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PRICE AND INCOME ELASTICITIES OF DEMAND FOR RED MEAT IN IRAN, 1959-1986[1]

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ABSTRACT

This study is an attempt to estimate the price and income elasticities of demand for red meat in Iran to help in policy making concerning this commodity. Time series data and log linear partial adjustment regression model, is used to estimate the elasticities. The results show that the long-run price and income elasticities of demand for red meat in Iran are -0.60 and 0.51, respectively. The estimated price elasticity of -0.60 is comparable to the results of the other similar studies carried out on the demand for meat for Greece and Middle East. However, the estimated income elasticity of 0.51 is lower than the similar estimations made by the above-mentioned studies, which were generally close to or larger than one.

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1. This analysis was initiated in Iran and completed at the Department of Agricultural Economics, the University of Western Australia while the author was a visiting research fellow there during 1989-90.

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کشش قیمتی و درآمدی برای گوشت قرمز در ایران سالهای ۱۹۸۶-۱۹۵۹

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چکیده

در این مطالعه کشش قیمتی و درآمدی تقاضا برای گوشت قرمز در ایران بمنظور کمک به سیاستگذاری مربوط به این کالا تخمین زده می‌شود. برای تخمین کشش‌های مورد نظر از اطلاعات سری زمانی و مدل رگرسیون لگاریتمی با تعدیل جزئی استفاده می‌شود. نتایج نشان می‌دهد که کشش‌های دراز مدت قیمتی و درآمدی تقاضا برای گوشت قرمز در ایران به ترتیب ۰/۶- و ۰/۵۱ است. کشش قیمتی تقاضای ۰/۶- این مطالعه قابل مقایسه با نتایج سایر مطالعات مشابه که روی گوشت قرمز در یونان و در خاورمیانه انجام شده است، می‌باشد. اما کشش درآمدی تقاضای ۰/۵۱ کمتر از تخمین‌های مطالعات مشابه فوق‌الذکر است. در آن مطالعات تخمین کشش درآمدی تقاضا نزدیک به یک و یا بیشتر از یک بوده است.

INTRODUCTION

Real wholesale price index for red meat (sheep, goat, beef, buffalo and camel) has considerably risen in Iran since 1972. Fig. 1 shows the real price indices for red meat, dairy products, rice, bread and chicken meat in Iran from 1959 to 1986. These are possible competitive commodities for which data are available.

The rapid price rise for red meat has been due to the widening gap between its supply and demand in spite of considerable increase in the import of this commodity. The import of red meat has risen from 125 tons in 1959 to 178145 tons in 1986. These quantities constitute 0.05% and 23.05% of red meat consumptions of the country in these two periods respectively. Fig. 2 shows annual production, import, and consumption quantities of red meat in Iran from 1959 to 1989. It should be noted that the red meat annual production quantities are calculated as

