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FORECASTING PRIVATE CONSUMPTION STRUCTURE IN 10 EUROPEAN COUNTRIES: SKIM Model Results and Comparison with other Approaches

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Abstract:

This analysis was performed with data from 10 European Union countries in the period 1962-86 and is devoted to the changes in the structure of private consumption with respect to eight commodity groups. We began with eleven different approaches from which we chose four. In turn we then compared them with the SKIM model. A total of 880 equations have been estimated during the period 1962-84 and from that source of information we evaluated the forecasting accuracy for the period 1984-86. The main conclusion is that the Skim model, presented in this paper, generally performs better than the other models considered, (Rotterdam, loglinear, LES, Deaton and Muellbauer, and related models). The paper also analyses the evolution of Private Consumption in 15 European Union countries during the period 1960-2000, in comparison in the USA and Japan.

KEY WORDS: Private Consumption, Applied Econometric Models, European Economics.
JEL Classification: C5, E2, O52

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1.- INTRODUCTION

For the last few years we have been studying and applying several econometric models for explaining and forecasting Private Consumption structure in EEC countries. Through an analysis of this research we have arrived at a new demand model, and we have compared it with some of the best known. Here, we present our own model and our main conclusions.

This study was carried out with data from 10 EEC countries, for the period 1962-1986 analysing eight commodity groups (Luxembourg and Portugal were excluded because of a problem with missing data).

The data source was OECD National Accounts. Refining the data, we got a homogeneous series in constant US dollars, at the exchange rates and price levels of 1980. We also tried using purchasing power parities instead of 1980 exchange rates, but the results seemed to undervalue the consumption level of Germany and overvalue that of Spain, so we chose the values based on 1980 exchange rates.

The commodity groups considered were:

1. Food, beverages and tobacco.
2. Clothing and footwear.
3. Gross rent, fuel and power.
4. Furniture, furnishings and household equipement and operation.
5. Medical care and health expenses.
6. Transport and communication.
7. Recreational, entertainment, education and cultural services.
8. Miscellaneous goods and services (personal care, restaurants, and other).

We considered eleven models for each of the ten countries which, taking into account the eight commodity groups included in each model, implies 880 equations have been estimated in the period above mentioned.

The aim was to explain the value of real consumption per head, for each commodity group, as well as the general price index for private consumption and the relative price indices of the eight commodities, given, as exogenous variables, total expenditure at current prices and the absolute price indices of each commodity. We included the lagged value of real consumption per head as an explanatory variable in almost all of the models.

From now on, we shall refer to real consumption briefly as "consumption" and the value of consumption at current prices as "expenditure".

The eleven estimated models were the following:

LLSE: A Simple Loglinear model with total expenditure as one of the explanatory variables. The model is simple in the sense that the only price included in each equation was one taken from the commodity group.

LLCE: A Complete Loglinear model with total expenditure as one of the explanatory variables. The model is complete in the sense that all the prices within the eight commodity groups were included in each equation.

LLSI and **LLCI**: Similar to models LLSE and LLCE but with income instead of expenditure as one of the explanatory variables. As expenditure data refers to "domestic" consumption and not to "national" consumption, we have considered a "domestic" income, calculated as the sum of national family income plus domestic expenditure by non-residents and less expenditure abroad by resident families. These models, as well as the other two loglinear models mentioned above, are based on Houthaker's approach (1965).

CE: Constant Elasticity model, directly deduced from the demand equations, and which explains the increase in the logarithm of consumption of each commodity as a function of the increase in the logarithm of total expenditure and to the increase of the logarithms of all prices. It is worth mentioning that we have not found published applications of this model, in spite of its simplicity and reliability, although we suppose that it was probably used at an earlier time.

LES: Linear Expenditure System proposed by Stone (1954) which relates expenditure in each commodity to the "subsistence" expenditure plus a proportion of the "supernumerary" income, this being defined as the difference between current income and the sum of the "subsistence" expenditure of all commodities.

Rotterdam: This is the model proposed by Barten (1969) and used by many authors, especially after the work by Deaton (1974) who tested its restrictions. We have estimated the model in two ways, with and without the restriction of symmetry, and assuming in both cases the restrictions of homogeneity and additivity. We shall refer to these models as: RS (Rotterdam with symmetry) and RNS (Rotterdam with no symmetry hypothesis).

DM: This is the model proposed by Deaton and Muellbauer (1980), also known as AIDS (almost ideal demand system), which has in common with the Rotterdam model the fact that it includes the budget shares on the left hand side of each equation. This model is more manageable than the Rotterdam model for the purposes of convergence with respect to estimation and forecasting. As in the case of the Rotterdam model, we have taken into account the restrictions of homogeneity and additivity and we have estimated the model with and without symmetry. We will refer to the Deaton-Muellbauer model with symmetry as DMS and to the same model without symmetry as DMNS.

SKIM: Our own model. It is a "Substitution, Keeping and Increasing Model" based on the view that these are the three main features of consumer behaviour with regards to expenditure in each commodity group. The principle of "substitution" implies that consumers try partially

to substitute their real consumption of a commodity when its price index increases more than the general price index. The principle of "keeping" implies that when there are no changes in income and relative prices, consumers try to "keep" their previous level of real consumption for each commodity. The "increasing" principle implies that when real income grows consumers usually increase their real consumption of all goods and services.

Before presenting the forecasting results of the different models in section 3, we have devoted section 2 to presenting an overview of the evolution of private consumption, according to groups of commodities, in EEC countries during the periods 1960-85 and 1988-1999.

2.- PRIVATE CONSUMPTION IN EEC COUNTRIES 1960-1999.

First of all we present an analysis of the period 1960-85 in the ten European countries that are the main object of the econometric study of this paper, and secondly we present an analysis of the evolution of private consumption in European Union countries during the period 1960-99, in comparison with the USA and Japan.

Private Consumption in 1960-85

Real private consumption increased for all 12 EEC countries, even after the oil crisis, although the increase became less pronounced during the period 1980-85 than in the two previous decades.

Germany, France and Italy, were the countries which experienced the greatest absolute increase in real private consumption in the period 1960-85. They were followed by the UK, Spain, the Netherlands and then the other countries (Fig. 1).

With respect to each country's share of real private consumption, considered as a fraction of the consumption for all countries, certain aspects from Fig. 2 stand out: the constant stability of the German share; a positive trend in the French share; a markedly negative trend in the British share

which became positive in the period 80-85; Italy experienced a reduction in the rate of the growth of its share after 1970, whilst the trend with respect to Spain`s share changed from positive to negative after 75; The Netherlands and the "other" countries have maintained a rather stable share.

In Fig. 3 we can observe that there was a great similarity in the real consumption per head for Belgium, Germany, France and the United Kingdom in 1965. The very gentle increase in the real consumption for U.K. in comparison with Belgium, Germany and France is also very noticeable. What is also remarkable is the increase experienced by Spain in the period 1965-1975 and the stagnation afterwards.

