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INCOME, EDUCATION AND AGE EFFECTS ON MEAT AND FISH DEMAND IN TUNISIA

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Abstract

Socio-economic and demographic variables can have a deep impact of the demand for food. The objective of this work is to analyze how these variables can affect the demand for meat and fish for Tunisian consumers. This study covers two important aspects: the non-imposition of, a priori, a functional form and the use of cross-section data including demographic and socioeconomic variables. Relations among meat and fish through cross price elasticities can be substitutions or complementary. The consumption of these products patterns by age, level of income and level of education. This consumption is relatively different as regards to the economic factors (food expenditure and price). Elasticities expenditure for beef and mutton increases with age whereas elasticities expenditure for chicken and fish decrease with age. Age is a major factor in consuming meat and fish as it integrates health dimension. These results imply that changes in economic and demographic factors and increasing health awareness have influenced the changes in meat and fish demand in Tunisia.

Key words: *Food demand analysis, socioeconomic and demographic variables, Tunisia*

1. Introduction

Tunisia as a Mediterranean country has for a long time food culinary traditions similar to the "Mediterranean diet". The Tunisian diet is characterized in 2010 by a consumption of cereals (181 kg/person/year), fruits and vegetables (145 kg/person/year) and milk (95 kg/person/year). The consumption of meat, poultry and fish is about 39 kg/person/year accounting for only 5.3% of the total food products consumed in 2010 (INS, 2010). The consumption of meat and fish has undergone a significant evolution over the past two decades. Between 1990 and 2010, consumption of poultry and fish grew remarkably respectively by 138% and 36%. Sheep meat consumption increased by 24% while beef decreased by 32% over the same period. The expenditures have concurrently increased for mutton (102%), poultry (143%) and fish (206%). The remarkable increase in fish expenditure reflects the new consumption patterns among the Tunisian consumer. Beef expenditures increased by almost 50% despite the drop in its consumption due to the increase in the price (INS, 2010). These changes reflect the change in food habits of the Tunisian consumer. Since the 1990's, food demand has had significant changes related particularly to urbanization process, new lifestyles, industrialization of food sectors, woman work, the emergence of modern retail and increasing nutritional health concerns. Food habits are changing rapidly with the new socio demographic characteristics of the Tunisian population. Indeed, age, level of income and education level are thus important factors in purchasing decisions in a country where 55% of the population has an age lower than 30 years in 2010 and whose education and income is improving day by day (INS, 2010).

The literature on demand analysis of meat and fish is very diverse (Brester & Wohlgenant, 1993; Gracia & Albisu, 1998; Wilson & Marsh, 2005;Jabarin, 2005;Taljaard, Van Schalkwyk & Alemu, 2006).From a methodological point of view, most of the mentioned researches are limited in two ways: On the one hand, they impose a priori a particular functional form for demand equations (Almost Ideal Demand System, Rotterdam, Central Bureau of Statistics, GADS) without testing whether an alternative model might better fit the data; on the other hand, these works only consider one dimension of the data (time series). Considering a cross section dimension would substantially improve the precision of the estimates of the parameters of the models, although we must recognize the difficulty of conducting such studies in Tunisia due to the lack of information to build a real cross section at a national level.

In Tunisia, the analysis of the meat and fish consumption was the subject of several studies using national and international time series statistics data bases (Ben Kaabia, Dhehibi & Gil, 2000; Dhehibi& Gil, 1999; Dhehibi, Gil &Angulo 2001; Dhehibi& Gil 2003). However, to the author's knowledge, no study has assessed the patterns of meat and fish consumption in Tunisia using cross section data and estimating the impacts both of economic (price, income) and socio-demographic factors (age, education).

The aim of this workis to analyze the impact of socio-economic and demographic variables on the demand for beef, mutton, chicken, turkey and fish among Tunisian consumers using cross section data and different functional forms of food consumer's models.

The outline of this paper is as follows: Section 2 develops the empirical model and the estimation procedure. Results and discussion are presented in Section 3. Finally, section 4 outlines the conclusion and policy implications drawn from this study.

