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Un effet structurel positif qualifie la structure régionale d'adaptée à la demande communautaire (ou mondiale) de l'Espagne (ou de l'Italie) : la région avait l'année de base une « bonne » structure pour répondre à l'évolution de la demande de ces pays.

Un effet régional positif signifie que le taux de croissance observé est supérieur au taux de croissance auquel on pouvait s'attendre compte tenu d'une part de la structure de base de ses exportations et d'autre part de l'évolution de la demande étrangère : il y a bien là un effet dû au dynamisme propre de la région.



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# Is Leisure Weakly Separable from Consumption Goods in Spain ?

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*In this paper I test the hypothesis that leisure is weakly separable from consumption goods in Spain. To that end, I specify and estimate a dynamic version of the* Almost Ideal Demand System *using aggregate data. The principal result is that the separability of leisure is rejected and, therefore, I present empirical evidence for the joint modelling of the demand for leisure and goods. The elasticities show that all goods are normal and also that all demands are both decreasing and inelastic.*

*Dans cet article est examinée une hypothèse faible de la séparabilité entre le loisir et les biens de consommation en Espagne. Pour ce faire, est spécifiée et estimée une version de* Almost Ideal Demand System *pour lequel on utilise des données agrégées. Le résultat le plus*

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*important est que la séparabilité du loisir est rejetée, ce qui justifie le test d'une modélisation conjointe de la demande pour le loisir et les biens de consommation. Le calcul des élasticités montre que tous les biens sont normaux, toutes les demandes décroissantes et inélastiques.*

The concept of separability has played an important role in economic analysis ever since the seminal papers of Leontief (1947) and Sono (1961), with consumer demand analysis being no exception to this rule. In this context, leisure is usually assumed to be separable from all other goods when demand decisions are modeled. That is to say, it is supposed that the utility function is separable in the partition leisure/goods and, hence, is specified only in terms of the goods and services that the agents buy in the market.

Following this line, a very significant number of empirical papers have specified utility functions that include both leisure and consumption goods, from which different demand systems are derived. The estimation of these systems has allowed us to jointly characterize the demand for leisure and goods in several Western countries. Among these, we can cite Abbott and Ashenfelter (1976 and 1979), Kiefer (1977), Phlips (1978), Barnett (1979), Joerding (1982) and Dowd (1992), all of these using US data; Darrough (1977) for Japan; Blundell and Walker (1982) and Ray (1982a and 1982b) for Great Britain; Blundell, Laisney and Ruth (1993) using French data and, finally, Kaiser (1993) for Germany.

Against this background, the objective of this paper is to test the hypothesis of the weak separability of leisure from consumption goods in Spain and, on the basis of the results obtained, to present empirical evidence on the joint modelling of the Spanish demand for leisure and goods. To that end, we carry out a parametric analysis, testing the separability hypothesis on a dynamic version of the Almost Ideal Demand System of Deaton and Muellbauer (1980b), with this model being estimated with time series from 1964 to 1992 for expenditure on leisure time and the consumption of goods. We then show that the model does not present autocorrelation problems; thereafter, we test the theoretical hypotheses and, finally, we calculate the expenditure and Marshallian and Hicksian price elasticities.

The rest of the paper is organised as follows. In Section I we formulate both the dynamic specification of the Almost Ideal Demand System (hereafter referred to as AID) and the restrictions of separability. In





Section II we present a descriptive analysis of data. Section III is dedicated to an explanation of the empirical results and, finally, section IV closes the paper with a summary of the main conclusions.

## I. THE THEORETICAL MODEL: AID

Let us consider that the rational consumer is able to decide on the purchase of consumption goods and on the distribution of his total time between work and leisure. If we assume that $\mathbf{q} = (q_1, q_2, \ldots, q_n)$ is the vector of $n$ consumption goods and $q_\ell$ is leisure, then the utility function is weakly separable in leisure if it can be expressed as:

$$u = F[u_A(q_1, q_2, \ldots, q_n), q_\ell] \tag{1}$$

As we can see, first $\{q_1, q_2, \cdots, q_n\}$ and $\{q_\ell\}$ form two separable groups in the utility function $F[\cdot]$ and then $q_1, q_2, \ldots, q_n$ are $n$ specific goods included in the sub-utility function $u_A(\cdot)$; that is to say, in the first stage, total expenditure is allocated between consumption goods and leisure and, in the second, consumers distribute their expenditure in the consumption goods category among specific products.