From Fig. 4 to Fig. 12 we can see the evolution of private consumption per head in the period 1965-1985 for six EEC countries: three of the richest in terms of consumption per head (Belgium, Germany and France), one which is more or less average (United Kingdom) and two of the poorest or least rich (Spain and Greece).

For the commodity group "Food, beverages and tobacco", Fig.4, we can see that the differences are not very great in the sense that even the poorest countries are near to the average, but the richest countries have a much higher level.

For the commodity group "Clothing and footwear", Fig. 5, Germany's position is better than that of the other countries. The increase experienced by the United Kingdom in the period 1980-85 is also remarkable and is clearly related to the reduction of the relative price within this commodity group: in the United Kingdom, the absolute price in this five-year period increased by only 20% while the general price index of private consumption increased by 40%.

Fig. 6 shows the private consumption per head of "Gross rent, fuel and power" and reveals a strong similarity to Fig. 3, that is, with the evolution of total private consumption per head.

The level of consumption with regard to "Furniture and household equipment", shown by Belgium, Fig. 7, is significantly higher than that of Germany and France. Belgium's consumption level with respect to this group was already the highest of all the countries studied in 1965 but still

increased substantially in the period 1970-80. An explanation for this increase can be found both in the growth of real income per head and in the reduction of the relative price within this commodity group.

Fig. 8 shows private consumption per head with respect to "Medical care and health expenses". Obviously, the differences are due to the different systems and levels of public medical services. The consumption of these services is higher in countries with less highly developed public services, as is the case with Belgium and France.

Fig. 9 shows private consumption per head for the commodity group "Transport and communication" which includes personal transport equipment. The two most noteworthy features are France`s high consumption level and the sharp increase in consumption in the United Kingdom after 1970.

With respect to private consumption per head in "Education, culture and entertainment", Fig. 10, we can draw parallels with Fig. 8: the lower the level in expenditure in public services the higher private consumption in education. That is to say there is an inverse relationship between private and public expenditure.

Fig. 11 and Fig. 12 show consumption per head within the group "Restaurant, personal care and other". The reason for having two graphs for this commodity group is because of the relative weight of tourist expenditure. This is because the OECD National Accounts clasification of private consumption by commodities refers to "domestic" and not to "national" consumption.

Fig. 11 shows the ratio of domestic consumption in this commodity group to the population of each country, while Fig. 12 shows, the ratio of national consumption to population.

The differences between the two graphs are not very important for countries which have a relatively balanced tourism account, such as France and the United Kingdom, but they are important for countries where the difference between purchases abroad by resident households and purchases in

the domestic market by non-resident households is higher, as is Spain`s case where the relatively high level of domestic consumption per head is due mainly to tourism, while national consumption per head is clearly lower.

Finally, Fig. 13 and Fig. 14 show an overview of the private consumption structure in the 6 EEC countries. Fig. 13 is expressed in dollars per head (1980) and Fig. 14 shows the corresponding shares of total consumption per head.

From the graphs 13 and 14 we can see that the most important commodity group with respect to weight on real consumption are "Food, beverages and tobacco", followed by "Rent, fuel and power", "Transport and communication" and "Restaurants, personal care and other". At a lower level the other three commodity groups: "Clothing and footwear", "Furnishing and household equipment" and "Education, culture and entertainment" show rather stable and similar shares.

These figures show data of Private Consumption by inhabitant at 1980 prices and exchange rates. This means that could be some degree of overvalue or undervalue in some countries. In the next subsection, for the period 1985-1999, we present the evolution of Private Consumption by inhabitant in European Union countries expressed at 1990 prices, both with exchange rates and purchasing power parities. This second option is the generally the best one for international comparisons when the sample includes countries with very different levels of development.

An important question is the relation between Private and Public Consumption in some items that are specially interesting for Public Policies, like Education and Health. Here we do not analyze Public Consumption of those goods and services, but the interested reader could find information in interesting papers on that subjects like those by Arranz and Guisan(2001) and Neira and Iglesias(2001).

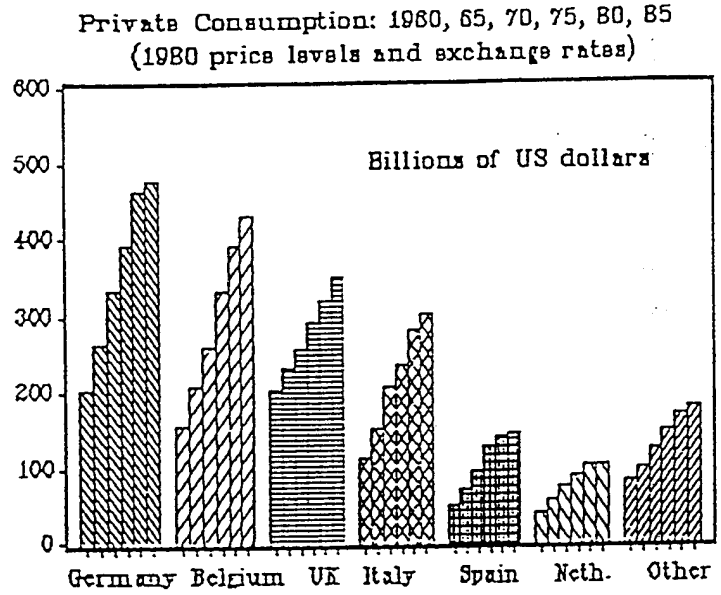
Private Consumption: 1960, 65, 70, 75, 80, 85
(1980 price levels and exchange rates)
Billions of US dollars
600
500
400
300
200
100
0
Germany
Belgium
UK
Italy
Spain
Neth.
Other

Fig. 1

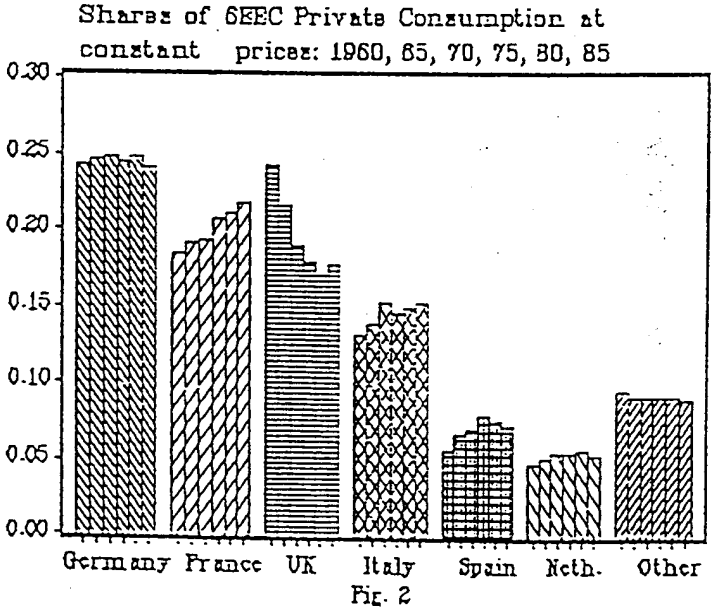
Shares of EEC Private Consumption at
constant prices: 1960, 65, 70, 75, 80, 85
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Germany
France
UK
Italy
Spain
Neth.
Other