2. Methodological Framework

2.1. Theoretical model

Classical demand theory considers the behaviour of an individual consumer who wishes to maximise its utility function, subject to a budget constraint:

$$\text{Max. } u(q)=u(q_1,q_2,......q_n)$$

$$\text{S.a } \sum_{i=1}^{n} p_i q_i = m \qquad i=1, ...,n \qquad (1)$$

Where u is utility; q_i, p_i, are quantity and price for food i respectively; and m is the total expenditure or income.

The demand equations satisfying (1) have the general form:

$$q_i = f_i(m, p_1 ....p_n) \tag{2}$$

The equation of demand obeys to several restrictions expressed in terms of elasticities which are derivatives of the logarithmic version of (2). The logarithmic differential of (2) is

$$dlnq_i = \eta_i dlnm + \sum_{j=1}^{n} \mu_{ij} dlnp_j \tag{3}$$

Where η_i is the income elasticity of demand for good i, μ_{ii} is the uncompensated, own-price elasticity, and the μ_{ij} $(i \neq j)$ are the cross-price elasticities.

Demand equations (2) were approximated by double-logarithmic specifications with constant elasticities. Even if this approximation could fit the data and generate plausible estimates of the elasticities, it is not well suited to investigate the restrictions of classical demand analysis.

The adding-up restriction cannot be generally satisfied by the double-logarithmic specification (Deaton, 1989; Barten, 1993).

2.1.1. Rotterdam System (ROT)

Theil (1965)developed the Rotterdam model by replacing μ_{ij} by e_{ij} in the logarithmic differential equation (3), using the compensated price elasticities:

$$dlnq_i = \eta_i (dlnm - \sum_{j=1}^{n} w_j dlnp_j) + \sum_{j=1}^{n} e_{ij} dlnp_j \tag{4}$$

Then he multiplied both sides through by w_i to obtain:

$$w_i dlnq_i = b_i (dlnm - \sum_{j=1}^{n} w_j dlnp_j) + \sum_{j=1}^{n} s_{ij} dlnp_j \tag{5}$$

The marginal shares $b_i = w_i \eta_i$ and the Slutsky coefficients $s_{ij} = w_i e_{ij}$ are considered as constants.

The first term in brackets in (5) can be read as the change in one particular logarithmic measure of real income $d\ln Q = d\ln(m/P)$ where $dlnP = \sum_{j=1}^{n} w_j dlnp_j$ is the Divisia price index. Considering the logarithmic differential of the ith budget share is an another way for calculating the real income term:

$$dlnw_i = dlnp_i + dlnq_i - w_i lnm \tag{6}$$

Then we multiply both sides through by w_i :

$$w_i dlnw_i = dw_i = w_i dlnp_i + w_i dlnq_i - dlnm \tag{7}$$

Sum (7) over all i:

$$\sum_{i=1}^{n} dw_i = 0 = \sum_{i=1}^{n} w_i dlnp_i + \sum_{i=1}^{n} w_i dlnq_i - dlnm \tag{8}$$

Therefore, $dlnm - \sum_{i=1}^{n} w_i dlnp_i = \sum_{i=1}^{n} w_i dlnq_i = dlnQ$ (9)

And the real income term $dlnQ = \sum_{i=1}^{n} w_i dlnq_i$ is recognised as the Divisia quantity index for the change in real income. Considering this definition, the Rotterdam model can be rewritten as:

$$w_i dlnq_i = b_i dlnQ + \sum_{j=1}^{n} s_{ij} dlnp_j \qquad (10)$$

2.1.2. Almost Ideal Demand System (AIDS)

The next model considered in this work is the Almost Ideal Demand (AID) system developed by Deaton and Muellbauer (1980) written as follows:

$$w_i = d_i + c_i(lnm - lnP^*) + \sum_{j=1}^{n} r_{ij} lnp_j \qquad (11)$$

Where,

$$lnP^* = \alpha_0 + \sum_{k=1}^{n} d_k lnp_k + \frac{1}{2} \sum_{k=1}^{n} \sum_{j=1}^{n} r_{kj} lnp_k lnp_j \qquad (12)$$

Stone's index gives an approximation for (12):

$$lnP^* = \sum_{j=1}^{n} w_j lnp_k \qquad (13)$$

Then with (13) substituted into (11), we have the AIDS system in levels:

$$w_i = d_i + c_i(lnm - \sum_{j=1}^{n} w_j lnp_j) + \sum_{j=1}^{n} r_{ij} lnp_j \qquad (14)$$

The differential version of (14) can be written as follows; we add a constant γ_i to each equation to represent autonomous trends in demand:

$$dw_i = \gamma_i + c_i dlnQ + \sum_{j=1}^{n} r_{ij} dlnp_j \qquad (15)$$

The AIDS is very similar to the Rotterdam model equation (10), even if the dependent variables are different. This model explains the change in the budget share of each good, whilst the Rotterdam model considers only the quantity component, $w_i d\ln q_i$, of the budget share change.