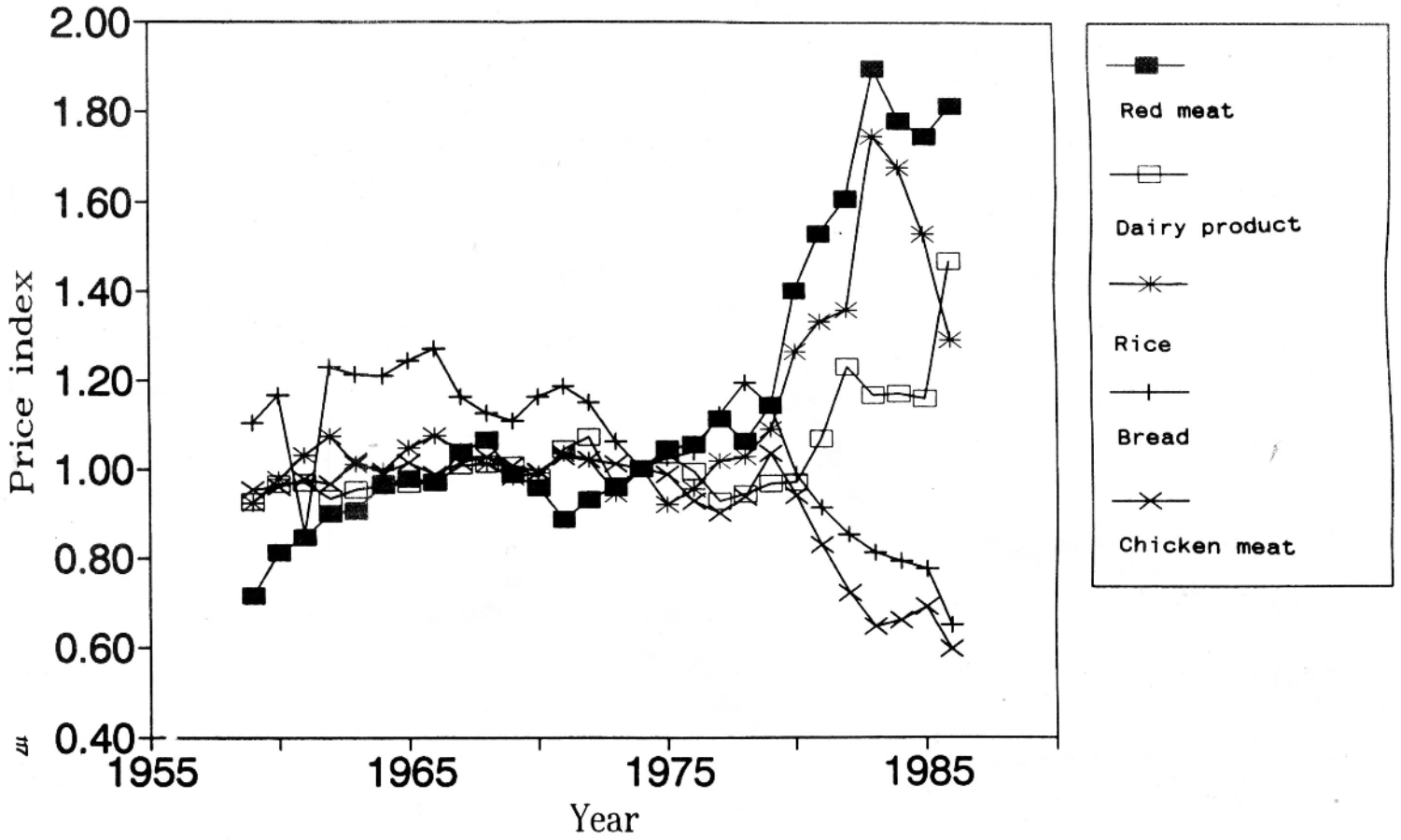

Fig. 1. Real price indexes for red meat, dairy products, rice, bread and chicken in Iran, 1959–1986.