Fig. 2

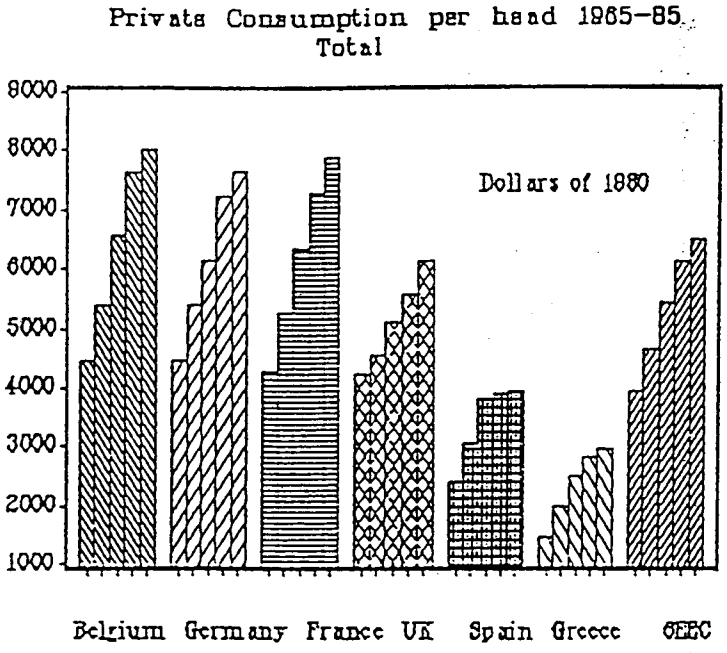
Private Consumption per head 1965-85
Total
8000
8000
7000
6000
5000
4000
3000
2000
1000
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

FIG. 3

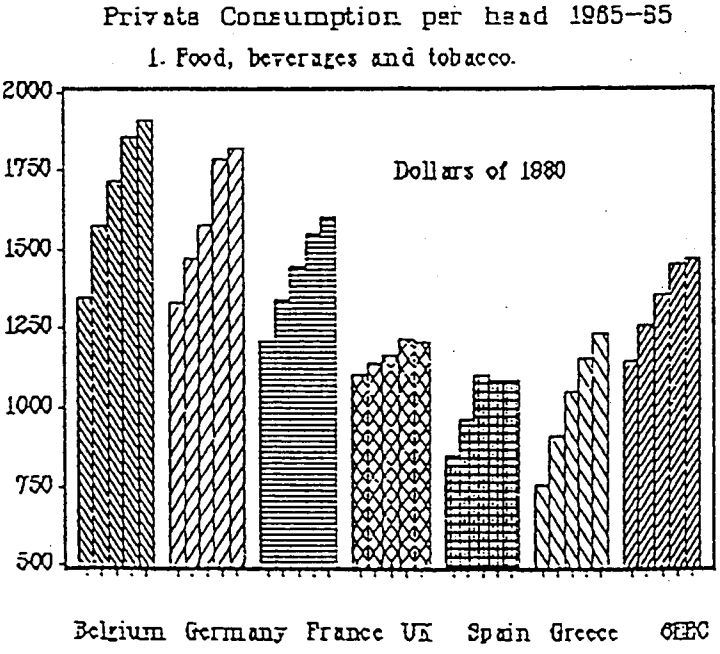
Private Consumption per head 1965-85
1. Food, beverages and tobacco.
2000
1750
1500
1250
1000
750
500
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

FIG. 4

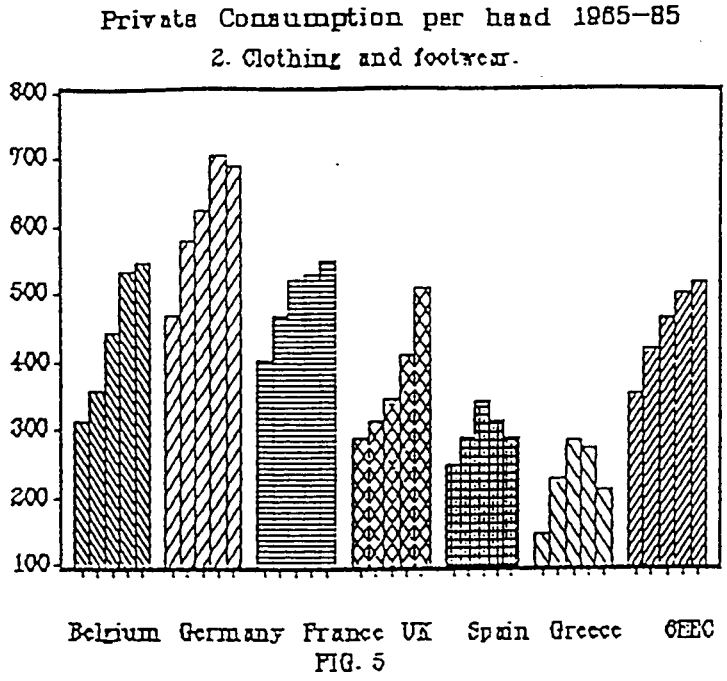
Private Consumption per head 1965–85
2. Clothing and footwear.
800
700
600
500
400
300
200
100
Belgium Germany France UK Spain Greece 6EEC

FIG. 5

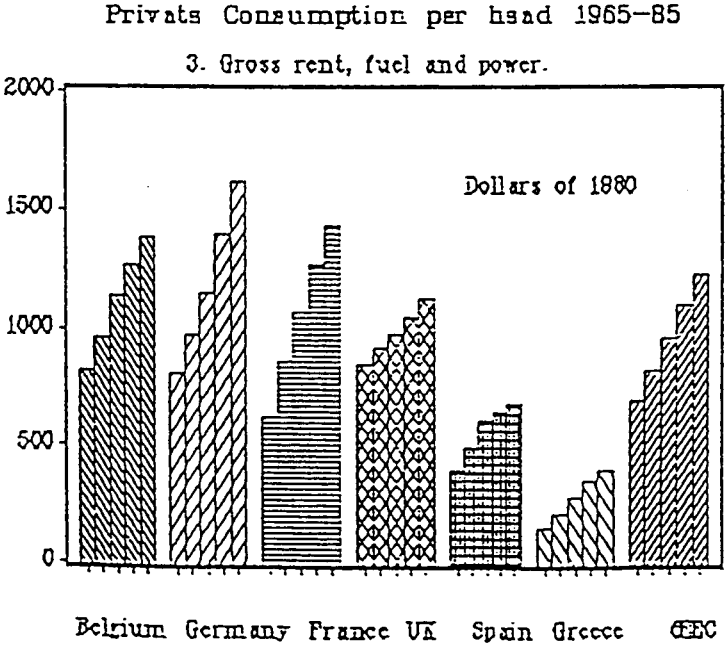
Private Consumption per head 1965–85
3. Gross rent, fuel and power.
2000
1500
1000
500
0
Dollars of 1980
Belgium Germany France UK Spain Greece 6EEC

