple arithmetic mean price can under these circumstances hardly be representative.

³⁾ This was done thus:

It is understood that in 1942 the distribution of cheap sugar merely took place in December. We deducted therefore from the total amount of the December sales the quantity of cheap sugar, said to be sold during 1942, and calculated a weighted average price for this month only. The simple arithmetic mean of this average and of the ordinary mean prices for the other 11 months was taken as the yearly average for 1942. In 1943 and 44 cheap sugar was distributed throughout the year. But although the yearly amounts of the distributions are known, the quantities given out in each month could not be established. We calculated therefore the mean price of these years by weighting the price of cheap sugar (which never changed) and the average price of expensive sugar (which remained stable only in 1944) by their corresponding yearly quantities. Our procedure can be summarized by the formula

$$M = \frac{\sum p q + p' q'}{q + q'}$$

where M is the general average price for the year, p the monthly mean price of free sugar, q the quantities of free sugar sold during the year, p' the constant price of cheap sugar and q' the total amount of it distributed in the course of the year.

It must be noted that this method, taking no account of the months in which the distribution of cheap sugar was effected, will yield in general different results from the method applied to the price data of 1942. It gives e.g. as average price for 1942: 141.1 piasters instead of 116.8.

(b) Some of the price modifications were effected *within months*. If this is the case the average price for the respective month and therefore the mean price for the year will contain a certain bias. For a relatively larger part of the sales of the month will have been carried out to the lower price so that this price ought to be given a greater weight.

(c) There is reason to believe that *cheap sugar was not consumed entirely by the receivers* and that a considerable part of it came again to the market, to be sold at prices approaching that of expensive sugar. It is likely that this happened especially during the time when the price difference between cheap and expensive sugar was very important, i. e. in the months (December 1942-April 1943).

As regards the other figures in our table the following explanations will suffice to make their nature clear:

In column 3 of the table is shown the *population* of Turkey in the different years of our period (in millions). The figures for 1927, 35 and 40 represent results of censuses⁴). The population of the other years has been inter- and extrapolated from these three items by using a formula of the type

$$y = a + bx + cx^2$$

where y is the population and x the years. Column 4 gives the *per capita consumption* in kgs. (amount of sales divided by population), while column 5 contains the index of wholesale prices prepared by the Istanbul Chamber of Commerce with 1913 as base year. In this column the figure for 1944 is an estimate, made by analogy with the development of the other index (that of the Bureau of Business Cycles) in the same year. Finally in column 6 we give the *real (deflated) price*, obtained by dividing the raw prices by the index numbers of column 5.

4 — Sugar demand — Sugar price — General price level.

Turning now to the analysis of our data we begin by pointing out that since we have here the case of a monopoly and the price of

⁴) As a considerable number of inhabitants could not be counted in the census of 1927, its result (13.6 millions) was subjected to a correction.

sugar is determined arbitrarily, *demand is to be treated as the dependent*, the price as the independent variable.

If we compare the variations of the *raw (unadjusted) prices* with those of the *total sales* there appears between the two series no marked relationship. It is true that their coefficient of correlation for the period 1927-39 attains the quite high level of -0.712 . But this is only due to the influence of the respective trends, which in the period in question are strongly diverging. Thus if we consider only the years 1927-35 we get for r the absurd value of $+0.184$, the trends as regards this shorter period running in similar directions.

Even if we take into account the *number of population* a better result is not obtained: The coefficient of correlation between the series "per capita consumption" and "raw prices" amounts:

for the period 1927—39 to -0.483 ,
 " " " 1927—35 " $+0.435$.

On the other hand, a strong agreement manifests itself if we consider as further factor the fluctuations of the *general price level*. The coefficient of multiple correlation, corrected for the number of parameters ⁵⁾, between the per capita consumption (y) and the two independent variables, raw prices (p) and index of wholesale prices (i) has the following values:

For the period 1927—39 $R'_{y \text{ pi}} = 0.875$
 " " " 1927—35 $R'_{y \text{ pi}} = 0.913$

The comparison of the per capita consumption (y) with the *real prices* (x) [instead of raw prices (p) + index (i)] gives very close results, the corrected simple coefficient of correlation r'_{yx} amounting

in the period 1927—39 to -0.879 ,
 " " " 1927—35 to -0.958 .