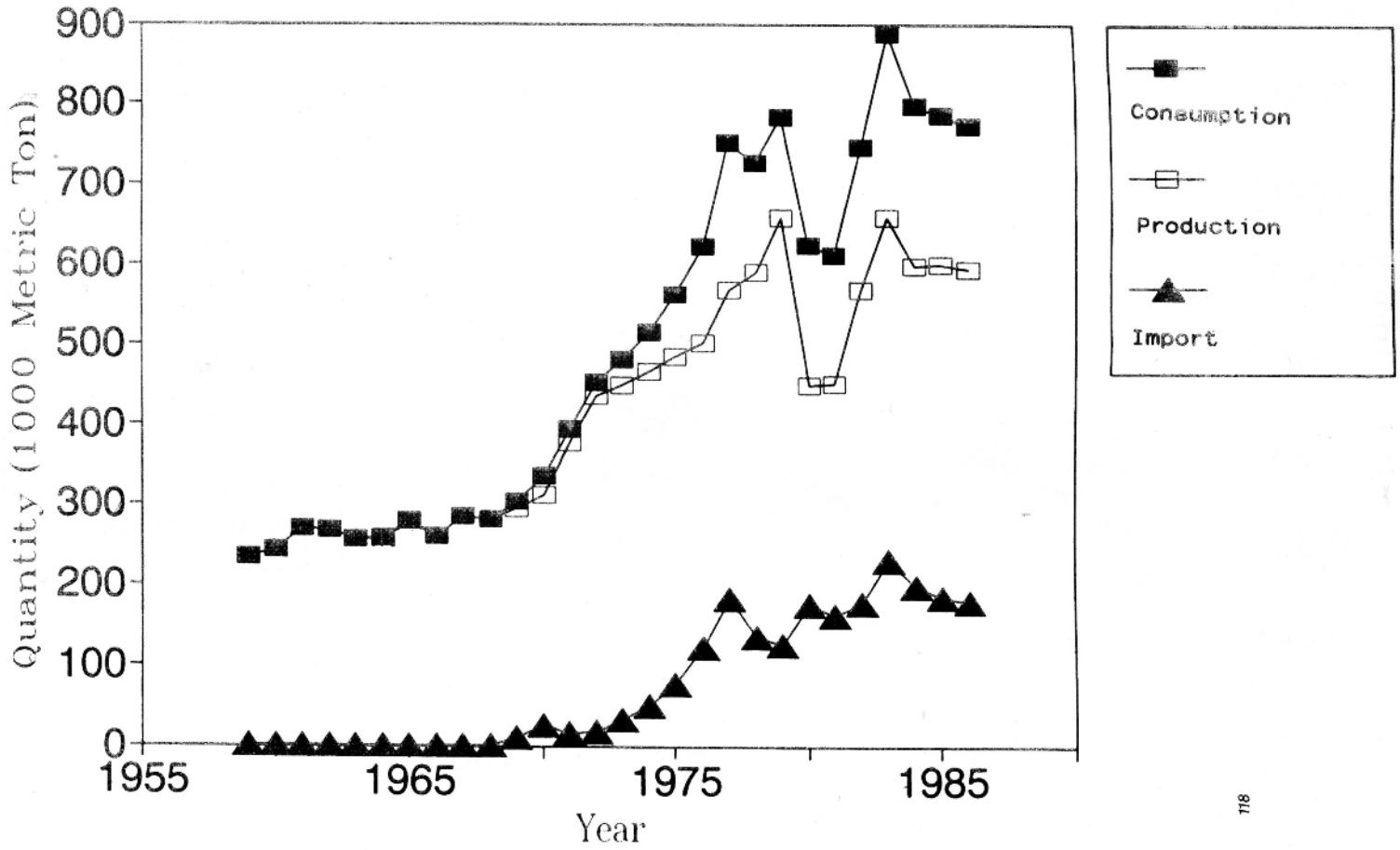

Fig. 2. Production, import and consumption of red meat in Iran, 1959–1986.

the difference between quantities of consumption and imports. The annual consumptions are calculated from annual per capita consumption and population figures. Red meat production in Iran is from two main sources of tribes and farms. Data for the red meat produced by the tribes were not available for the years under study. As Fig. 2 shows aggregate consumption, except for a few years, has been constantly increasing in the 28 year period under study. Per capita consumption, however, has had less upward move than aggregate consumption, despite the considerable increase in real per capita income (Fig. 3). For example until 1970 the per capita consumption for red meat has been less than 12 kg per year and within 1972 to 1986 it has been fluctuating between 14.9 to 21.72 kg. Therefore, the rapid increase in the aggregate consumption for red meat has been largely due to the high population growth of more than 3% in this period.

Aside from demographic factors which are not considered in this paper, the extent of the impacts of changes in price and income are important in forecasting the demand for red meat in Iran. Many studies have been carried out on the demand for food including meat and especially red meat. For example, Mergos and Donatos (11) estimated the price and income elasticities for various food commodities for Greece. Kneebone (8) carried out a study on the demand for meat for the Middle East. Although Kneebone's primary intention has been to analyse the demand for meat on the country basis, due to insufficient data he could not consider each country separately. This study, however, analyzes the demand for red meat in Iran using the data on the country level. The price and income elasticities of demand for red meat are estimated.

METHODOLOGY AND DATA

Log version of the Nerlovian partial adjustment model on the basis of the equation (1) below (3, pp. 527-529, 4, pp. 223-224, 12, 13) is employed to estimate the coefficients of the variables affecting the per capita consumption of red meat, the dependent variable. Independent variables include real price index of red meat, real per capita income, and real price indices of competing commodities including