FIG. 6

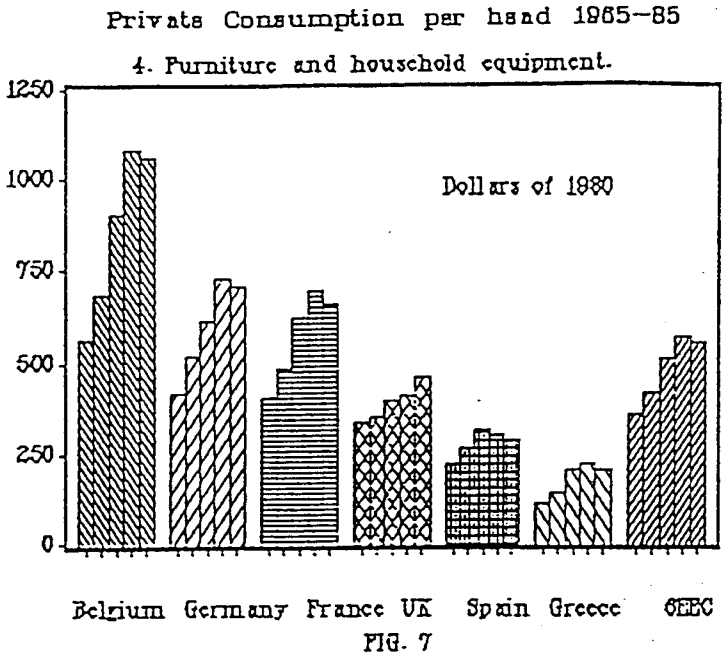
Privats Consumption per head 1965–85
4. Furniture and household equipment.
1250
1000
750
500
250
0
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

FIG. 7

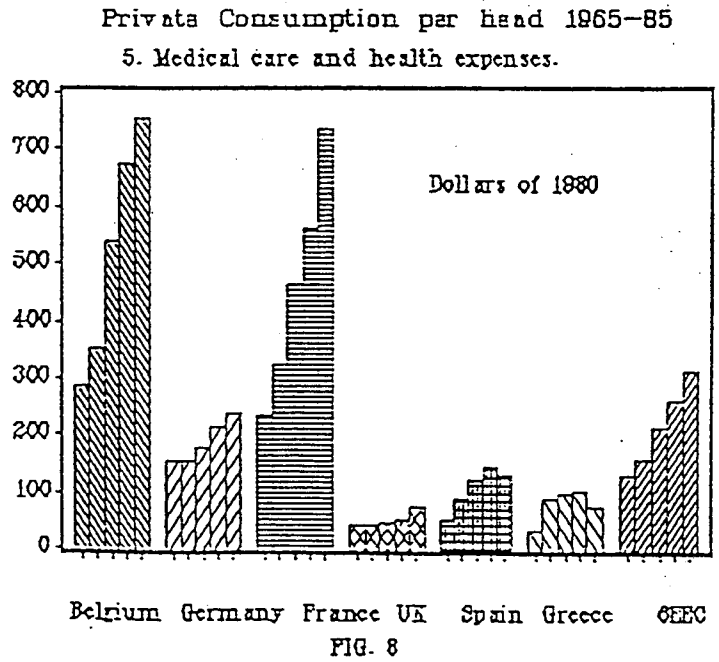
Privats Consumption per head 1965–85
5. Medical care and health expenses.
800
700
600
500
400
300
200
100
0
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

FIG. 8

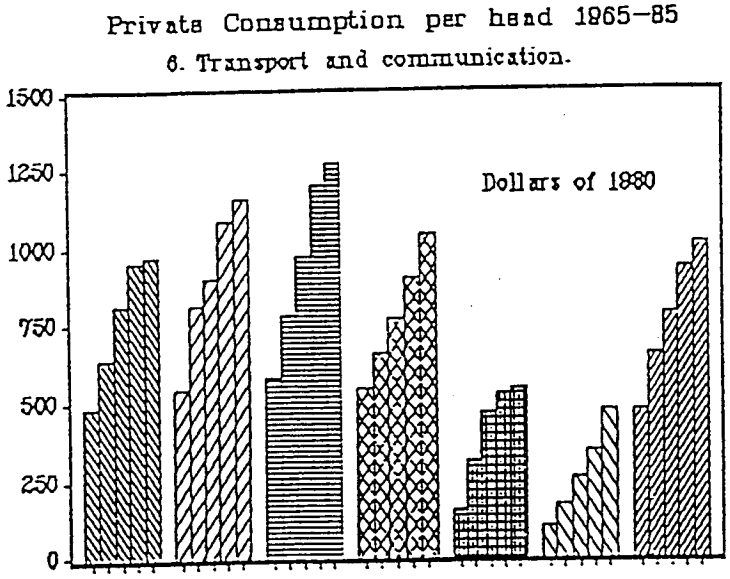
Privats Consumption per head 1965–85
6. Transport and communication.
1500
1250
1000
750
500
250
0
Dollars of 1980
Belgium Germany France UK Spain Greece 6EEC

FIG. 8

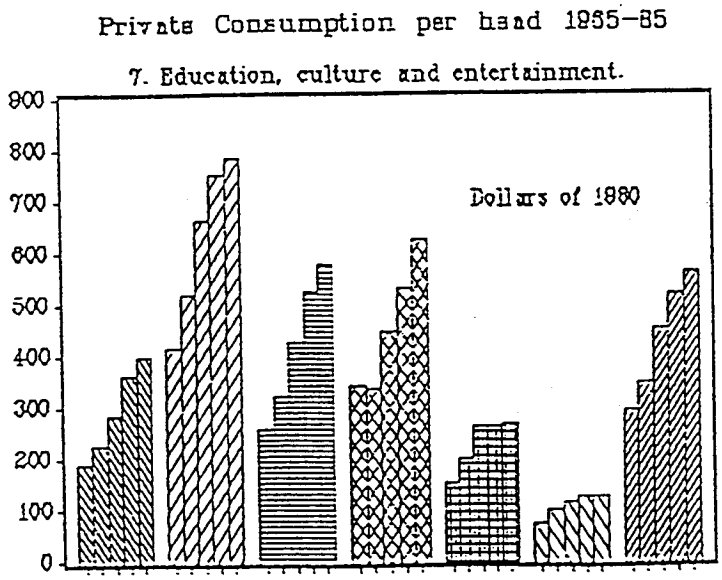
Privats Consumption per head 1965–85
7. Education, culture and entertainment.
900
800
700
600
500
400
300
200
100
0
Dollars of 1980
Belgium Germany France UK Spain Greece 6EEC