Continuing with the definition of the variables, $\mathbf{p} = (p_1, p_2, \ldots, p_n)$ is the price vector corresponding to $q$, $p_\ell$ is the price of leisure, that is to say, the wage, $L$ is the labour supplied by the consumer, $T$ is the number of hours available over the period, that is to say, $q_\ell + L = T$, and $\overline{y}$ is the household's non-labour income. Thus, the consumer maximizes the utility function subject to the budget constraint:

$$\left.\begin{array}{l} \text{Max}\, u = F[u_A(q_1, q_2, \ldots, q_n), q_\ell] \\ s \cdot to\, \mathbf{p}\,\mathbf{q} + p_\ell q_\ell = \overline{y} + p_\ell T = y \end{array}\right\} \tag{2}$$

where $y$ is the «full income», obtained as the sum of th non-human income and the value of the time endowment. Given the properties of the utility function, the solution of (2) allows us to obtain the Marshallian demand functions for each of the $n$ consumption goods and leisure:

$$\mathbf{q} = \mathbf{q}(\mathbf{p}, p_\ell, y) \tag{3a}$$

$$q_\ell = q_\ell(\mathbf{p}, p_\ell, y) \tag{3b}$$

In order to determine the functional form of demand equations (3a) and (3b), we use the AID model as a flexible formulation, which is an approximation to any demand model formulated from a expenditure function. In addition to its flexibility, this model has other advantages, namely that it is easy to estimate and to interpret the results and it also allows us to test the theoretical conditions of homogeneity and symmetry using linear restrictions on the parameters of the system.

The AID we estimate with aggregate data is a model that is perfectly consistent with the theory formulated for individual agents, given that it is derived from a preferences structure characterized by the PIGLOG expenditure function proposed in Muellbauer (1975 and 1976), which permits exact aggregation among the agents:

$$c(\mathbf{p}, p_\ell, u) = [a(\mathbf{p}, p_\ell)]^{1-u}[b(\mathbf{p}, p_\ell)]^u \tag{4}$$

where:

$$\log a(\mathbf{p}, p_\ell) = \alpha_0 + \sum_k^{n,\ell} \alpha_k \log p_k + \frac{1}{2}\sum_k^{n,\ell}\sum_j^{n,\ell} \gamma_{kj}^* \log p_k \log p_j \tag{5}$$

$$\log b(\mathbf{p}, p_\ell) = \log a(\mathbf{p}, p_\ell) + \beta_0 \prod_k^{n,\ell} p_k^{\beta_k} \tag{6}$$

Applying Shephard's lemma, we obtain the demand equations of AID for the $n$ consumption goods and leisure in its budget share form:

$$w_i = \alpha_i + \sum_j^{n,\ell} \gamma_{ij} \log p_j + \beta_i \log\left(\frac{y}{P}\right) \quad (i = 1,\ldots,n) \tag{7a}$$

$$w_\ell = \alpha_\ell + \sum_j^{n,\ell} \gamma_{\ell j} \log p_j + \beta_\ell \log\left(\frac{y}{P}\right) \tag{7b}$$

where $\alpha_i, \alpha_\ell, \beta_i, \beta_\ell, \gamma_{ij} = (\gamma_{ij}^* + \gamma_{ji}^*/2)$ are parameters and $P$ is the index price:

$$\log P = \alpha_0 + \sum_k^{n,\ell} \alpha_k \log p_k + \frac{1}{2}\sum_k^{n,\ell}\sum_j^{n,\ell} \gamma_{kj} \log p_k \log p_j \tag{8}$$

However, the empirical literature has shown that one of the less satisfactory features of AID is its static character (see, for example,





Anderson and Blundell (1982 and 1983), Blanciforti and Green (1983), Ray (1984), Blanciforti, Green and King (1986) and Mergos and Donatos (1989)). Therefore, we dynamize our model, following the formulation of Deaton and Muellbauer (1980a), which specifies the intercept to be linear functions of a lagged endogenous variable and a time trend, with the purpose of measuring the effects of consumption habits:

$$\alpha_i = \alpha_i^* + \alpha\, w_{it-1} + \alpha_i^{**}\, t \quad (i = 1,\cdots, n,\ell) \tag{9}$$

This dynamic specification generates the following demand equations:

$$w_{it} = \alpha_i^* + \alpha\, w_{it-1} + \alpha_i^{**}\, t + \sum_j^{n,\ell} \gamma_{ij} \log p_{jt} + \beta_i \left\{ \log y_t - \alpha_0 - \sum_k^{n,\ell} (\alpha_k^* + \alpha\, w_{kt-1} + \alpha_k^{**}\, t) \log p_{kt} - \frac{1}{2}\sum_k^{n,\ell}\sum_j^{n,\ell} \gamma_{kj} \log p_{kt} \log p_{jt} \right\} \quad (i = 1,\ldots,n) \tag{10a}$$

$$w_{\ell t} = \alpha_\ell^* + \alpha\, w_{\ell-1} + \alpha_\ell^{**} t + \sum_j^{n,\ell} \gamma_{\ell j} \log p_{jt} + \beta_\ell \left\{ \log y_t - \alpha_0 - \sum_k^{n,\ell} (\alpha_k^* + \alpha\, w_{kt-1} + \alpha_k^{**}\, t) \log p_{kt} - \frac{1}{2}\sum_k^{n,\ell}\sum_j^{n,\ell} \gamma_{kj} \log p_{kt} \log p_{jt} \right\} \tag{10b}$$