The coefficients yielded by the two methods besides agreeing with each other are all high and little affected by the length of the period -therefore also by trend. As also strong theoretical reasons

⁵⁾ According to the method of Schultz. See "The Theory and Measurement of Demand", Chicago 1938, pp. 218, 740-41.

are at hand we conclude that sugar price, general price level and the number of population⁶⁾ have influenced as major factors the consumption of sugar. As a first approximation to the law of sugar demand we write the equation of regression of real prices on per capita consumption for our basic period 1927-39:

$$y = 7.406 - 0.744 x \quad (S = \pm 0.359) \quad (1)$$

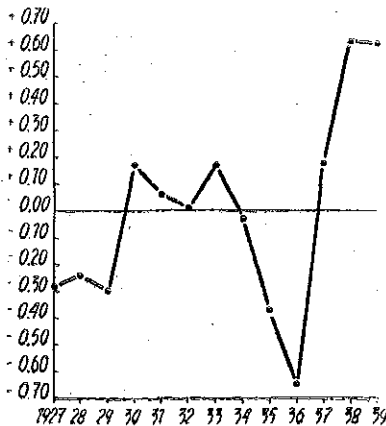
The logarithms of real prices and per capita consumption give an even somewhat higher value for r' . For the period 1927-39 it is equivalent to -0.912 and the equation of regression is:

$$\log y = 1.062 - 0.717 \log x \quad (S = \pm 0.0304) \quad (2)$$

5 — The influence of purchasing power.

In order to get a notion about the nature of the other factors affecting sugar demand, the differences between the real per capita consumption (y) and that computed from our equations 1 and 2 (y') are plotted below against time.

According to equation (1)



According to equation (2)



There appears in the graphs a characteristic cyclical movement which suggests that periodic fluctuations of purchasing power have

⁶⁾ If we neglect the factor population and seek the corrected simple correlation coefficient between total sales and real prices we get:

for the period: 1927—39: Only (-0.758) instead of (-0.879)
 " " " 1927—35: " (-0.919) " " (-0.958)

influenced sugar demand. Moreover the steep rise of the line towards the end of the period gives the impression of an upward trend.

Let us first try to verify the influence of the former factor. For this purpose we need a series capable of representing purchasing power. (Since neither statistics of payrolls nor an index of production or business activity are available, we use as an approximate indicator hereof the *deflated values of the exports*. The reasons which make us believe that these values could on the whole describe the development of purchasing power are the following:

Turkey being an agrarian country with a very limited inner market, it is clear that the level of the exports will affect materially the incomes of wide groups, especially those of the rural population. Indeed prosperity periods have as a rule always been marked in Turkey by high export figures, depression periods on the other hand by diminished exports, a fact which, by the way, should be noticeable in every agrarian country. Furthermore there is a very high correlation between the values of the exports and imports (it equalled in the period 1927-37 92 %); and the inference seems justified that if rising exports are accompanied by increased purchases of foreign goods they will be also concomittant with increased purchases of domestic products⁷⁾. The necessity of considering in this connection not the original but the *deflated* export figures needs no further explanation.

Certainly all this can only be valid under normal circumstances and in times like the present war period, when foreign trade is artificially cut off, export values will by no means be capable of expressing the evolution of buying power. For in such times, the decline of foreign trade can be more than compensated by a forced expansion of the inner market. Hence — and having no other series which we could use instead of exports — we have to confirm our analysis of the relation between sugar demand and purchasing power to the prewar period.

The original and deflated^{7*)} values of the Turkish exports in the years 1927-39 are shown below:

⁷⁾ Imports could therefore also serve as indicator of purchasing power. But as tariffs and import regulations have undergone very sharp modifications during the period 1927-39, it was thought preferable to base the analysis on the export figures.

^{7*)} Deflated by the index of wholesale prices (base year 1913).

(Millions of Turkish pounds)

Years	Value of Exports		Years	Value of Exports	
	Raw	Deflated		Raw	Deflated
1927	158.4	12.55	1934	92.1	13.72
1928	173.5	13.39	1935	95.9	13.05
1929	155.2	11.78	1936	117.7	14.41
1930	151.5	15.15	1937	138.0	16.25
1931	127.3	14.81	1938	144.9	18.00
1932	101.3	13.72	1939	127.4	15.33
1933	96.2	14.87			

We must emphasize again that the series of deflated exports values is supposed to indicate only the development of consumers buying power, and it should be noted that these values can by no means be representative of national income.