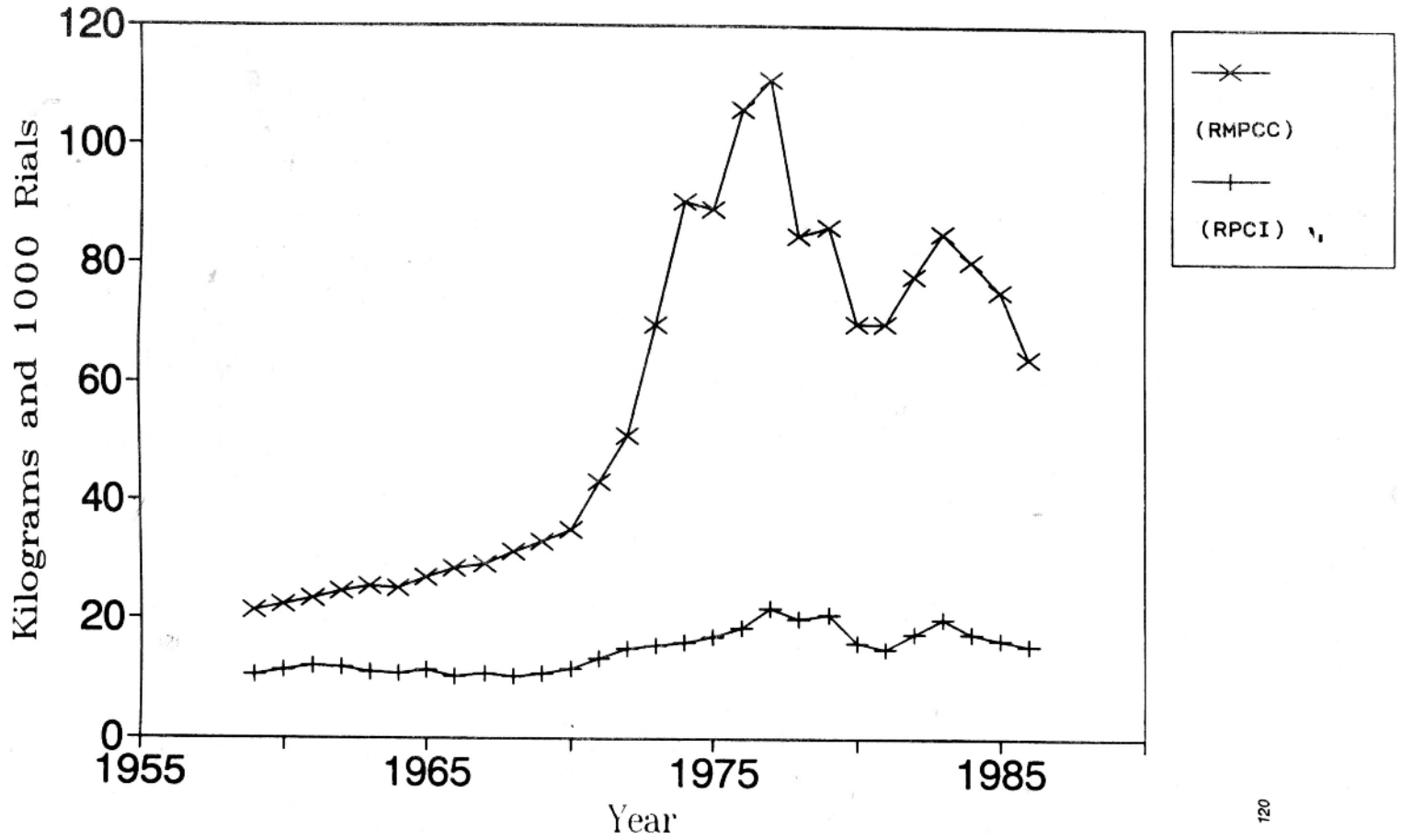

Fig. 3. Red meat per capita consumption (RMPCC) and real per capital income (RPCI) in Iran, 1959–1986.

chicken, dairy products, bread and rice. Other competing commodities such as fish are not included due to lack of data. Dummy variable for two periods of time were also included in the model. First, for the years 1973 to 1978, the years of high oil revenue and inflation. Second, for the years 1979 to 1986, the years of revolution and war. In neither cases, the estimated coefficient for the dummy variable was significant.

(1) $Y^*_t = b_o P_{ot}^{b1} I_t^{b2} P_{1t}^{b3} P_{2t}^{b4} P_{3t}^{b5} P_{4t}^{b6} e^{ut}$

Where:

Y^*_t = Expected per capita consumption for red meat in kg in year t.

P_{ot} = Wholesale price index of red meat deflated by commodity wholesale price index in year t, using 1974 as the base year.

I_t = Per capita income in 1000 Rls. (official exchange rate: 79 Rls. =1 US dollar in 1986).