Demand theory imposes several restrictions on the parameters of the model:

- adding-up: $\sum_i^{n,\ell} \alpha_i^* = 1 - \alpha;\ \sum_i^{n,\ell} \alpha_i^{**} = \sum_i^{n,\ell} \gamma_{ij} = \sum_i^{n,\ell} \beta_i = 0$ (11)
- homogeneity: $\sum_j^{n,\ell} \gamma_{ij} = 0$ (12)

• symmetry: $\gamma_{ij} = \gamma_{ji}$ (13)

• negativity: the matrix of substitution effects must be negative semi-definite.

Conditions (12) and (13) are restrictions that we can test by the usual procedures, but condition (11) is satisfied automatically and, hence, we cannot test it in the model. The restriction of negativity cannot be imposed as a restriction on the parameters of the model; however, one necessary condition for negativity is that all the diagonal terms of the substitution matrix must be non-positive.

As we stated earlier, we are especially interested in testing the weak separability between consumption goods and leisure. The characterization of different separable structures and their theoretical implications for demand analysis has been rigourously studied in Blackorby, Primont and Russell (1978) and in Deaton and Muellbauer (1980a). Some empirical papers that test weak separability conditions are Byron (1970), Jorgenson and Lau (1975), Pudney (1981), Barnett and Choi (1989) and Baccouche and Laisney (1991).

According to Deaton and Muellbauer (1980a) and Pudney (1981), the general testable restrictions of separability between consumption goods and leisure can be expressed as:

$$\frac{\sigma_{i\ell}}{\sigma_{j\ell}} = \frac{e_i}{e_j} \; \forall i,\, j \neq \ell,\, i,\, j = 1, \cdots, n \quad (14)$$

with $\sigma_{i\ell}$ and $e_i$ being the Allen-Uzawa elasticity of substitution for the goods $i$ and $\ell$ and the expenditure elasticity, respectively. Thus, knowing that the elasticity of substitution and the expenditure effect in a general AID model are: $\sigma_{i\ell} = \frac{\gamma_{i\ell}}{w_i w_\ell} + \frac{\beta_i}{w_i}\frac{\beta_\ell}{w_\ell}\log\left(\frac{y}{P}\right) + 1$ and $e_i = 1 + \frac{\beta_i}{w_i}$, the particular restrictions of its separability can be written as:

$$\frac{\gamma_{i\ell}+\beta_i\beta_\ell\log\left(\frac{y}{P}\right)+w_i w_\ell}{\gamma_{j\ell}+\beta_j\beta_\ell\log\left(\frac{y}{P}\right)+w_j w_\ell} = \frac{w_i+\beta_i}{w_j+\beta_j} \; \forall i,\, j\neq\ell,\, i,\, j=1, \cdots, n \quad (15)$$

Equation (15) defines a set of restrictions that are tested. For this purpose, it is important to know the number of independent restrictions





that are implied by the particular separability structure being postulated. Let us suppose that there are $G$ weakly separable groups in a general utility function and there are $n_s$ substitution terms $\sigma_{ik}$ that pertain to goods belonging to different groups. If $n$ is the total number of goods, there will be a total of $n(n-1)/2$ cross-substitution terms $\sigma_{ik}(i \neq k)$, and if $n_g$ is the number of goods belonging to the $g$ group $(g = 1, 2, \cdots, G)$, then there will be $[\sum_g n_g(n_g - 1)]/2$ cross substitution terms $\sigma_{ik}$ that pertain to goods belonging to the same group. Taking the difference between these two quantities, we obtain $n_s$. Moreover, there will be $n_\mu = \binom{G}{2} = G(G-1)/2$ proportionality coefficients $\mu_{AB}$. Hence, the number of nonreduntant restrictions will be:

$$n_R = n_s - n_\mu = [n(n-1) - \sum_{g=1}^{G} n_g(n_g - 1) - G(G-1)]/2 \quad (16)$$

Furthermore, the expressions of price elasticities are:

• Marshallian:

$$e_{ij}^{y} = -\delta_{ij} + \left\{\gamma_{ij} - \beta_i\left[\alpha_i + \sum_{k}^{n,\ell}\gamma_{kj}\log p_k\right]\right\} w_i^{-1} \quad (17)$$

• Hicksian:

$$e_{ij}^{u} = -\delta_{ij} + $$
$$+\left\{\gamma_{ij} - \beta_i\left[\alpha_i + \sum_{k}^{n,\ell}\gamma_{kj}\log p_k\right] + w_i w_j + \beta_i w_j\right\} w_i^{-1} \quad (18)$$

## II. DATA

In this paper we use Spanish annual time series covering the period 1964-1992. The personal consumption expenditures and prices are obtained from several issues of the National Accounts, Vol. II (OECD), and the nominal wage and labour supplied are obtained from the Year Book of Labour Statistics (ILO).

We have specified a model with six equations, five of which correspond to consumption goods and the sixth to leisure. As regards the first five, we disaggregate the total expenditure in consumption goods into the following groups, following the items of the OECD data base and also according to the highest average budget shares, namely 1. Food, beverages and tobacco, 2. Clothing and footwear, 3. Gross rent, fuel and power, 4. Furniture, furnishings and household equipment and operation, and 5. Miscellaneous goods and services (medical care and health expenses, transport and communication, recreational, entertainment, education and cultural services, personal care and expenditures in restaurants, cafes and hotels).

The nominal wage is the earnings of a production worker in non-agricultural activities. Consumption good expenditures are then divided by employment in non-agricultural sectors, obtaining per capita values. On the other hand, the expenditure on leisure is obtained by multiplying the nominal wage by the leisure demand, that is to say, $p_\ell q_\ell$. Non-labour earnings are taken as the difference between the personal available income and labour earnings, that is to say, $\overline{y} = \mathbf{pq} - p_\ell L$. I then calculate «full income» by adding per capita non-labour income to the value of an individual's time over the year. This value is obtained by the product of the wage and the number of hours in each year, $y = \overline{y} + p_\ell T$, and, following Segura (1994), we consider $T = 16$ h./day.

Table 1 provides a brief descriptive analysis. First, we can observe the time evolution of budget shares and, secondly, the results of an inflation analysis, where we have calculated the annual average rates for each group, both for the total sample period and for several subperiods.

With respect to budget shares, it can be seen that the aggregate miscellaneous goods and services and, thereafter, the food, beverages and tobacco group have the largest average shares, 33.38% and 28.78%, respectively, whereas the furniture, furnishings and household equipment and operation group, and expenditure on leisure, exhibit the smallest values, 7.17% and 8.57%, respectively. The time evolution indicates that expenditures on food, beverages and tobacco, on clothing and footwear, on gross rent, fuel and power, and on furniture, furnishings and household equipment and operation have steadily decreased over the whole sample period by 53.13%, 23%, 21.64% and 26.58%, respectively. By contrast, expenditures on miscellaneous goods and services and leisure have increased from the beginning of the sample





*Table 1*

**Descriptive analysis**

| Budget shares (%) | 1964 | 1970 | 1975 | 1980 | 1985 | 1992 | Average |
|---|---|---|---|---|---|---|---|
| Food, beverages and tobacco | 39.26 | 34.19 | 32.14 | 25.77 | 22.39 | 18.40 | 28.78 |
| Clothing and footwear | 10.13 | 9.66 | 9.34 | 7.41 | 7.76 | 7.80 | 8.73 |
| Gross rent, fuel and power | 14.46 | 13.31 | 12.17 | 15.15 | 13.03 | 11.33 | 12.85 |
| Furniture, furnish. and hous. operation | 8.05 | 8.12 | 7.72 | 7.15 | 6.05 | 5.91 | 7.17 |
| Miscellaneous goods and services | 20.99 | 27.20 | 29.99 | 35.42 | 40.62 | 47.02 | 33.88 |
| Leisure | 7.08 | 7.50 | 8.60 | 9.07 | 10.12 | 9.51 | 8.57 |
| **Rates of inflation (%)** | **1965-1969** | **1970-1973** | **1974-1978** | **1979-1985** | **1986-1989** | **1990-1992** | **1965-1992** |
| Food, beverages and tobacco | 6.19 | 8.80 | 17.10 | 8.73 | 6.90 | 4.71 | 9.09 |
| Clothing and footwear | 7.64 | 10.37 | 19.88 | 12.83 | 8.91 | 5.05 | 11.42 |
| Gross rent, fuel and power | 5.96 | 7.01 | 15.88 | 16.06 | 5.12 | 6.86 | 10.38 |
| Furniture, furnish. and hous. operation | 6.86 | 8.64 | 21.82 | 10.81 | 5.66 | 5.50 | 10.46 |
| Miscellaneous goods and services | 5.16 | 8.83 | 19.39 | 14.88 | 6.80 | 7.54 | 11.14 |
| Leisure | 13.89 | 16.25 | 24.88 | 16.36 | 9.50 | 8.90 | 15.65 |

period up to the early 1990's, specifically by 124% and 34.32%, respectively.