FIG. 10

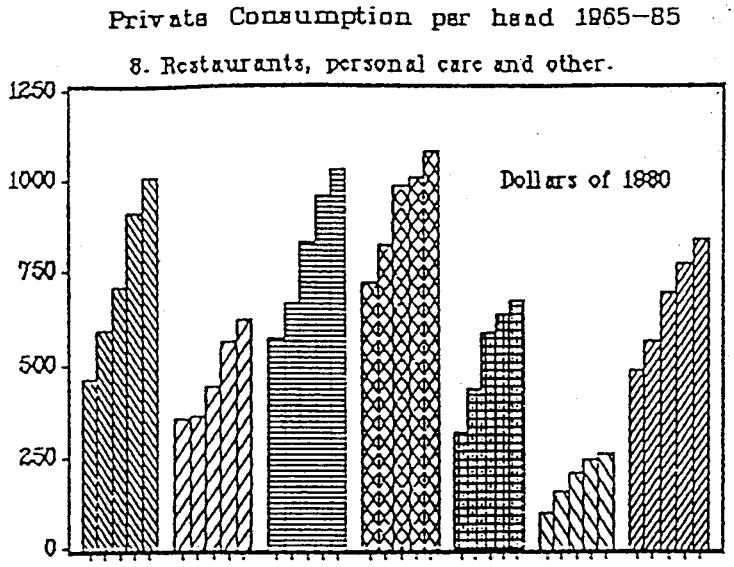
Privats Consumption per head 1965–85
8. Restaurants, personal care and other.
1250
1000
750
500
250
0
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

FIG. 11

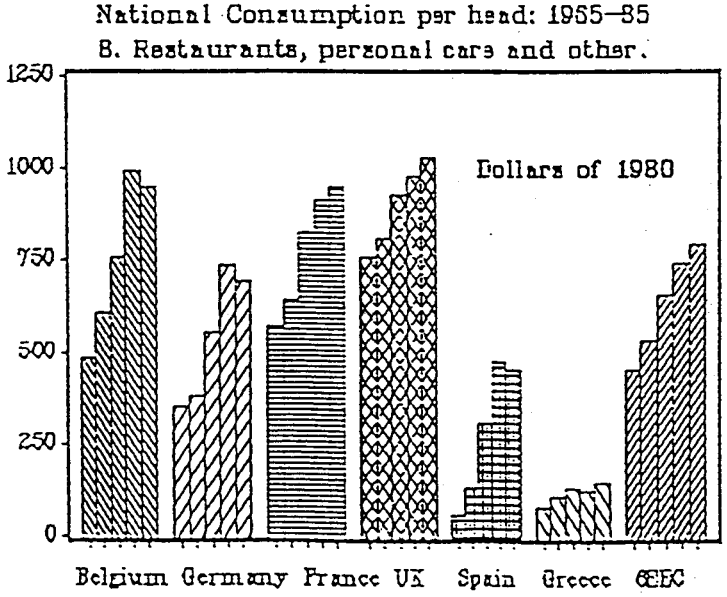
National Consumption per head: 1965–85
8. Restaurants, personal care and other.
1250
1000
750
500
250
0
Dollars of 1980
Belgium Germany France UK Spain Greece EEC

Fig. 12

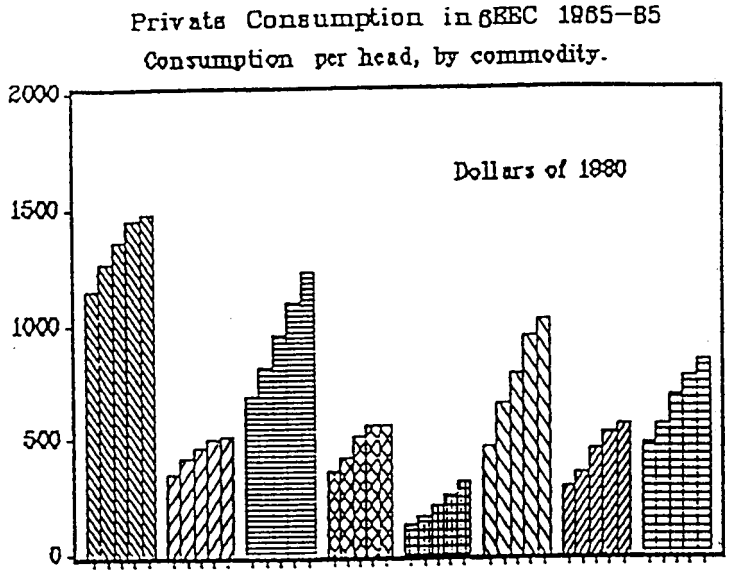
Privats Consumption in 6EEC 1965–85
Consumption per head, by commodity.
2000
1500
1000
500
0
Dollars of 1980
Food Clothing Rent Furn. Med. Trans. Educ. Rest.

FIG. 13

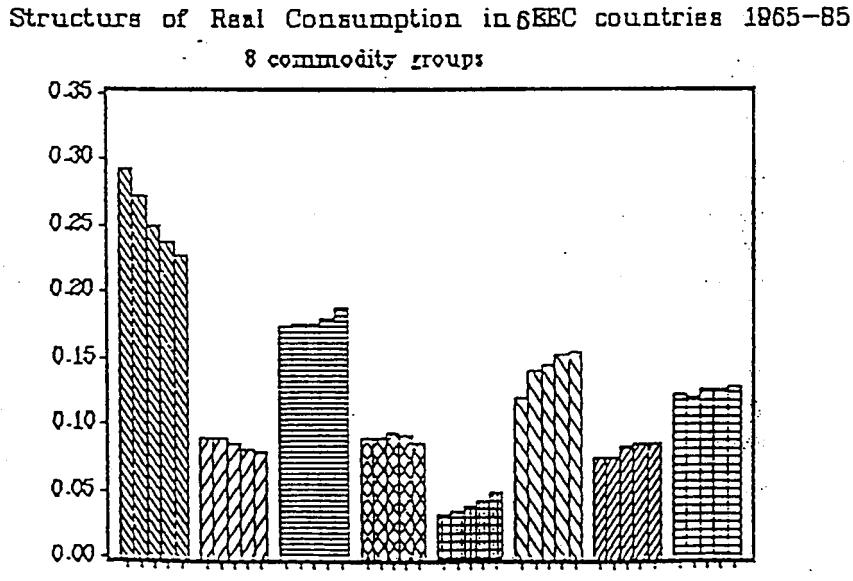
Structure of Real Consumption in 6EEC countries 1965–85
8 commodity groups
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Food Clothing Rent. Furn. Med. Trans. Educ. Rest.

FIG. 14

Private Consumption in 1960-2000

Table 1 shows the evolution of Private Consumption in EU countries, the USA and Japan during the period 1960-97, with figures expressed in constant dollars at 1990 prices and purchasing power parities, PPPs, while fig.15 and 16, present a graphical comparison.