P_{1t} = Wholesale price index for chicken deflated by commodity wholesale price index in year t.

P_{2t} = Wholesale price index for dairy products deflated by commodity wholesale price index in year t.

P_{3t} = Retail price index for bread (all kinds of bread) deflated by commodity wholesale price index in year t.

P_{4t} = Wholesale price index for rice deflated by commodity wholesale price index in year t.

e^{ut} = Disturbance term for year t.

b_o = Intercept

$b_1 \ldots b_6$ =Estimated partial regression coefficients.

Note that one of the advantages of the multiplicative function is that the exponents of the variables give direct estimates of elasticities (3, p 145). For statistical estimation equation (1) is expressed in log form as:

(2) $\ln Y^*_t = \ln b_o + b_1 \ln P_{ot} + b_2 \ln I_t + b_3 \ln P_{1t} + b_4 \ln P_{2t} + b_5 \ln p_{3t} + b_6 \ln P_{4t} + U_t$

Since the expected per capita consumption for red meat is not directly observable, let us assume the red meat consumption adjustment hypothesis; namely:

$$(3) \quad \frac{Y_t}{Y_{t-1}} = \left(\frac{Y_t^*}{Y_{t-1}}\right)^{\delta} \qquad 0 \leq \delta \leq 1$$

where Y_t and Y_{t-1} are the actual per capita consumption of red meat in year t and t-1 respectively and δ is the elasticity or the coefficient of adjustment (9, 10, 13). Equation (3) states that a constant percentage of discrepancy between the actual and the expected per capita consumption for red meat is eliminated within a single period (year). In log form, equation (3) is expressed as:

$$(4) \quad \ln Y_t - \ln Y_{t-1} = \delta (\ln Y^*_t - \ln Y_{t-1})$$

Substituting in $\ln Y^*_t$ from equation (2) into equation (4) and rearranging, we obtain:

$$(5) \quad \ln Y_t = \delta \ln b_o + \delta b_1 \ln P_{ot} + \delta b_2 \ln I_t + \delta b_3 \ln P_{1t} + \delta b_4 \ln P_{2t} + \delta b_5 \ln P_3t + (1-\delta) \ln Y_{t-1} + \delta U_t$$

which may be called the short-run demand function for red meat. To get back to long-run demand function (equation 2) all that needs to be done is to divide the short-run demand function through by δ and drop Y_{t-1} term. In short, the short-run elasticities are the estimated coefficients of the variables in equation (5), that is, δb_i, i = 1 ... 6. And the long-run from equation (2), that is b_i calculated by dividing δb_i by δ.

The almost ideal demand system (AIDS) has been frequently used in 1980's for demand estimations (1, 11); however, due to the lack of data, this model is not used in this study. The results, however, are compared with coefficients estimated by AIDS in studies including Kneebone (8). The regressions are compared on the basis of R^2 (coefficients of multiple determination), F-ratios and the Durbin-Watson statistics. The regressions are also compared on the basis of the theoretically expected signs and the significance level of the estimated partial regression coefficients.

Complete adjustment regression log model (equation 6), ignoring lagged dependent variable in the right hand side of the equation, is used as well:

(6) $\ln Y_t = \ln b_o + b_1 \ln P_{ot} + b_2 \ln I_t + b_3 \ln P_{1t} + b_4 \ln P_{2t} + b_5 \ln P_{3t} + b_6 \ln p_{4t} + U_t$

in which it is assumed that δ, the coefficient of adjustment, equals 1. That is, the actual per capita consumption for red meat equals its expected values. However, since the results on the basis of this model showed positive autocorrelation, they are not used for discussion. These results are shown in Table 1 only for the purpose of comparison.

The data used for this study include the available time series data from 1959 to 1986 for yearly values of the variables used in this model. The data employed include other variables such as the import quantities of red meat and population as well. Sources of data include annual reports, and other Farsi publications and some unpublished reports from Plan and Budget Organization, Islamic Republic of Iran. The data comprised reports of Central Bank of Iran as well.