The AIDS model (15) and the Rotterdam model (10) are similar in some ways. Thus, their coefficients are linked in the following way: If we replace $w_i d\ln q_i$in (7) by the right-hand side of the Rotterdam model (10), and replace $d\ln m$by $dlnQ + \sum_{j=1}^{n} w_j dlnp_j$, we obtain:

$$dw_i = (b_i - w_i) dlnQ + \sum_{j=1}^{n} (s_{ij} + w_i\, \delta_{ij} - w_i w_j) dlp_j \qquad (16)$$

Where δ_{ij} =1 if i=j, 0 otherwise.

Equation (16) is identical in form to the AIDS model (15), which reveals that the AIDS and Rotterdam coefficients are linked through the following way:

$$c_i = b_i - w_i \qquad (17)$$

$$r_{ij} = s_{ij} + w_i \delta_{ij} - w_i w_j \tag{18}$$

2.1.3. Central Bureau of StatisticsCBS System

Keller and Van Driel developed the CBS system (Keller & Van Driel, 1985).This model has the AIDS income coefficients c_i and the Rotterdam price coefficients s_{ij} . It is formed by replacing b_i in (10) by c_i+w_i and subtracting $w_i d\ln Q$ from both sides. The CBS system can be written as:

$$w_i(dlnq_i - dlnQ) = \gamma_i + c_i dlnQ + \sum_{j=1}^{n} s_{ij} dlnp_j \tag{19}$$

In this case, the dependent variable is the (w_i-weighted) deviation of the log change in q_i from the (w_i-weighted) average log change in the quantities of all n goods. The left-hand side is the weighted change in the volume share, q_i/Q, of the i[th] product.

2.1.4. NBR System

Neves developed the NBR model which has the Rotterdam income coefficients and the AIDS price coefficients (Neves,1994). If we replace c_i in the AIDS system (15) by b_i-w_i and move $w_i dlnQ$ over to the left-hand side, we obtain the NBR system:

$$dw_i + w_i dlnQ = \gamma_i + b_i dlnQ + \sum_{j=1}^{n} r_{ij} dlnp_j \tag{20}$$

2.2. Data, and estimation procedure

2.2.1. Data

Data was collected on spring 2008 among a sample of 504 heads of households distributed equally among seven regions of Tunisia.

According to the gender, the sample was predominantly composed of men (90.67%). Moreover, about 92.46% of those interviewed were married. The sample was divided into five age groups. The education level had two dominant levels: high school and the upper level representing 41.67% and 34.13%, respectively. The variable income was distributed among six income classes. The class of less than 143 US $ is considered as the poorest class corresponding to households wage below the minimum required. This class represents only 3.17 % of the sample (See Table 1).

2.2.2. Estimation procedure

The Rotterdam, CBS, AIDS, and NBR models are defined in a differential form. To obtain estimable equations they have to be converted to finite changes. We follow the usual practice of approximating w_{it}, $dlnp_{it}$ and $dlnq_{it}$ for $\frac{(w_{it}+w_{it-1})}{2}$, $ln\frac{p_{it}}{p_{,,t-1}}$ and $ln\frac{q_{it}}{q_{i,t-1}}$, respectively, where subscript t indicates time.

The four empirical models have been estimated using the Full Information Maximum Likelihood (FIML) procedure in the TSP4.4 program. The "fish" equation was deleted to avoid singularity of the variance and covariance matrix of residuals due to the adding-up restriction. Restrictions imposed by economic theory (homogeneity and symmetry) were imposed in each model in order to obtain results consistent with the economic theory.