Table1. Private Consumption by inhabitant
(thousands of dollars at 1990 prices and PPPs)

Country	1960	1970	1980	1990	1997
Austria	3.679	5.206	7.513	9.361	10.319
Belgium	4.534	6.204	9.016	10.588	11.446
Denmark	4.749	6.738	7.405	8.390	10.162
Finland	3.047	4.857	6.293	8.479	8.345
France	4.400	6.679	8.673	10.341	10.838
Germany	3.422	5.273	7.267	8.889	9.831
Greece	2.146	3.899	5.490	6.720	7.452
Ireland	3.226	4.336	5.635	6.614	8.652
Italy	3.032	5.271	7.610	9.967	10.471
Luxemburg	5.468	7.773	10.822	14.146	15.059
Netherlands	4.098	6.599	8.487	9.345	10.541
Portugal	2.031	3.466	4.676	6.042	7.240
Spain	2.478	4.524	6.018	7.324	8.021
Sweden	5.056	6.796	7.717	8.657	8.572
UK	4.938	5.877	7.250	9.971	11.029
EU15	3.705	5.547	7.371	9.189	9.956
Japan	2.542	5.406	7.597	10.348	11.605
USA	7.442	9.864	12.047	14.887	16.634

Source: OECD. National Accounts Statistics.

In this table we see that EU15 Private Consumption represented in 1997 about a 60% of the value corresponding to the USA and 86% of the value of Japan. As it happens that Public Consumption is higher in EU that in the other cases, the differences in total consumption, both public and private are lower and EU is more close to the values of Japan and the USA, as we can see in Guisan(2001), and Guisan and Arranz(2001).

Consumption by inhabitant in USA (U), European Union (UE) and Japan (J)
(thousands of dollars at 1990 prices and PPPs

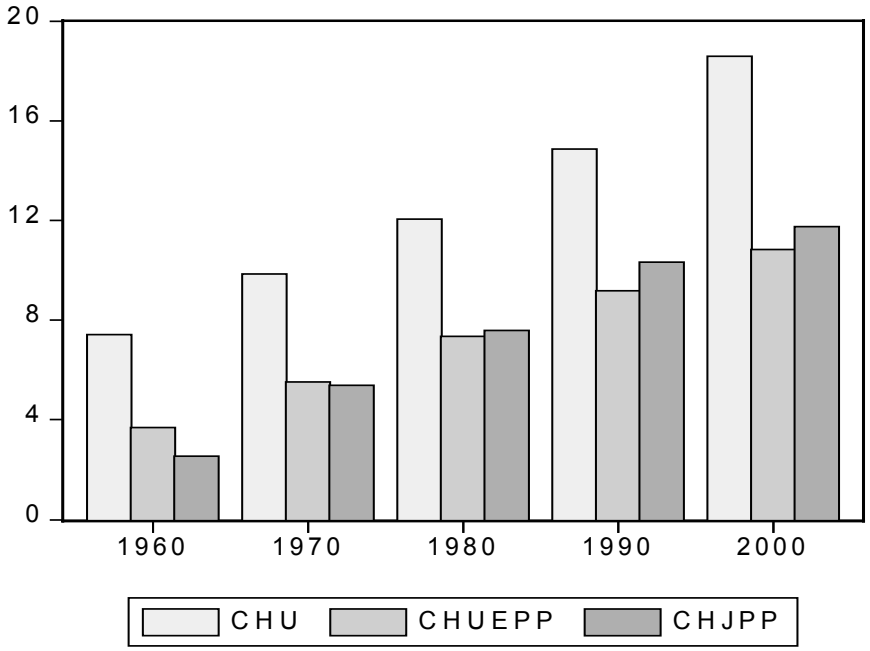

Fig. 14

Consumption by inhabitant in USA, EU15 and Japan,1960-2000
(thousands of dollars at 1990 prices and PPPs

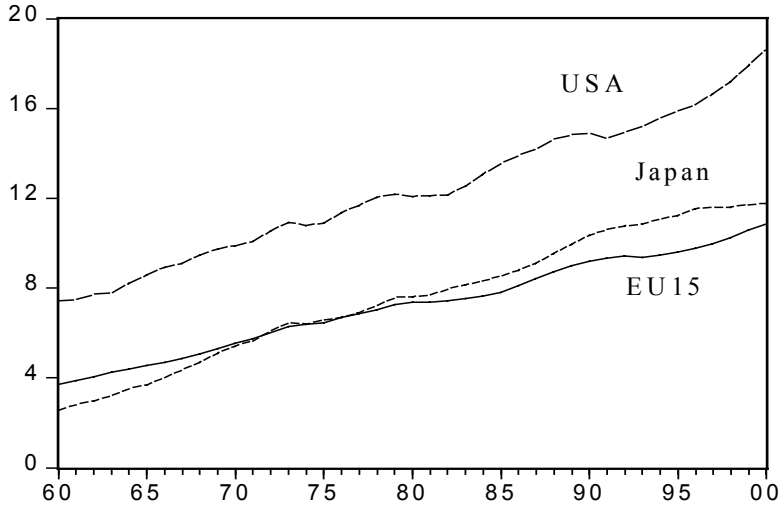

Fig. 15

3.- FORECASTING ACCURACY OF THE SKIM MODEL AND A COMPARISON WITH OTHER MODELS.

Among the eleven models mentioned in section 1 (after estimating all equations and, after performing several specification tests), four models were chosen for comparing the forecasting accuracy of each of the four approaches with that of the SKIM model.

These models were:

1) LLCE, chosen as the best of the four loglinear models considered.

2) CE, which provided the simplest approach.

3) LES.

4) DMNS, chosen as the most accurate for forecasting purposes out of the two Rotterdam and two Deaton and Muellbauer models.

The equation for each commodity group (i=1,2,...8) in the five models was the following:

LLCE:

$$LCH_{it} = \beta_{0i} + \Sigma_{j=1}^{8} \alpha_{ij} LRP_{jt} + \beta_{1i} LTCH_t + \beta_{2i} LCH_{i,t-1} \qquad (1)$$

where LCH represents the logarithm of real consumption per head, LRP the logarithm of relative price and LTCH the logarithm of total real consumption per head.

CE:

$$ILCH_{it} = \beta_{1i}\, ILEH_t + \Sigma_{j=1}^{8}\, \alpha_{ij}\, ILP_{jt} \qquad (2)$$

ILCH being the increase in the logarithm of real consumption per head, while ILEH is the increase in the logarithm of expenditure per head or the total value of consumption per head at current prices, and ILP is the increase in the logarithm of absolute price.

LES:

$$EH_{it} = EH0_{it} + \beta_i\, (TEH_t - TEH0_t) \qquad (3)$$

where EH represents expenditure per head, while EH is the "subsistence" expenditure per head, TEH is total expenditure per head and TEH is total "subsistence" expenditure per head.

DMNS:

$$W_{it} = \alpha_i + \Sigma_{j=1}^{8}\, \delta_{ij}\, LP_{jt} + \beta_i\, LTCH_t \qquad (4)$$

where W represents expenditure in commodity group i as a share of total expenditure, while LP represents the logarithm of absolute price and LTCH the logarithm of total real consumption per head.

SKIM:

$$LEH_{it} = \beta_{0i} + \beta_{1i} LEH^*_{it} + \beta_{2i} LRRP_{it} + \beta_{3i}(LTEH_t - LTEH^*_t) \quad (5)$$

where LEH is the logarithm of expenditure per head, and LEH* the logarithm of expenditure per head necessary to maintain the real consumption of the previous year at the new prices of the current year. LRRP is the logarithm of the ratio of the current year's relative prices and the previous year's relative prices. Finally, LTEH represents the logarithm of total expenditure per head and LTEH* the logarithm of total "necessary" expenditure per head.