As regards the rates of inflation, we can note that the nominal wage displays the highest average value along the whole sample period, 15.65%, and food, beverages and tobacco the smallest, 9.09%. The rest of aggregates exhibit similar percentages, in the region of 10% and 11%. We can also note that the highest rates appear in the subperiods 1974-78 and 1979-85, that is to say, immediately after the oil crises. Thereafter, the values show a clearly declining trend.

# III. ESTIMATION AND EMPIRICAL RESULTS

## 1. Estimation

The initial specification of the model (10a)-(10b) generates equations which are non linear in the parameters. To avoid non-linear estimation, our paper follows Deaton and Muellbauer (1980b) and uses the Stone price index, $P_t^*$, as a convenient approximation to $P_t$. With this transformation, and adding an error term that captures taste shifts, measurement errors in the dependent variable and the effects of left out variables, the AID model, in its stochastic version, takes the following form:

$$w_{it} = \alpha_i^* + \alpha\, w_{it-1} + \alpha_i^{**}\, t + \sum_j^{n,\ell} \gamma_{ij} \log p_{jt} +$$

$$+ \beta_i \log\left(\frac{y_t}{P_t^*}\right) + u_{it} \quad (i = 1,\dots,n,\ell) \tag{19}$$

where:

$$\log P_t^* = \sum_j^{n,\ell} w_{jt} \log p_{jt} \tag{20}$$

and $u_{it}$ and $u_{\ell t}$ are vectors of error terms which are assumed to be contemporaneously correlated but serially uncorrelated, that is to say, $E(u_{it}) = 0$ and $E(u_{it}, u_{it}') = \Omega\, \forall\, t$ and $E(u_{it}, u_{is}') = 0\, \forall\, t \neq s$.

Due to the adding-up restriction, the covariance matrix is singular and the likelihood function undefined. The usual procedure followed in this study has been to drop one of the equations, estimate the remaining system and calculate the parameters in the omitted equation (miscellaneous goods and services) via the adding-up condition.

Model (19) include regressors that are not identical across equations, which has motivated the choice of SURE rather than OLS. Therefore, the system has been estimated by using the SURE method, employing the TSP version 4.3. I have tested joint autocorrelation by means of one diagnostic test which recognises the adding-up restrictions and, hence, allows us to consider the system globally. We have started from the initial model expressed in a more general form, $w_{it} = X_{it}\, \beta_i + u_{it}$, and have assumed that the error terms are specified as $u_{it} = r_{ii}\, u_{it-1} + e_{it}$, with $r_{ii}$ being the first-order autocorrelation coefficient corresponding to the $i$ group. If we now substitute this hypothesis in the initial model and, knowing that the adding-up conditions imply the equality of the coefficients $r_{ii}$, we obtain $w_{it} = X_{it}\, \beta_i + r(w_{it-1} - X_{it-1}\, \beta_i) + e_{it}$. Therefore, the rejection of the hypothesis $H_0 : r = 0$ in this specification shows the existence of first-order autocorrelation problems (see Berndt and Savin, 1975). Furthermore, the theoretical restrictions of the system are tested by means of the Wald test, which is distributed asymptotically as a chi-squared variable with degrees of freedom equal to the number of restrictions being tested (for details, see Berndt and Savin, 1977, and Gallant and Holly, 1980).

If the estimated demand model is the linear version (19), then the appropriate formula for the elasticity of substitution is $\sigma_{i\ell} = \frac{\gamma_i}{w_i w_\ell} + 1$. Therefore, the restrictions of separability to be tested are four conditions, which will be expressed as:

$$\frac{\gamma_{i\ell} + w_i w_\ell}{\gamma_{j\ell} + w_j w_\ell} = \frac{w_i + \beta_i}{w_j + \beta_j} \forall\, i, j \neq \ell,\, i, j = 1, \dots, n \tag{21}$$

To obtain the number of nonredundant weak separability restrictions, we use (16), where $n = 6$, $n_g = 5$ and $G = 2$, that is to say, $n_R = 1/2\,[30 - 22] = 4$.