RESULTS AND DISCUSSION

The estimated elasticities of demand for red meat with respect to different variables are shown in Tables 1 and 2 where equations (6) and (5) are employed, respectively. Underlining that, in equation (5) lagged dependent variable is used as one of the explanatory variables, while in equation (6) the lagged dependent variable is ignored in the right hand side of the equation. On the basis of Durbin-Watson test, the estimated regressions in which equation (6) is used and are shown in Table 1 show serial correlation. Hence, they are not considered for discussion. They are illustrated only to be compared with the results of the partial adjustment regressions in Table 2. The regressions of Table 2 in which equation (5) is used are estimated to correct the autocorrelation. On the basis of Duribn-Watson test, the results show that when the partial adjustment model is used the null

Table 1. Estimated elasticities of demand, b_i, using equation (6) -- the dependent variable is per capita consumption of red meat in Iran in kg per year. 1960-61 to 1985-86.

Explanatory variables	Regression number					
	1	2	3	4	5	6
Pot	-0.0190	-0.2928	0.0379	-0.0549	-0.4530*	-0.4739
	(0.23)†	(1.78)	(0.30)	(0.46)	(2.58)	(2.19)
I_t	0.4210**	0.4431**	0.4150**	0.4221**	0.4738**	0.4694
	(11.06)	(11.73)	(10.41)	(10.88)	(12.11)	(11.18)
P_{1t}		-0.4112				-0.4957
		(1.94)				(1.77)
P_{2t}			-0.1629			-0.2924
			(0.59)			(0.90)
P_{3t}				-0.0674		0.0577
				(0.41)		(0.30)
P_{4t}					0.6136*	0.4154
					(2.72)	(1.62)
R^2	0.88	0.90	0.89	0.89	0.91	0.93
R^2(adjusted)	0.88	0.89	0.87	0.87	0.90	0.90
F-ratio	97.20**	73.20**	63.29**	62.72**	83.87**	43.20**
n_1,n_2	2.25	3.24	3.24	3.24	3.24	6.21
D-W	0.85	1.02	0.91	0.86	1.20	1.51
k,n	2.28	3.28	3.28	3.28	3.28	6.28
SEE	0.03811	0.03618	0.03862	0.03876	0.03402	0.03373
Intercept	0.4399*	0.3998*	0.4492*	0.4408*	0.3441*	0.3428*
	(7.07)	(6.36)	(6.89)	(6.93)	(5.21)	(4.74)

* Significant at 5% level.

** Significant at 1% level.

† Figures in parentheses are t-ratios. The signs are the same as their corresponding estimated coefficients.

Table 2. Estimated elasticities of demand, b_i, using equation (5) -- the dependent variable is per capita consumption of red meat in Iran in kg per year. 1960-61 to 1985-86.

Explanatory variables†	Regression number					
	1	2	3	4	5	6
P_{ot}	-0.0810	-0.3765*	0.1605	-0.1354	-0.3814*	-0.5803**
	(1.10)§	(2.65)	(1.26)	(1.20)	(2.32)	(2.87)
I_t	0.2649**	0.2810**	0.2534**	0.2622**	0.3286**	0.3321**
	(4.53)	(5.22)	(4.16)	(4.41)	(5.18)	(5.30)
P_{1t}		-0.4704*				-0.4610
		(2.37)				(1.69)
P_{2t}			0.2015			0.0423
			(0.77)			(0.13)
P_{3t}				-0.0941		0.0850
				(0.64)		(0.50)
P_{4t}					0.4354	0.3517
					(2.02)	(1.55)
Y_{t-1}	0.4351**	0.4419**	0.4864**	0.4443**	0.3592*	0.3829*
	(3.28)	(3.640)	(3.25)	(3.28)	(2.76)	(2.70)
R^2	0.92	0.94	0.92	0.92	0.93	0.94
R^2(adjusted)	0.91	0.92	0.91	0.91	0.92	0.92
F-ratio	86.98**	79.71**	64.24**	63.66**	74.97**	46.12**
n_1,n_2	3.23	4.22	4.22	4.22	4.22	7.19
D-W	1.68	2.14	1.73	1.69	1.90	2.32
k,n	3.27	4.27	4.27	4.27	4.27	7.27
SEE	0.03260	0.02976	0.03289	0.03302	0.03062	0.02971
Intercept	0.2083*	0.1689*	0.1707	0.2066*	0.1829*	0.1428
	(2.38)	(2.07)	(1.69)	(2.33)	(2.19)	(1.45)

* Significant at 5% level.

** Significant at 1% level.

† Y_{t-1} is per capita consumption of red meat in year t-1.