Table 1. Socio-demographic statistics of the sample, N=504 (%)

Age (years)	<30	5.16
	30-40	23.21
	40-50	42.06
	50-60	22.62
	>60	6.95
Education Level	Illiterate	3.77
	Coranic school	4.56
	Primary school	15.87
	Secondary school	41.67
	Higher school	34.13
Income (per month)	< 143 US $	3.17
	143-286 US $	19.25
	286-429 US $	24.80
	429-714 US $	24.80
	714-1072 US $	15.87
	> 1072 US $	12.10

Source: Field survey, 2012.

2.3. Empirical model

The four competing demand systems (10, 16, 19 and 20) are not nested. To asses and compare the empirical performance of each of the four conditional systems, we employed Barten's (1993) non-nested testing procedure. However, the synthetic model nests all demand systems:

$$w_i dlnq_i = (\delta 1 w_i + d_i) dlnQ + \sum_{j=1}^{n} (e_{ij} - \delta 2 w_i (\delta_{ij} - w_j)) dlnp_j \qquad (21)$$

Where; $d_i = \delta 1 b_i + (1 - \delta 1)$;$e_{ij} = \delta 2 \delta_{ij} + (1 - \delta 2) s_{ij}$; and δ_1 and δ_2 are additional parameters: 1) when $\delta_1 = \delta_2 = 0$, system (21) reduces to the Rotterdam. When $\delta_1 = 1$ and $\delta_2 = 0$, system (21) reduces to the CBS. When $\delta_1 = \delta_2 = 1$, system (21) reduces to the AIDS and when $\delta_1 = 0$ and $\delta_2 = 1$, system (21) reduces to the NBR.

These parametric restrictions satisfy the theoretical restrictions of adding-up, homogeneity and symmetry, implied by demand theory :

Adding-up : $$\sum_{i=1}^{k} d_i = 0, \quad \sum_{i=1}^{k} e_{ij} = 0 \qquad (22)$$

Homogeneity : $$\sum_{j=1}^{k} e_{ij} = 0 \qquad (23)$$

Symmetry : $$e_{ij} = e_{ji} \qquad (24)$$

Since the four systems satisfy the adding-up, homogeneity and symmetry, the second step consists on a comparison between the four competing systems. For comparison, a likelihood ratio test and Barten's (1993) test are used(Dhehibi, Gil & Angulo, 2001). The Likelihood Ratio Test (LRT) for model selection is:

$$LRT = -2 \, [\ln L(\theta^*) - \ln L(\theta)] \qquad (25)$$

Where θ is the vector of parameter estimates of a restricted model (Rotterdam, CBS, AIDS, and NBR) ; θ* is the vector of parameter estimates of the synthetic model; and L(.) is the log value of the likelihood function (Theil , 1965).

Table 2 presents the log values of the likelihood function and the corresponding statistics for model selection. In pair-wise likelihood ratio tests between the synthetic model and the four individual systems, the Rotterdam, differential AIDS, and NBR were firmly rejected by the hybrid model. The CBS system was the only system to be not rejected (at least at the 5 percent level).

Table 2. Tests results for the competing demand models and the synthetic system: likelihood ratio test statistics and Goodness of fit

Demand Systems	Maximised Log Likelihood	Likelihood Ratio Test: named demand system v. the ‘synthetic’ system.[a]	Goodness of Fit R^2
Synthetic System[b]	800.82	-	0.298
ROT	703.76	194.12	0.247
CBS	799.80	2.04	0.289
AIDS	782.75	36.15	0.298
NBR	686.05	229.54	0.237

[a]. With two degrees of freedom, the critical value at the 5% significance level is 5.99. The 1% critical value is 9.21. [b]. The estimates for δ_1 and δ_2 in (23) are 1.06 and 0.16 with standard errors 0.0686 and 0.136, respectively.

Source: Field survey, 2012.