As stated above, absolute prices for each commodity group have been considered as exogeneous variables. In all models the general price index of private consumption is the sum of the prices weighted by the shares of real private consumption and therefore an endogeneous variable explained by the model.

The five models were estimated using data from ten EEC countries. The end of the sample period for all the countries was the year 1984, whilst the starting point was 1962 when possible. The forecasting comparison was carried out for the period 1985-86. Ireland was excluded because of missing data in the last issue of OECD National Accounts.

There are 9 forecasts to be considered for each country (the eight commodity groups of real consumption per head and the general price index of private consumption). As the comparison between forecasts is carried out using data from 9 countries, we can evaluate 81 SSR's (sum of squares of residuals) for the forecasting period in question, as well as 9 TSSR's (total sum of squares of residuals), that is, the sum of the 9 SSR for each country.

Table 2 reveals the number of times each model achieved the best forecasting accuracy for each variable, in keeping with the minimum SSR for the forecasting period.

TABLE 2

Number of times that each model performs better

Minimum SSR	LLCE	CE	LES	DMN	SKIM
Food, beverages and tobacco	0	2	4	0	3
Cloting and footwear	1	3	1	0	4
Gross rent, fuel and power	2	1	0	1	5
Furniture and household equipment	1	4	0	1	3
Medical care and health expenses	3	2	1	0	3
Transport and communication	1	4	0	1	3
Education, culture and entert	0	3	3	2	1
Restaurant, personal care and other	0	1	3	3	2
General consumption price index	1	2	1	0	5
All variables	0	3	0	0	6
TOTAL	9	25	13	8	35

The following tables, numbers 3 to 10, show the estimation results of the different models in 10 European countries, showing the high goodness of fit that generally present Private Consumption models.

Table 3. Commodity: Food, beverage and tobacco

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	0.0106260	0.9970017	-0.0649691	0.5563658	0.999331
	(0.02663)	(0.00674)	(0.18121)	(0.17171)	
Denmark	-0.0071554	1.0036477	-0.3389906	0.4392935	0.999470
	(0.01353)	(0.00633)	(0.19566)	(0.14624)	
France	-0.0022202	1.0009200	-0.3708283	0.4914246	0.999937
	(0.00636)	(0.00266)	(0.09697)	(0.10410)	
Germany	0.0015499	0.9975528	-0.5199665	0.5113254	0.999642
	(0.00603)	(0.00493)	(0.15817)	(0.09455)	
Greece	0.0267893	0.9954324	0.1228903	0.3569518	0.999853
	(0.01903)	(0.00477)	(0.15548)	(0.14522)	
Italy	0.0009020	1.0014243	-0.0750435	0.5490029	0.999899
	(0.00420)	(0.00336)	(0.15878)	(0.11811)	
Netherlands	0.0177757	0.9864671	0.0749771	0.3629764	0.998604
	(0.01644)	(0.01578)	(0.08504)	(0.18593)	
Spain	0.159372	1.0101244	-0.3051666	1.0993037	0.999721
	(0.02297)	(0.00863)	(0.15190)	(0.25305)	
UK	-0.0104536	0.9988832	-0.2163155	0.6206974	0.999761
	(0.00596)	(0.00372)	(0.20247)	(0.12063)	

Table 4. Commodity: Clothing and footwear

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	-0.0575578	1.0083657	-1.3889742	1.7899607	0.997587
	(0.03594)	(0.01290)	(0.39939)	(0.39086)	
Denmark	-0.0497431	1.0367766	-0.9091661	1.5980974	0.997008
	(0.01317)	(0.01580)	(0.31176)	(0.24437)	
France	-0.0324400	1.0084916	-1.0010862	1.3062246	0.999562
	(0.00958)	(0.00684)	(0.21345)	(0.24639)	
Germany	-0.0204577	0.9925213	-0.1862693	1.4370056	0.998721
	(0.00659)	(0.00995)	(0.45959)	(0.21831)	
Greece	-0.0687033	0.9985696	-0.0286268	2.5633968	0.997218
	(0.05426)	(0.02153)	(0.39113)	(0.59266)	
Italy	-0.0478968	0.9901755	-0.4644390	2.0164104	0.999283
	(0.01291)	(0.00882)	(0.39421)	(0.32836)	
Netherlands	-0.0344638	0.9698197	-0.2983480	1.1302785	0.987558
	(0.01069)	(0.04245)	(0.31525)	(0.50040)	
Spain	-0.0041248	1.0045593	-0.3799970	1.4370754	0.999530
	(0.04453)	(0.01125)	(0.24805)	(0.36921)	
UK	0.0404337	1.0141753	-0.0322215	1.1876521	0.999468
	(0.01919)	(0.00614)	(0.18528)	(0.20997)	

Table 5. Commodity: Gross rent, fuel and power

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	0.0040963	1.0016947	-0.0640502	0.4993203	0.999125
	(0.02805)	(0.00851)	(0.21675)	(0.25852)	
Denmark	0.0787659	0.9693711	-0.1870560	0.3327531	0.999664
	(0.01143)	(0.00510)	(0.15641)	(0.14129)	
France	0.0277266	0.9922566	0.2121799	0.5818069	0.999730
	(0.01364)	(0.00546)	(0.22819)	(0.28116)	
Germany	0.0257266	1.0023240	0.0111143	0.2398674	0.999292
	(0.01006)	(0.00777)	(0.26810)	(0.21940)	
Greece	0.0417476	0.9961731	-0.0858187	0.3615214	0.999801
	(0.01569)	(0.00540)	(0.11670)	(0.16061)	
Italy	0.0121039	0.9969405	-0.0011327	0.2834216	0.999907
	(0.00487)	(0.00361)	(0.08853)	(0.13248)	
Netherlands	0.0026421	1.0117475	0.0012466	0.7026137	0.998864
	(0.01237)	(0.01503)	(0.03351)	(0.35444)	
Spain	0.0050104	0.9979660	0.0201233	0.5393673	0.999866
	(0.01998)	(0.00601)	(0.11194)	(0.18897)	
UK	0.0039763	0.9973635	-0.0226195	0.3524699	0.999804
	(0.00696)	(0.00333)	(0.14483)	(0.14311)	