Consumers purchasing power depends on several other factors besides the amount of the national income, especially the rate of savings resp. investments and — what is very important for a country like Turkey — the *relative extent of autarcic economy*, i. e. satisfaction of wants by ones own production, without effecting exchanges. To make the meaning of this last factor clear it might be pointed out that production, though always creating income, brings forth purchasing power only when the products are exchanged and that, if the ratio of the exchanged goods rises to the detriment of those directly consumed by producers, buying power might increase without a corresponding increase of the incomes or of a decrease in the rate of investments.

We believe that the rising tendency which can be remarked in our deflated export figures must to a great extent be ascribed to this cause, i. e. to the fact that, in connection with the improvement of the transport conditions, the exchange economy sector widened while autarcic economy steadily lost ground.

If we introduce the deflated export values (g) as second independent variable into our equation of demand, we get as corrected coefficient of multiple correlation $R'_{y, xg}$ the value 0.944 and as the equation of regression

$$y = 4.709 - 0.696 x + 0.175 g, (S = \pm 0.238), \quad (3)$$

where y represents the per capita consumption and x the real price. The corresponding value and expression for the logarithmic form is:

$$R'_{\log y \log x \log g} = 0.958$$

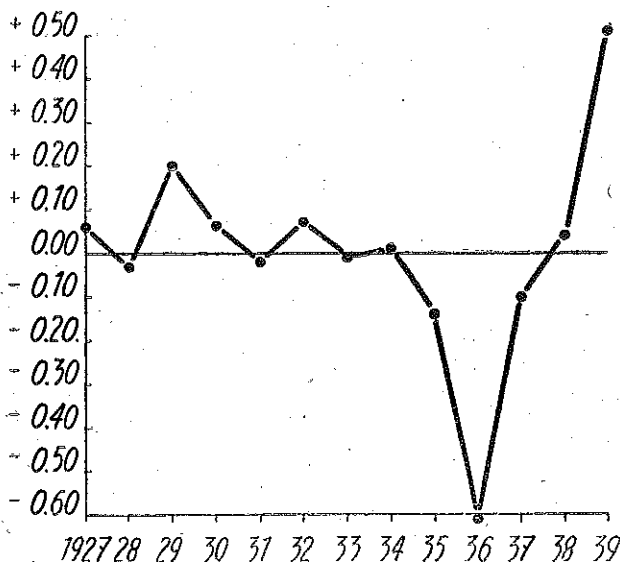
$$\log y = 0.521 - 0.684 \log x + 0.451 \log g, (S = \pm 0.221). \quad (4)$$

A calculation by another method confirms the relationship between exports and sugar demand. If instead of the real prices (x) and the real export values (g) we take as independent variables the raw price of sugar (p), the raw value of exports (e) and the index of wholesale prices (i), we get for the corrected coefficient of multiple correlation $R'_{y, pei}$ the value 0.901 which, though not as high as the coefficient just found, is sensibly superior to that yielded by the two independent variables, raw price and index of wholesale price, only ($=0.875$, see page 211).

6— *Changes of taste.*

The graphs of the residuals on page 212 showed besides a cyclical movement — which we think has been identified as the effects of fluctuations of purchasing power — an upward tendency. This tendency could at first sight be attributed to the growing taste for sugar, inducing — independently of an increase in purchasing power — those groups who already use sugar to consume more and the non consumers to become consumers. In fact it can be said that in Turkey this factor is likely to play a certain rôle. The general level of consumption is very low and the number of persons who use no sugar at all should in the interior of the country not be small. The saturation point being still very far off, the assumption seems reasonable that, in time, people getting better acquainted with the qualities of sugar, the predilection and demand for it will gradually grow, even if purchasing power and price remain constant. The improvement of transports will certainly work also in this direction. But if we plot against time the differences between the observed values of y and those computed from our last equation (No. 3) — which takes account of purchasing power — we remark that all traces of a rising trend have vanished. As will be seen from the figure below, the line fluctuates in general about the o axis and although

showing a sharp decline in 1936 and an abrupt rise in 1939. manifests no marked upward or downward tendency.



Indeed if we introduce into our equation of demand an additional variable for time (the linear function t) we get a lower value for the corrected coefficient of multiple correlation. $R'_{y, xgt}$ equals 0.940 while $R'_{y, xg}$ amounted to 0.944. It results from this that what seemed to be effect of growing taste was in reality due to the rising tendency of purchasing power. Nevertheless, in view of the approximate nature of our index for purchasing power, it seems advisable to postpone the definite verdict on this point.

7 — A transitory factor and a faulty item.