To conclude, we have seen that CBS model is the best specification that fit with data aggregated over consumers. Thus, the empirical model has the following expression:

$$w_i(dlnq_i - dlnQ) = \gamma_i + c_i dlnQ + \sum_{j=1}^{n} s_{ij} dlnp_j \qquad (26)$$

Where parameters are explained in the previous sections. Moreover, applying linear restrictions on the estimated parameters homogeneity and symmetry restrictions are satisfying. The expenditure elasticity of each commodity group (η_i), the uncompensated price elasticities (E_{ij}) and the compensated price elasticities (ε_{ij}) for the CBS model are:

- Total expenditure: $$\eta_i = \frac{ci}{wi} + 1 \qquad (27)$$
- Uncompensated price elasticities: $$Eij = \frac{sij}{wi} - \eta_i \, w j \qquad (28)$$
- Compensated price elasticities: $$\varepsilon_{ij} = \frac{s_{ij}}{w_i} \qquad (29)$$

3. Results

Table 3 shows own price and expenditure elasticities for beef, mutton, poultry and fish. The expenditure has a positive and significant impact on the consumption of meat and fish. Beef and mutton are luxury goods while poultry and fish are necessity goods. All own price elasticities are negative. Nevertheless, the fish has an elasticity price which is superior to one which indicates that the demand for fish is relatively elastic. The period of the consumption of fish seems to explain this expenditure elasticity compared to the other products. Beef and mutton demand is less elastic as shown by the less than one own-price elasticities in spite of the high prices of these products compared to the others (See table3). Poultry demand is inelastic to any changes in its price.

Table 3.Expenditure and own price elasticities

Products	Elasticities	
	Expenditures	Prices
Beef	1.06**	-0.66**
Mutton	1.35**	-0.88**
Chicken	0.73**	-0.39**
Turkey	0.43**	-0.26**
Fish	0.61**	-1.19**
** significance at 5% level. * significance at 10% level.		

Source: Field survey, 2012.

We observed substitutions or complementary relations among meat and fish after analyzing the cross price elasticities. The diagonal of the hicksian matrix shown in Table 4 is composed by significant and negative price elasticities. Mutton substitutes any type of meat. Beef substitutes mutton, chicken and fish. Chicken substitutes beef and mutton. Fish substitutes also mutton and chicken. Turkey does not substitute any type of meat because it was recently introduced into the culinary practices of the Tunisian consumer.

Table 4: Cross price elasticities

Products	Beef	Mutton	Chicken	Turkey	Fish
Beef	**-0.42****	0.22**	0.17*	0.008	0.027
Mutton	0.14**	**-0.40****	0.09*	0.024	0.28**
Chicken	0.16**	0.14*	**-0.22****	-0.02	0.24**
Turkey	0.07	0.35**	-0.26	**-0.25***	0.25
Fish	0.61**	0.60**	0.01	0.01	**-1.09****
** significance at 5% level. * significance at 10% level.					

Source: Field survey, 2012.

Beef and Mutton are net substitutes because they are considered as essential in the traditional kitchen. Tables 5, 6 and 7 show the results of meat and fish demand: the expenditure and rice elasticities are differentiated by education level, age and household income. Expenditure elasticities by education level are superior to one which is considered as a "luxury product" for beef and mutton except for beef for consumers with a high level of education. Poultry and fish are necessary products except turkey bought by illiterate consumers or those having coranic or primary education. The high price of turkey compared to chicken and fish could explain the classification of this type of meat as a luxury product for this type of consumer (See Table 5).

Generally, consumers with a high level of education are more concerned by health than those with a low level of education. This result explains the high quantity of fish and meat purchased with a low level of greases. The less expenditure elasticities of chicken, turkey and especially fish for consumers with high level of education confirm this reality.

Table 5. Own price and expenditure elasticities by education level of the head of household

Products	Illeterate, coranic and primary studies		Secondary studies		Higher studies	
	Expenditures	Prices	Expenditures	Prices	Expenditures	Prices
Beef	1.09**	-0.84**	1.01**	-0.39	0.98**	-0.85**
Mutton	1.33**	-0.85**	1.38**	-0.91**	1.38**	-0.97**
Chicken	0.76**	-0.18*	0.78**	-0.55**	0.68**	-0.44**
Turkey	1.10**	-0.23	0.18	-0.07	0.51*	-0.0083
Fish	0.65**	-0.12*	0.61**	-0.17**	0.52**	-0.11**
** significance at 5% level. * significance at 10% level.						

Source: Field survey, 2012.