## 2. Results

The results of the estimation are reported in Tables 2 to 4. However, we have first tested for the existence of first-order autocor-

*Table 2*
**Estimated parameters**

| | $\alpha_i^*$ | $\alpha$ | $\alpha_i^{**}$ | $\gamma_{i1}$ | $\gamma_{i2}$ | $\gamma_{i3}$ | $\gamma_{i4}$ | $\gamma_{i5}$ | $\gamma_{i6}$ | $\beta_i$ | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Food, beverages and tobacco | 0.8362<br>(3.2)* | 0.1318<br>(3.89)* | −0.0057<br>(−4.17)* | 0.1746<br>(5.7)* | −0.0301<br>(−1.92) | −0.0356<br>(−2.77)* | −0.0277<br>(−1.04) | −0.0463<br>(−1.82) | 0.0058<br>(0.20) | −0.0688<br>(−2.41)* | 0.99 |
| Clothing and footwear | 0.1278<br>(1.11) | 0.1318<br>(3.89)* | −0.0010<br>(−1.63) | −0.0031<br>(−0.23) | 0.0434<br>(6.06)* | −0.0373<br>(−6.58)* | −0.0260<br>(−2.49)* | 0.0012<br>(0.10) | 0.0150<br>(1.16) | −0.0048<br>(−0.33) | 0.98 |
| Gross rent, fuel and power | 0.1316<br>(1.33) | 0.1318<br>(3.89)* | −0.0014<br>(−2.48)* | −0.0385<br>(−3.3)* | −0.0135<br>(−2.35)* | 0.0990<br>(20)* | −0.0089<br>(−0.81) | −0.0397<br>(−3.36)* | −0.0070<br>(−0.63) | 0.0014<br>(0.11) | 0.99 |
| Furniture, furnish. and hous. operation | −0.0895<br>(−1.02) | 0.1318<br>(3.89)* | 0.0020<br>(4.33)* | 0.0038<br>(0.37) | −0.0187<br>(−3.5)* | −0.0221<br>(−5.09)* | 0.0599<br>(6.48)* | −0.0206<br>(−2.34)* | −0.0204<br>(−2.36)* | 0.0129<br>(1.17) | 0.98 |
| Miscellaneous goods and services | −0.2245<br>(−0.76) | 0.1318<br>(3.89)* | 0.0089<br>(5.59)* | −0.1186<br>(−3.41)* | 0.0257<br>(1.44) | −0.0063<br>(−0.43) | 0.0065<br>(0.21) | 0.0841<br>(2.92)* | −0.0331<br>(−1) | 0.0689<br>(1.87) | 0.99 |
| Leisure | 0.2183<br>(1.63) | 0.1318<br>(3.89)* | −0.0027<br>(−3.8)* | −0.0180<br>(−1.13) | −0.0067<br>(−0.82) | 0.0024<br>(0.37) | −0.0215<br>(−1.56) | 0.0213<br>(1.58) | 0.0397<br>(2.63)* | −0.0096<br>(−0.56) | 0.97 |

* Denotes significant at the 5% level (t-rates between parentheses).





relation, obtaining a value of $r = 0.6408$, with a $t$-rate = 0.0115, lower than the critical value at the usual 5% level of significance, 1.96. Therefore, we can accept that our model does not exhibit autocorrelation problems.

Table 2 shows the estimated parameters and the degree of fit. As regards the individual significance of the coefficients, we can see that almost 45% of the estimated parameters are significant at the 5% level. With respect to the dynamic coefficients which measure the effect of consumption habits, we can observe that the parameter of the lagged variable, as well as five of the six coefficients of the time trend, are individually significant. This result confirms that the chosen dynamic specification improves the economic representativity of the model. As regards price parameters, we can note that all direct prices are statistically significant at the 5% level. Moreover, the equation corresponding to furniture, furnishings and household equipment and operation shows the largest number of parameters with this property.

Despite the fact that $R^2$ is only an approximate indicator of the fit in the demand system, and thus has to be carefully interpreted, it is also true that the majority of empirical papers that have estimated the AID have included this coefficient in their results tables. In our study, and as is usually the case, the model appears to fit very well, as is illustrated by the very high coefficients; specifically, all values appear between 0.97 and 0.99.

The tests of the theoretical hypotheses are reported in Table 3. We have first tested the homogeneity condition, both jointly and individually (separately for each equation), with all the Wald values being higher than their corresponding critical values at the 5% level of signi-

*Table 3*
**Hypotheses tests**

| | | | Wald | | |
|---|---|---|---|---|---|
| Homogeneity | | | | | |
| Jointly (5 d.f.) | | | 49.44* | | |
| Individually (1 d.f.) | 20.51* | 3.90* | 6.64* | 34.61* | 13.26* |
| Homogeneity and symmetry (20 d.f.) | | | 215.07* | | |
| Weak separability (4 d.f.) | | | 13.68* | | |