The residuals calculated from equation (3) are for the years 1936 and 39 of abnormal magnitude. The deviation of the real per capita consumption (y) from the computed consumption (y') attains in these two years the values -0.61 and $+0.51$ kgs. respectively, whereas in the other 11 years the maximum deviation is not more than 0.20 kgs. This gives the idea that in these years, special factors must have been in action, an idea which is confirmed by the analysis of the circumstances prevailing during the years in question.

In June 1935 — as was said before — the price of sugar was lowered from 36.75/39.50 to 25.0/28.0 piasters the kg. which level was maintained till 1940. The yearly average price for granulated sugar sunk from 36.75 piasters in 1934 to 30.40 in 1935 and to 25.0 in 1936. Since, on the other hand, there was during the same years a marked rise in the general price level, the decline of the real price was even sharper. It fell from 5.47 in 1934 to 4.14 in 1935 and to 3.06 in 1936.

Now it can be assumed that *to sharp and continued price reductions, demand will not immediately respond* in the degree corresponding to its elasticity. For it will take time to change the established habits of consumption and to find new uses for the commodity, the more so as a decline of price being in question, there is no economic constraint urging the consumer to these changes. In other words, the increase of demand will lag behind such price reductions.

The fact that in 1936 the real per capita consumption was much lower than the theoretical amount must, we believe, be attributed principally to this cause. We can explain the situation in the light of this hypothesis as follows: To the price reduction which had taken place in 1935, demand had already been unable to react to the extent that it ought to, according to its elasticity (the deviation for this years is —0.14 kgs.). Its reaction to the further important price fall had therefore, for the reasons mentioned, to be less strong.

As regards the year 1939 the world war which broke out in September of this year meant a serious drawback for Turkish exports (especially since the bulk of these take place as a rule during the months September-December) leading to a quite important decline of exports relatively to 1938. But this does not imply that purchasing power sank correspondingly. For even if the war did not lead to an increase of business within the country, the decline of exports was due principally to the difficulties of transportation and apparently not to a decrease of sales to foreign countries, the value of the goods which could not be exported having been, as it seems, mostly received. Hence our export figure for 1939 can not be looked upon as representative of purchasing power.

If we leave out these two years which we regard as affected by abnormal or transitory factors and base our calculations upon the remaining 11 years we get for the relation between the per capita consumption (y), the real price (x) and the deflated value of exports (g) the following results:

$$R'_{y, xg} = 9.992$$

$$y = 4.986 - 0.708 x + 0.159 g \quad (S = \pm 0.0834) \quad (5)$$

and for the logarithmic form

$$R'_{\log y, \log x \log g} = 0.987,$$

$$\log y = 0.577 - 0.710 \log x + 0.419 \log g \quad (S = \pm 0.0109) \quad (6)$$

The coefficients of correlation obtained being very near unity, we can regard these equations as the two forms of the equation of sugar demand.

8 — Results and Tests.

Our logarithmic equation (No. 6) gives as coefficient of *elasticity of demand* the constant value -0.71 while equation (5) yields as average value of elasticity (i. e. the elasticity which corresponds to the mean value of the variables⁸⁾ -0.642 . The two figures are quite close to each other and it follows from them that the demand for sugar in Turkey is inelastic, though not so much as in the western countries, the coefficient computed for instance for the United State lying between -0.26 and -0.36 ⁹⁾. But this difference seems reasonable as it can be assumed that the degree of elasticity will in general be inversely correlated with the level of welfare.

From equation (5) it ensues that our two independent variables account for 98.8% of the variance of the per capita consumption, of which amount, according to the *coefficients of determination*, 82.4% is attributable to the real price and 16.4% to purchasing power (deflated export values).

The *mean square error* has for equation (5) the value of 0.0978 kgs., i. e. 2.21% of the mean per capita consumption. The corresponding value for the logarithmic equation is 0.0128 logarithmic units which we can express as 2.99% of the computed values¹⁰⁾.

We give below the differences between the real per capita consumption and the figures calculated from equation (5), from which

⁸⁾ See H. Schultz, "The Theory and Measurement of Demand", pp. 190-93, 215-17.

⁹⁾ Coefficients computed by Schultz. See op. cit. page 196-7.

¹⁰⁾ See Schultz, op. cit., p. 217-18.

it can be seen that the maximum deviation does not even attain twice the value of the mean square error.