Empirical results for own price elasticities of meat and fish by level of education shown are negative in agreement with the economic theory and lower than one. Most of the coefficients reported in the table are intuitively reasonable. The demand for chicken meat is less elastic than the demand for beef and mutton. Nevertheless, it is more elastic than the demand for fish. In this case, the own price elasticities for fish is low compared to the other products. This shows that the Tunisian consumers are insensitive to any changes in the price of fish. Consequently, an increase in the expenditure of fish is not the result of lower prices, but of a rise in the income and probably also because of the interest for the health by consumers.

Expenditure elasticities by age (See table 6) show that beef and mutton are luxury goods except beef for young consumers (age lower than 40 years). Chicken and fish are necessary goods for all types of consumers. Elasticities expenditure for beef and mutton increases with age whereas elasticities expenditure for chicken and fish decrease with age. Age is a major factor in consuming meat and fish as it integrates health dimension. This is confirmed by a high elasticity for mutton meat (1.5) and a low elasticity for fish (0.45) for the Tunisian consumers aged more than 50 years. In fact, oldest consumers decrease their consumption of mutton meat which is rich in animal greases and increase their consumption of fish whose benefits are recognized (See Table 6).

Table 6: Own Price and expenditure elasticities by age of household head

Products	AGE1 < 40 years		AGE2 from 40 to 50 years		AGE3 > 50 years	
	Expenditures	Prices	Expenditures	Prices	Expenditures	Prices
Beef	0.96**	-0.07	1.04**	-1.27**	1.11**	-0.53*
Mutton	1.29**	-0.64**	1.35**	-1.12**	1.45**	-0.80**
Chicken	0.86**	-0.58**	0.73**	-0.57**	0.65**	-0.04
Turkey	0.51**	-0.28	0.39	-0.32	0.30	-0.28
Fish	0.69**	-0.19**	0.60**	-0.34**	0.45**	-0.05**
** significance at 5% level. * significance at 10% level.						

Source: Field survey, 2012.

The own price elasticities by age are in the majority of cases significant. The demand for beef and mutton is elastic to any change in their prices for the category of age between 40 and 50 years. For the others, this demand is relatively elastic. This variability in demand elasticity confirms the effect of age in beef and mutton consumption. The demand for fish is inelastic for the age category more than 50 years. This confirms that fish consumption is not dependent on its price but on health aspects.

Table 7 shows own price and expenditure elasticities by level of income. Empirical results points outthat beef and mutton are luxury goods except beef for consumers with a monthly income between 286 and 714 US $. Poultry and fish are necessary goods for all categories of income.

Table 7: Own Price and expenditure elasticities by income

Income	RVN1		RVN2		RVN3	
Products	Expenditures	Prices	Expenditures	Prices	Expenditures	Prices
Beef	1.23**	-0.76**	0.91**	-0.38	1.15**	-1.31**
Mutton	1.21**	-0.61**	1.48**	-1.17**	1.31**	-0.85**
Chicken	0.81**	-0.29*	0.78**	-0.40**	0.52**	-0.52**
Turkey	0.67*	1.48*	0.15	-0.42**	0.31	-0.16
Fish	0.71**	-0.13**	0.45**	-0.00	0.71**	0.09**

** significance at 5% level. * significance at 10% level.
RVN1: Monthly income <286 US $, RVN2: Monthly income between 286 and 714 US $, RVN3: Monthly income > 714 US $.

Source: Field survey, 2012.

The own price elasticities by level of income are not all negative and are positive for two cases. The first case relates to turkey meat belonging to the category of consumers with an income lower than 286 US $. The second case concerns fish bought by the consumers having an income higher than 714 US $. This seems to be explained for turkey meat by the volume of purchase which is definitely lower than the volume of purchase of the other products. Indeed, the majority of the purchases of turkey meat do not exceed the half-kilo. Concerning fish which is often consumed in summer, even if its price increases, the consumed quantity increases because the periodicity of this product. Comparing to the other kind of meat (Beef, mutton, poultry), mackerels and sardines have a lower price. Even if there is an augmentation in the price it has no effects on its consumption.

The demand for beef and mutton for the consumers with an income higher than 714 $ and the demand for mutton meat for the consumers with an income between 286 and 714 $ are elastic to any changes of the price. Demand elasticity for chicken meat increases with the income. In spite what it seems to be normally observed, the consumers with a high income are the most sensitive to the changes in the price of chicken. In other words, they benefit from a reduction in prices of this product to increase the quantity bought.

