

## INCOME ELASTICITIES OF DEMAND FOR MIDDLE AND LOW INCOME LIBYAN EMPLOYEES IN TRIPOLI

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### Introduction

The present study is based on the data collected in the Family Budget Survey of Tripoli in 1962 <sup>1</sup>. The 1962 survey was primarily conducted to establish suitable weights for the calculation of a Cost of Living Index for a specific group of Libyan employees in Tripoli. However, the extensive set of tables provided in the report enables one to make some econometric studies. In this work an attempt has been made to estimate income elasticities of demand for food, housing, clothing, and miscellaneous items of consumer expenditure. The method adopted for analysis is similar to that given by Wold and Jureen <sup>2</sup>. Field work for the Tripoli survey was completed within three months—15th. January to 15th. April 1962. It may not, therefore, be very wrong to assume that the prices for the consumer goods remained constant throughout the period.

### Data and calculations

Table 1 below presents logarithms of average monthly income per household and the average monthly consumption expenditure per household for the four income groups.

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<sup>1</sup> Sami W. Dajani, *Report on Family Survey in Tripoli Town 1962*.

<sup>2</sup> H. Wold and Jureen, *Demand Analysis : A Study in Econometrics*, (Uppsala, 1952).

TABLE 1.

Income group £L per month	log (Avg. income per household) log I	log (Avg. con- sumption ex- penditure) log E	log I log E	(log I) <sup>2</sup>	(log E) <sup>2</sup>
15 or less	1.1189	1.0759	1.2038	1.2519	1.1577
15 — 30	1.3314	1.2565	1.6730	1.7726	1.5785
30 — 45	1.5581	1.4462	2.2528	2.4274	2.0913
45 or more	1.7934	1.6431	2.9459	3.2149	3.2168
Total	5.8018	5.4217	8.0755	8.6668	8.0443

The relationship between log E and log I has been assumed to be linear. That is,

$$\log E = A + B \log I \quad . . . . . (1)$$

The two normal equations for determining A and B are, from Table 1,

$$\begin{aligned} 4 A + 5.8018 B &= 5.4217 \text{ and } . . . . . (2) \\ 5.8018 A + 8.6668 B &= 8.0755 \end{aligned}$$

From (2) we have

$$A = 0.1328 \text{ and } B = 0.8429$$

$$\text{Thus } \log E = 0.1328 + 0.8429 \log I$$

or in non-logarithmic form we have

$$E = 1.3577 I^{0.8429} \quad . . . . . (3)$$

The correlation coefficient between log E and log I turns out to be  $r = 0.506$ , giving a coefficient of determination equal to approximately 0.25. This will mean that about 25 percent of variability in the average monthly household consumption expenditure could be explained by the average household monthly income, a conclusion not very convincing. The group under study were from the low and middle income class, and so we expect that a greater proportion of variability in the consumption expenditure should have been explained

by the average income. The cause for this low coefficient of determination is not difficult to identify. From the report it can be seen that the number of persons in each household for the four income groups were not the same. Consumption expenditure for these groups of employees consists mainly of food expenditure, and food expenditure is directly related to the size and composition of the family. So both income and expenditure should be standardized with respect to the family size. An obvious way to adjust for variable family size is to consider the variable per capita income and per capita expenditure. Table 2 gives the per capita data and the subsequent analysis shows that the coefficient of determination improves considerably. But calculation of per capita expenditure both overall and for individual items of consumption presents a serious problem. A straightforward calculation of per capita expenditure for any item — equal to the ratio of total expenditure on the item to the number of persons — is not always meaningful. Let us take the simplest item, say food. Food consumption in a family depends upon the composition of the family ; the nature and quantity of any food item consumed depends on the number of male and female adults and also on the number of children in the family. In order to get a truly weighted expenditure on food, we need some sort of weight for the members in the family. For instance, an adult female may be taken to be equivalent to 0.9 of an adult male as far as cereal intake is concerned. A child's consumption of milk may be much more than that of an adult. Thus a complication arises as to what should be the criterion for fixing weights<sup>3</sup>. One way is to base the weights on the calorie requirement of the members in a family. This method has its own difficulties. A pound of butter may give all the calories needed by a person in a day but who will take just a pound of butter and nothing else ? In any case, a set of weights for food items is feasible and with some effort we may be able to determine such weights for Libya's population. For other items, weights will still

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3 H. Wold in his book has given a set of weights for food for the Swedish population. The National Sample Survey, Indian Statistical Institute, Calcutta has been trying to find a set of weights for consumption items.

remain a problem. In clothing, for example, how can childrens ; womens', and mens' wear be equated into a sensible set of weights ? Miscellaneous items such as cigarettes, hair-cuts, shaving sets, etc. should not be pooled with the predominantly female expenditures on cosmetics. Our aim here is to indicate that the question of weights deserves some attention, and care should be taken in the planning stage of the survey. Let us now return to the demand equations based on per capita data from the Tripoli survey.