Year	Actual per capita Consumption (y) Kgs.	Computed per capita Consumption (y') Kgs.	$y - y'$ Kgs.
1927	4,48	4,47	+0,01
1928	4,76	4,83	-0,07
1929	4,86	4,72	+0,14
1930	4,77	4,73	+0,04
1931	4,39	4,41	-0,02
1932	3,68	3,62	+0,06
1933	3,31	3,30	+0,01
1934	3,31	3,30	+0,01
1935	3,96	4,13	-0,17
1936	—	—	—
1937	5,40	5,49	-0,09
1938	5,73	5,65	+0,08
	48,65	48,65	

The standard errors of the coefficients in our equations of regression and the result of *Fisher's (t)* test to which they were submitted are shown below:

Equation 5

<i>Value of the Coefficient</i>	<i>Standard errors</i>	<i>t</i>	<i>p</i>
b = -0.7076	0.03127	22.63	< 0.01
c = +0.1592	0.01762	9.034	< 0.01

Equation 6

b = -0.7096	0.03911	18.14	< 0.01
c = +0.4188	0.07762	5.395	< 0.01

It is seen that all probabilities are very low, which, to the extent of the limited power of proof of this test, seems to validate our results.

9 — The subsequent development.

The best test for the validity of a demand equation is to examine to what extent it is capable of explaining the subsequent development. In our case this test is rendered very difficult by the fact that the years following our period of investigation are of an extraordinary nature and that for these years we have no index of purchasing power and — for part of the period — no reliable mean prices. But it is not altogether impossible. Let us suppose for the moment that our index of purchasing power (g) remained throughout the years 1939-44 at its level in 1938 (i. e. 18.0) and compute from equations (5) and (6) the theoretical consumption (y') making use of our item for (g) and the yearly average prices (x) given in the table on page 223. The figures thus obtained are compared below with the real consumption (y).

Year	x Real Price	g Index of purchasing power	y Per capita consump- tion Kgs.	Computed p. cap. con- sumption (y') according to		Residuals (y - y') according to	
				Equation 5 Kgs.	Equation 6 Kgs.	Equa. 5 Kgs.	Equa. 6 Kgs.
1939	3,01	18	5,80	5,72	5,79	+ 0,08	+ 0,01
1940	3,33	18	5,58	5,51	5,39	+ 0,07	+ 0,19
1941	3,70	18	6,01	5,59	5,54	+ 0,42	+ ,047
1942	5,16	18	3,38	4,20	3,95	- 0,82	- 0,57
1943	6,39	18	2,30	3,33	3,39	- 1,03	- 1,09
1944	5,26	18	3,95	4,13	3,90	- 0,18	+ 0,05

It appears from the table:

1) That the two equations give in general — especially for low prices — quite close results;

2) that the estimates hold good for 1939 and more or less also for 1940 and 44, whereas for the years 1941, 42 and 43 they depart materially from the real consumption.

Could these conformities and disagreements be explained reasonably? To answer this question we must consider each year separately.

For 1939 our yearly mean price is accurate as the sugar price remained stable throughout the year. The war having broken out only in September, an appreciable effect of hoardings on con-

sumption is not to be expected, the more so as at first, there was no reason to fear a scarcity of sugar or an increase of its price. Important changes in purchasing power are also not likely to have occurred and since, according to our equations, this factor has only a secondary bearing on sugar demand, the changes which really took place would not affect materially the figure computed for this year. Under these circumstances it seems justified to see in the agreement between actual and computed consumption in 1939 a confirmation of our equations.

All this is true to a great extent also for 1940. In the course of this year the sugar price was modified only once and that very slightly so that our yearly average price should be quite correct. Furthermore there is no reason to believe that material changes of purchasing power occurred, especially since the general price level varied very little in this first year of the war. Hoardings might have begun, but our computed consumption, being somewhat above the real quantity, offers a certain margin for this factor.

For 1941 the yearly average price is apparently also trustworthy, only one small price modification having taken place during the year. On the other hand, although it can be assumed that there took place far-reaching changes in the structure of incomes, due to the general rise of prices, nothing can be said about the probable level of the purchasing power index. But there can be no doubt that the important surplus in actual consumption (relative to computed consumption) results in the main from hoardings which were, as explained before, very pronounced in 1941.

In 1942, on account of the growing inflation, the alterations in the structure of incomes were certainly very accentuated. The decline of the fixed incomes and the rise in the incomes of farmers and entrepreneurs assumed very great proportions. But no surmise whatsoever is possible about the final effects of these alterations on general purchasing power. It must moreover be born in mind that our mean price for this year is far from being correct. Nevertheless, it seems certain that on account of the drastic increase of the sugar price hoarded sugar was consumed in 1942 to a great extent, which may account, at least partly, for the fact that real consumption was much less than the computed.