* Hypotheses rejected at the 5 % level. Critical values: $\chi^2(1)_{0.05} = 3.84$, $\chi^2(4)_{0.05} = 9.48$, $\chi^2(5)_{0.05} = 11.07$, $\chi^2(20)_{0.05} = 31.40$.

ficance, $\chi^2(1)_{0.05} = 3.84$ and $\chi^2(5)_{0.05} = 11.07$. Secondly, the value for joint homogeneity and symmetry are also higher than the critical value at the same level of significance, $\chi^2(20)_{0.05} = 31.41$. Therefore, both hypotheses are clearly rejected. These results are in accordance with those reported in other papers that have estimated the Almost Ideal Demand System, such as Deaton and Muellbauer (1980b), Blanciforti and Green (1983) and Mergos and Donatos (1989).

Bearing in mind that the central objective of this paper is to test the weak separability of leisure, a particular comment should be made at this point. As the separability restrictions are not simple parametric restrictions, but also involve the data, we have used the average budget shares in order to test them. Given the value of the Wald test, 13.68, as well as the critical value, $\chi^2(4)_{0.05} = 9.48$, we show that leisure is not weakly separable in Spain at the 5% level of significance. Therefore, the utility function of Spanish consumers should include as exogenous variables both the expenditure on leisure and the expenditures on consumption goods.

Finally, we have obtained the short-run and the long-run elasticities, with the latter being calculated by assuming that $w_{it} = w_{it-1}$. All these effects, derived from unrestricted estimates and evaluated at the mean point of the explanatory variables, are reasonable in terms of signs and magnitude. Given that the short-run values are very similar to those of the long-run, we have decided to present only the former in Table 4, with the latter being available from the author upon request. Thus, with respect to the expenditure effects, we can observe that all values are statistically significant at the 5% level. The values above one displayed by furniture, furnishings and household equipment and operation and by miscellaneous goods and services indicate that these goods are luxuries, whereas food, beverages and tobacco and clothing and footwear are necessities. Leisure is also a necessity, as is similarly reported in Darrough (1977), Kiefer (1977), Barnett (1979), Blundell and Walker (1982) and Ray (1982a).

As regards own-price elasticities, we can see that all Marshallian values are negative according to decreasing demands. Four of these effects are significant at the 5% level. The values below one, in absolute terms, of all Marshallian own-price elasticities indicate that the six demands are price inelastic, with furniture, furnishings and household equipment and operation being the category which is most insensitive to its own price. By contrast, we can observe that miscellaneous goods and services is the good which is the most sensitive to its own price.





*Table 4*

**Elasticities**

| | Food, beverages and tob. | Clothing and footwear | Gross rent fuel and power | Furniture, furnis. and hous. oper | Miscellan. goods and services | Leisure |
|---|---|---|---|---|---|---|
| EXPENDITURE | 0.76<br>(6.71)* | 0.94<br>(5.70)* | 1.01<br>(10.28)* | 1.18<br>(7.7)* | 1.20<br>(11)* | 0.88<br>(4.47)* |
| MARSHALLIAN | | | | | | |
| Food, beverages and tobacco | – 0.20<br>(– 1.65) | – 0.07<br>(– 1.33) | – 0.09<br>(– 2.11)* | – 0.11<br>(– 1.18) | – 0.17<br>(– 2.01)* | – 0.06<br>(– 0.49) |
| Clothing and footwear | 0.006<br>(0.04) | – 0.49<br>(– 5.82)* | – 0.42<br>(– 7)* | – 0.30<br>(– 2.22)* | 0.01<br>(0.8) | – 0.18<br>(– 1.07) |
| Gross rent, fuel and power | – 0.30<br>(– 3.73)* | – 0.10<br>(– 2.01)* | – 0.23<br>(– 6.49)* | 0.06<br>(0.81) | – 0.30<br>(– 3.32)* | – 0.05<br>(– 0.55) |
| Furniture, furnshing and hous. operation | – 0.08<br>(– 0.6) | – 0.28<br>(– 3.69)* | – 0.33<br>(– 5.66)* | – 0.15<br>(– 1.16) | – 0.27<br>(– 2.27)* | – 0.31<br>(– 1.82) |
| Miscellaneous goods and services | – 0.35<br>(– 3.41)* | 0.07<br>(1.44) | – 0.01<br>(– 0.43) | 0.01<br>(0.21) | – 0.75<br>(– 8.84)* | – 0.09<br>(– 1) |
| Leisure | – 0.12<br>(– 0.73) | – 0.06<br>(– 0.69) | 0.04<br>(0.56) | – 0.25<br>(– 1.59) | 0.24<br>(– 1.55) | – 0.51<br>(– 2.43)* |
| HICKSIAN | | | | | | |
| Food, beverages and tobacco | – 0.01<br>(– 0.1) | – 0.01<br>(– 0.2) | – 0.001<br>(– 0.003) | – 0.05<br>(– 0.59) | 0.08<br>(0.86) | 0.12<br>(1.06) |
| Clothing and footwear | 0.27<br>(2.09)* | – 0.41<br>(– 5.01)* | – 0.3<br>(– 4.5)* | – 0.23<br>(– 1.7) | 0.33<br>(2.14)* | 0.26<br>(1.67) |
| Gross rent, fuel and power | – 0.01<br>(– 0.23) | – 0.01<br>(– 0.35) | – 0.1<br>(– 2.52)* | 0.14<br>(1.66) | 0.03<br>(0.32) | 0.02<br>(0.31) |
| Furniture, furnshing and hous. operation | 0.25<br>(1.95) | – 0.17<br>(– 2.3)* | – 0.17<br>(– 2.8)* | 0.93<br>(6.9)* | 0.12<br>(0.9) | – 0.21<br>(– 1.33) |
| Miscellaneous goods and services | – 0.06<br>(– 0.6) | 0.16<br>(3.1)* | 0.10<br>(2.55)* | 0.09<br>(1.02) | – 0.41<br>(– 4.85)* | – 0.01<br>(– 0.12) |
| Leisure | 0.13<br>(0.83) | 0.01<br>(0.11) | 0.15<br>(1.94) | – 0.19<br>(– 1.18) | 0.54<br>(3.17)* | – 0.43<br>(– 2.13)* |