TABLE 2

Income groups £L per months	log (per capita income) log Ip.	log (per capita consumption expenditure) log Ep.	(log Ip) <sup>2</sup>	(log Ep) <sup>2</sup>	log Ip log Ep
15 or less	0.4149	0.3617	0.1721	0.1308	0.1501
15 — 30	0.6434	0.5682	0.4139	0.3228	0.3656
30 — 45	0.7993	0.6812	0.6388	0.4640	0.5445
45 or more	0.9731	0.8260	0.9469	0.6822	0.8037
Total	2.8307	2.4371	2.1717	1.5998	1.8639

Ip and Ep stand for per capita income and expenditure respectively  
The relationship between log Ip and log Ep was assumed to be

$$\log Ep = A_1 + B_1 \log Ip$$

Using the entries in the last row of Table 2 and solving the normal equations we find

$$A_1 = 0.0253 \quad \text{and} \quad B_1 = 0.8252$$

Thus

$\log Ep = 0.0253 + 0.8252 \log Ip$  or in non-logarithmic form  
we have

$$Ep = 1.0600 Ip^{0.8252} \quad \dots \dots \dots (4)$$

The correlation between log Ep and log Ip turns out to be  
 $r = 0.9867$ , giving a coefficient of determination of about 97 percent.  
So in this case income per capita is able to explain about 97 percent of

Table 3 presents logarithms of per capita income and per capita expenditures on food, housing, clothing, and miscellaneous items.

TABLE 3

Income groups monthly fL	log Ip	log E <sub>pf</sub>	log E <sub>ph</sub>	log E <sub>pc</sub>	log E <sub>pm</sub>
15 or less	0.4149	0.0894	T 6600	T 0469	T 6202
15 — 30	0.6434	0.2301	T 9171	T 6454	T 8445
30 — 45	0.7993	0.3159	0.0458	T 8239	T 9955
45 or more	0.9731	0.3399	0.1415	0.0111	0.1177

$E_{pm}$  = per capita miscellaneous expenditure.

Ip as in the last case stands for per capita income.

Using the usual least square method, the four regression equations turn out to be in their non-logarithmic form :

$$E_{pf} = 0.9055 I_p^{0.4054} \quad (5)$$

$$\dot{E}_{ph} = 0.1862 I_p^{0.8705} \quad (6)$$

$$E_{pc} = 0.0277 I_p^{1.6806} \quad (7)$$

$$E_{pm} = 0.1817 I_p^{0.8958} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

Equations (4), (5), (6), (7) and (8), are interesting. Under

*ceteris paribus* from (4), we may conclude that a 10 percent increase in per capita income of this group of employees will result in an increase of about 8 percent in consumption expenditure. From the other four equations it appears that food is the least elastic. Clothing is over elastic — on the usual interpretation, it will mean that clothing is a luxury good for this group. Even though the elasticities for total expenditure, housing, and miscellaneous expenditures are less than unity, they are uncomfortably large. It is obvious that an increase in income will be very well utilized by this group of employees. We give below some other studies for purposes of comparison.

Average income elasticity of demand for all food as found by Professor Wold for worker and employee families in Sweden in 1933 was 0.53. Tripoli data shows a value of about 0.41. Professor Wold found that the income elasticity of some groups of expenditures was as follows. Elasticity of expenditure for

Food	0.33 (Prof. Wold)	0.41 (Tripoli data)
Housing	1.28 (Prof. Wold)	0.87 (Tripoli data)
Clothing	1.96 (Prof. Wold)	1.68 (Tripoli data)
All expenditures	0.97 (Prof. Wold)	0.83 (Tripoli data)

Allen and Bowley <sup>4</sup> showed that the income elasticities of demand for 112 clerks in London (1926) for food, rent, and clothing was 0.8 ; for fuel and light, 0.8 ; and for all other items, 1.5.

In the end it may be mentioned that family budget data for other income groups should also be collected. This will help us to calculate the income elasticities for Metropolitan areas of Libya as a whole. Demand equations for the urban areas of Libya may be taken in the form<sup>5</sup>  $d = AP^\alpha I^b$  The price elasticity  $\alpha$  should be determined from

<sup>4</sup> R. G. D. Allen and A. L. Bowley, *Family Expenditure* (London : 1935).

<sup>5</sup> H. Wold and Jureen, *Demand Analysis*, pp. 22.

time series data on demanded quantities and prevailing prices. Reliable retail price series are perhaps not yet available. The proper Ministry may be approached for the collection and publication of such data.

A start can be made by collecting the monthly prices and quantities sold in the different cooperatives in Benghazi, Tripoli and other towns of Libya. The income elasticity  $b$  is the weighted average of income elasticities for each income group. To have this weighted average elasticity it is necessary to collect family budget data from each income group in the cities.