For the great lag of actual consumption in 1943 behind the computed consumption the following explanations can be furnished:

- 1) There is reason to suppose that in consequence of very heavy

taxes, created this year (capital levy and tax on agricultural products), purchasing power declined, though it is an open question if the index fell below the level of 18.0 on which our calculations are based.

2) The *real yearly average sugar price seems to be higher* than our figure (6.39), as it is to be assumed that resales of cheap sugar to prices approaching that of the expensive sort occurred precisely in this year.

3) The fact that demand does not immediately respond to continued *price reductions* in the degree it should according to its elasticity, has apparently played also a part, for in the course of this years, two very important price reductions (from 480/500 to 235/238 and to 180/200 piasters the kg.) have taken place.

In 1944 the actual and computed quantities of per capita consumption approach again each other. The following circumstances might have contributed to this:

As the sugar price remained constant throughout the year, it can be supposed that the factor mentioned above under 3) lost in the course of time its force. Further, since the difference between the price of expensive and cheap sugar was greatly diminished, it is likely that factor 2 also was not effective. But on the other hand, we know nothing about the development of purchasing power in this year and the index of wholesale prices for 1944 and therefore also our yearly mean price represent estimates.

It is seen that the divergencies and agreements between the actual and computed consumption figures are to a great extent capable of being explained reasonably. But there is another point which seems to invalidate our results, at least our equation (5). According to this equation, if the real price of sugar should rise above (roughly) 10 piasters the kg. (1913 parity), the purchases of sugar ought to cease completely and at higher prices consumers ought, instead of buying, sell sugar, equation (5) giving in this case negative values for y . But during the months (December 1942 - April 1943, a real price of about 16-17 piasters the kg. prevailed (for free sugar) without that purchases stopped. To this possible objection it must be replied that equation (5), representing a linear function, can not be valid for extreme prices and recourse must be had in such cases to the *logarithmic form*. Indeed, our equation (6) is apparently capable of describing the development during the months in question. For example it ensues from our calculations that in December 1942 the sales of free sugar amounted to about 245 tons.

If we suppose that the index of purchasing power was at the level of 18.0 we get from equation (6) as monthly per capita consumption, corresponding to the real price of 17 piasters, the amount of 0.14 kgs. The division of 245 tons by the number of persons not benefiting from cheap sugar (presumably some 14-15 millions) would give a very close result. We can say that the evolution of sugar demand in Turkey during the war years, furnishes an inductive proof for the general superiority of the logarithmic demand equation to the linear form.

It is seen that the course of events in the subsequent years seems not to belie our results but on the contrary to confirm them. Nevertheless, part of our data, especially our index of purchasing power, is not reliable enough for a final judgement, and as this index can only be valid for the years before 1939, our equations are not liable of being of practical help to sugar price policy. In order to clear the problem definitely, better and more exact material is indispensable.

Basic Data

Years	1 Price granulated sugar (piast. the Kg.)	2 Total sales (metric tons)	3 Population (millions)	4 Consump- tion per capita Kgs.	5 Index of wholesale prices (1913-190)	6 Real Price (piast. the kg.)
1927	44.89	62721	14.00	4.48	1262	3.55
1928	42.05	67901	14.26	4.76	1296	3.24
1929	39.84	70603	14.53	4.86	1317	3.02
1930	37.67	70672	14.80	4.77	1000	2.77
1931	35.53	66150	15.07	4.39	859	4.24
1932	37 03	56503	15.34	3.68	738	5.02
1933	37.15	51712	15 61	3.31	648	5.73
1934	36.75	52566	15.88	3.31	672	5.47
1935	39.40	63737	16.16	3.96	735	4.14
1936	25.00	73685	16.44	4.48	817	3.06
1937	25.00	90312	16.72	5.40	849	2.94
1938	25.00	97465	17.00	5.73	805	3.11
1939	25.00	100620	17.38	5.80	831	3.01
1940	33.24	99299	17.81	5.58	999	3.33
1941	42.72	108454	18.10	6.01	1836	3.20
1942	116.77	62054	18.39	3.38	2265	5.16
1943	253.45	42932	18.68	2.30	3688	6.39
1944	157.88	75045	18.98	3.95	3000	5.26