* Denotes significant at the 5% level (t-rates between parentheses).

The decreasing character of leisure demand that we find is also reported in Darrough (1977), Kiefer (1977), Phlips (1978), Barnett (1979), Ray (1982a and 1982b) and Kaiser (1993).

One important subset of conditions in order for negativity to hold is that all the Hicksian own-price elasticities should be negative. In this paper, the positive value of the furniture, furnishings and household equipment and operation group violates the negativity condition implied by consumer demand theory.

The final results of interest concern the cross-price elasticities. Hicksian values provide the most accurate picture of cross-price substitution, since they are a measure of the substitution effects net of income effects. From Table 4 we can observe that cross-price effects are weak. This is suggested by the fact that all the values are, in absolute terms, smaller that one. Of the 25 values, 17 are postive, indicating net substitute goods. In particular, the following pairs are positive: leisure and food, beverages and tobacco; miscellaneous goods and services and clothing and footwear; leisure and clothing and footwear; miscellaneous goods and services and gross rent, fuel and power; leisure and gross rent, fuel and power; and, finally, miscellaneous goods and services and furniture, furnishings and household equipment and operation. By contrast, the following are negative: gross rent, fuel and power and food, beverages and tobacco; clothing and footwear and gross rent, fuel and power; clothing and footwear and furniture, furnishings and household equipment and operation; and, lastly, furniture, furnishings and household equipment and operation and leisure.

## IV. SUMMARY AND CONCLUSIONS

In this paper we have tested the hypothesis of the separability of leisure from consumption goods, using Spanish data from 1964 to 1992. The main finding is that the condition of weak separability is rejected. That is to say, the hypothesis that consumers first allocate expenditures between a consumption good aggregate and leisure, and thereafter among products within that aggregate, is rejected. Thus, when analyzing demand in Spain, we should not focus solely on the demand for consumption goods, but rather give simultaneous consideration to the demand for all types of goods.





We have specified and estimated a dynamic version of the Almost Ideal Demand System which allows us to test the theoretical hypotheses and calculate the expenditure and price elasticities. We have specified the model with six equations, namely five consumption goods and leisure, and have shown that the estimated model does not exhibit autocorrelation problems. Furthermore, we have tested and rejected the hypotheses of homogeneity, symmetry and weak separability.

The estimated elasticities for the Spanish demand system are in accordance with a priori expectations. In particular, expenditure elasticities allow us to consider the food, beverages and tobacco, the clothing and footwear and the leisure categories as necessities. On the other hand, the furniture, furnishings and household equipment and the operation and miscellaneous goods and services groups should be considered as luxuries. Marshallian own-price effects indicate that all demands are price inelastic, with furniture, furnishings and household equipment and operation being the good which is most insensitive to its own-price. One Hicksian cross-price effect indicates that the data does not satisfy the negativity restriction and, finally, cross-price elasticities indicate that the majority of goods are net substitutes.

By way of conclusion, we should note that our empirical results are consistent with those reported in other papers which have tested and rejected the hypothesis of weak separability and, in the light of this, have chosen to jointly model the demand for leisure and consumption goods in other Western countries.

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