§ Figures in parentheses are t-ratios. The signs are the same as their corresponding estimated coefficients.

hypothesis of no positive autocorrelation is not rejected. Therefore, the estimated coefficients of these regressions, in Table 2, are considered for discussion.

It should be noted that generally, Durbin-h test could be used for testing null hypothesis of no positive autocorrelation for the regressions which use lagged dependent variable as one of the explanatory variables (4, pp.311-313), however, Fomby *et al.* (2, p. 254) on the basis of Kenkel (5, 6, 7) and Park (14, 15) state that "Though in large sample the Durbin-h test is clearly superior to the Durbin-Watson bounds test, the relative peroformance of these two tests in small samples is inconclusive at this stage".

The following points are observed with regard to regressions in Table 2. All the estimated regressions in Table 2 have high R^2 and with F-ratios significant at 1% level. The estimated coefficients of the lagged dependent variables, Y_{t-1}, are all significant at either 1 or 5% level. The estimated elasticities for per capita income variables, It, are all significant at 1% level and have the expected sign. The estimated elasticities for own price, P_{ot}, are all with expected sign but significant only in regessions 2, 5 and 6. Among these three, regressions 2 and 6 are not considered because the sign for the estimated coefficients of chicken meat, P_{1t}, is unexpectedly negative. Negative sign for chicken could be due to multicollinearity between red meat and chicken meat prices. Cross elasticities of red meat with rice, P_{4t} in regression 5 of Table 2 is interesting. The estimated short-run cross elasticity is 0.4354 with the right sign and significant at 10% level. It is not surprising to obtain the result that rice is being a substitute for red meat in Iranian food ration. Regression 5, therefore, could be the best regression of Table 2 in the sense that it has significant estimated coefficients with right signs.

Considering regression 5 in Table 2, the short-run elasticities of demand for own real price index and real per capita income are -0.38 and

0.33, respectively. That is, in the short-run, the per capita consumption of red meat will change by 0.38% and in the opposite direction if the deflated price index of red meat changes by 1% and the per capita consumption of red meat will change by 0.33% and in the same direction if the real per capita income changes by 1%. The figures -0.38 and 0.33 are in fact δb_1 and δb_2 of equation (5), respectively. The estimated coefficient of Y_{t-1} in regression 5 in Table 2, $1-\delta$, is 0.3592. Therefore, δ, the coefficient of adjustment equals 0.6408. The long-run elasticities for own real price index and real per capita income, are calculated as short-run elasticities divided by δ and are -0.60 and 0.51, respectively.

Mergons and Donatos (11) in their studies on the demand for food in Greece came up with estimated price elasticities of -0.43 for meat when AIDS model was used and -0.99 and -0.18 when the other two medels were used. Their estimated income elasticities were 1.42, 1.11 and 0.95, respectively, depending on whether AIDS or the other two models were used. Kneebone (8) in the study on the demand for meat in the Middle East came up with estimated long-run price elasticities of -0.49 for sheep meat and -0.37 for beef and long-run income elasticity of 1.14. For the difference between the results of this study, -0.60 and 0.51 for long-run price and income elasticities, respectively, and other studies especially for the income elasticity difference, at least two factors are effective. First, the difference between socio-economic structure of the country or group of countries used in the study and, second, the types of the variable specifications used in the estimating models.

CONCLUSIONS

The results of this study show that the short-run elasticities of demand for red meat for own real price index and real per capita income in Iran are -0.38 and 0.33, respectively and the corresponding long-run figures are

-0.60 and 0.51. Price variables used are the real price indices, income variable is the real per capita income, and per capita consumption is in kg per year.

The values of the estimated short-run and long-run price elasticities show that increase in the real price index of red meat has impeding effect on its consumption. Possible diminish in the relative price of red meat requires an increase in quantity of supply which might be done either through expanding domestic production or increase in quantity of import.

Considering the positive income elasticities of demand and that the country is in a post war reconstruction stage, if the overall economic situation improves and the current negative real per capita income growth rate, (Fig. 3) turns to positive or at least to zero, a considerable rise in the quantity of demand for red meat will prevail, especially if the population growth persists to stay at the high existing rate. In the last few years of 1984 to 1986 the negative growth in real per capita income has helped very much in the downward trend of aggregate consumption shown in Fig. 2.

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