4. Conclusion and Policy Implications

In this paper we examined the consumers habits of food in Tunisia, from the standpoint of the quantities consumed of meat and fish, to changes in traditional economic variables, income and prices, and certain demographic and socioeconomic variables. This research has focused on the estimation of demand systems using cross-section data, thus a synthetic system was selected giving certain restrictions on its parameters. The selection of a functional form a priori would have meant the loss of significant information.

The results in terms of elasticities are comparable to other studies (Dhehibi & Gil, 1999, 2003) primarily those who have used time series data although there are some differences in the expenditure and price elasticities magnitude. The aggregation of meat and fish and the characteristics of the source of information used were undoubtedly the main drivers of this work by making it difficult to compare results.

In any case, we believe that the strategy used in our research is adequate and provides greater flexibility and consistency in the estimation of demand systems for meat and fish in Tunisia, even though there is some complexity. Thus, to what extent this increased complexity can improve the above result is an open question, which is away from the objective of this research and that every reader should appreciate. In any case, any estimated model should be validated from both the economically and statistically point of view, as we have done in this study.

In this work, we tried to start a certain line of research that will complement both aspects of which had already been treated in the demand literature. Obviously, this research can be improved in the future, both from the methodological and the applied point of view. In the first case, the estimation and comparison in multi-equation systems using panel data is a field that is the subject of theoretical research, especially in regard to the development of specification tests in multivariate version. From the applied point of view, the introduction of variables other than the traditional income, prices and demographic characteristics can be determinant for meat and fish consumption in the Tunisian society. Issues such as diet quality and information about the diet-health are factors that influence the demand for these products and therefore should be introduced in the future researches.

References

Barten, A.P. (1993). Consumer Allocation Models: Choice of Functional Form. *Empirical Economics,* 18, 129-158.

Ben Kaabia, M., Dhehibi, B.,& Gil, J.M. (2000). A new framework to estimate and identify co-integrated demand systems: An application to Tunisian meat consumption. XXIV-IAAE Conference. Berlin (Germany).

Brester, G.W.,&Wohlgenant, M.K. (1993). Correcting for Measurement Error in Food Demand Estimation. *The Review of Economics and Statistics* 75, 352-356.

Deaton, A.,& Muellbauer, J. (1980). An Almost Ideal Demand System. *The American Economic Review,*70, 312-326.

Deaton, A. (1989). Quality, Quantity and Spatial Variation of Price. *The American Economic Review*, 78, 418-430.

Dhehibi, B.,& Gil, J.M. (1999). Demand for red meat, poultry and fish in Tunisia : A generalized addilog demand system. *New Medit*, 99, 15-20.

Dhehibi, B., Gil, J.M. & Angulo, A. (2001). La demanda de carnes y pescados en Túnez: un enfoque dinámico. *Revista Española de Estudios Egresociales y Pesqueros* 190, 223-244.

Dhehibi, B.,& Gil, J.M. (2003). Forecasting food demand in Tunisia under alternativepricing policies. *Food Policy*, 28, 167-186.

Gracia, A.,& Albisu, L.M.(1998). The demand for meat and fish in Spain : Urban and Rural areas. *Agricultural Economics,* 19, 359-366.

Institut National de la Statistique (INS). (2010). *Enquête Nationale sur le Budget, la Consommation et le niveau de vie des ménages.*(report B). Tunisie.

Jabarin, A.S. (2005). Estimation of meat demand system in Jordan: an almost ideal demand system. *International Journal of Consumer Studies* 29, 232-238.

Keller, W.J.,& Van Driel, J. (1985). Differential Consumer Demand Systems. *European Economic Review,*27, 375-390.

Neves, P.A. (1994). Class of Differential Demand Systems. *Economic Letters,* 44, 83-86.

Taljaard, P.R., Van Schalkwyk, H.D.,& Alemu, Z.G. (2006). Choosing between the AIDS and Rotterdam models : A meat demand analysis case study. *Agrekon,* 45.

Theil , H. (1965). The Information Approach to Demand Analysis. *Econometrica,* 33, 67-87.

Wilson, C.A.,& Marsh, T.L. (2005). *The impacts of demographics and healthinformation on meat demand*. Staff Paper. Department Of Agricultural Economics. Perdue University.