Table 6. Commodity: Furniture, household equipment and operation

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	0.0190235	0.9857799	-0.5797075	1.7039719	0.998103
	(0.03750)	(0.01222)	(0.43266)	(0.36519)	
Denmark	-0.0429189	1.0090557	-0.9292326	1.6006481	0.996315
	(0.01591)	(0.01662)	(0.38068)	(0.25942)	
France	-0.0040290	0.9874669	-0.1114604	1.1103330	0.999128
	(0.01604)	(0.00928)	(0.52546)	(0.43890)	
Germany	-0.0174792	1.0021074	-0.7920182	1.4638445	0.998435
	(0.00696)	(0.00926)	(0.49919)	(0.19785)	
Greece	0.0312522	0.9843799	-0.3548679	0.6593745	0.998435
	(0.03755)	(0.01599)	(0.40527)	(0.47737)	
Italy	-0.0349358	0.9866961	-0.2211585	1.9571967	0.999406
	(0.01366)	(0.00834)	(0.24050)	(0.42603)	
Netherlands	0.0367624	1.0139044	0.4271212	2.4081682	0.981899
	(0.01663)	(0.05050)	(0.47311)	(0.65796)	
Spain	-0.0109986	1.0006627	-0.4330817	1.2630264	0.999477
	(0.04717)	(0.01169)	(0.21164)	(0.39642)	
UK	-0.0243023	1.0008092	-0.7197233	1.9831921	0.999668
	(0.01268)	(0.00452)	(0.22957)	(0.15734)	

Table 7. Commodity: Medical care and health expenses

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	0.0058553	1.0063183	0.0957978	0.9203888	0.998637
	(0.03095)	(0.01034)	(0.26002)	(0.40995)	
Denmark	-0.0020366	0.9788083	-1.0682014	-0.1168790	0.994097
	(0.01850)	(0.02132)	(0.31617)	(0.38589)	
France	0.0419640	1.0017473	0.5242825	0.6357694	0.999497
	(0.01300)	(0.00816)	(0.42147)	(0.37453)	
Germany	0.0425304	1.0228516	-0.6764808	0.8072465	0.998587
	(0.01460)	(0.01041)	(0.27619)	(0.28232)	
Greece	-0.0254291	0.9947908	-1.2794874	1.9521703	0.998247
	(0.03612)	(0.02230)	(0.38431)	(0.63005)	
Italy	0.0125990	0.9898041	-0.4284561	0.5392718	0.998349
	(0.02901)	(0.01362)	(0.29971)	(0.55888)	
Netherlands	0.0211831	0.9904301	0.0761862	0.0932332	0.999432
	(0.00707)	(0.01086)	(0.13021)	(0.22890)	
Spain	-0.2739567	0.9399710	-0.4635303	-0.1920359	0.999186
	(0.06297)	(0.01312)	(0.22722)	(0.58753)	
UK	0.0937692	1.0203041	0.4225023	1.2344773	0.997357
	(0.06957)	(0.01489)	(0.56581)	(0.47833)	

Table 8. Commodity: Transport and communication

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	0.0764035	0.9808646	-0.4525032	0.5051196	0.999157
	(0.02646)	(0.00854)	(0.30113)	(0.27815)	
Denmark	-0.0410903	1.0197854	-0.5101747	2.4022272	0.997650
	(0.02089)	(0.01340)	(0.43381)	(0.30897)	
France	-0.0285722	1.00684481	-0.5816470	2.2054659	0.999690
	(0.01369)	(0.00549)	(0.25889)	(0.31865)	
Germany	-0.0197358	0.9947140	-1.3406199	2.3311945	0.997793
	(0.01331)	(0.01191)	(0.60513)	(0.40019)	
Greece	-0.0052245	1.0124539	-0.0507693	1.5839006	0.999240
	(0.03177)	(0.01125)	(0.08683)	(0.42628)	
Italy	-0.0056838	1.0007921	0.0155643	1.6486723	0.998922
	(0.01773)	(0.01054)	(0.34157)	(0.47758)	
Netherlands	-0.0002804	0.9846568	-0.7592505	1.7584124	0.995254
	(0.01414)	(0.02610)	(0.41870)	(0.56302)	
Spain	-0.0325565	0.9883255	-0.4052958	1.7723934	0.998984
	(0.05912)	(0.01645)	(0.27768)	(0.64113)	
UK	-0.0123043	0.9901795	-0.2376323	1.6952629	0.999130
	(0.01611)	(0.00711)	(0.35472)	(0.32243)	

Table 9. Commodity: Recreational, education and cultural services

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	-0.0220585	1.0122969	-0.8950293	1.3473125	0.999210
	(0.01795)	(0.00746)	(0.26722)	(0.27292)	
Denmark	0.0243001	0.9870382	-0.9185202	0.3123721	0.999111
	(0.00895)	(0.00881)	(0.27896)	(0.18765)	
France	0.0005306	0.9973898	-0.5759107	1.1758988	0.999843
	(0.00780)	(0.00394)	(0.12726)	(0.21117)	
Germany	0.0036187	0.9899602	-0.0427088	0.9624524	0.999024
	(0.00779)	(0.00858)	(0.48464)	(0.21469)	
Greece	-0.0168945	0.9972715	0.1265559	1.2357375	0.998081
	(0.03723)	(0.01918)	(0.52883)	(0.63354)	
Italy	0.0100287	1.0043168	-0.9788609	0.7139228	0.999114
	(0.01719)	(0.00973)	(0.58336)	(0.52422)	
Netherlands	0.0220428	0.9848109	0.4129810	1.4180740	0.998598
	(0.00726)	(0.01453)	(0.18319)	(0.30986)	
Spain	-0.0810238	0.9795727	-0.2835522	0.5571989	0.999690
	(0.03914)	(0.00946)	(0.16618)	(0.33538)	
UK	-0.0366512	0.9849687	-1.7383860	1.1542722	0.999439
	(0.01612)	(0.00624)	(0.23038)	(0.22936)	

Table 10. Commodity: Restaurants and other goods and services

SKIM parameter estimates (standard errors in parentheses) and goodness of fit

Country	β_0	β_1	β_2	β_3	R^2
Belgium	-0.0552896	1.0094854	-0.0847423	2.4862798	0.996450
	(0.05496)	(0.01669)	(0.20640)	(0.59535)	
Denmark	-0.0065109	1.0014687	-0.1269572	1.2227241	0.997529
	(0.01566)	(0.01369)	(0.41736)	(0.28122)	
France	0.0079745	0.9992867	-1.0188036	0.9432144	0.999867
	(0.00823)	(0.00380)	(0.20726)	(0.18136)	
Germany	0.0206445	1.0133127	0.7912943	0.4503980	0.995576
	(0.01544)	(0.01790)	(0.78421)	(0.47910)	
Greece	-0.0539159	1.016973	-0.1034624	2.1353109	0.998788
	(0.03412)	(0.01325)	(0.31677)	(0.47853)	
Italy	0.0214463	1.0024122	-0.3316321	0.6428735	0.999868
	(0.00617)	(0.00399)	(0.26488)	(0.17083)	
Netherlands	0.0168431	0.9856742	-0.0943583	0.5826358	0.999044
	(0.00816)	(0.01200)	(0.10194)	(0.26278)	
Spain	0.0028864	0.9958611	-0.0575456	0.7773002	0.999762
	(0.02714)	(0.00778)	(0.18800)	(0.31953)	
UK	0.0052515	0.999072	-0.7756983	1.0031098	0.999468
	(0.01270)	(0.00594)	(0.33843)	(0.22616)	

4.- CONCLUSIONS

Although most of the models perform quite well, especially in the sample period, SKIM forecasts are generally more accurate than forecasts from other models, given that the TSSR value for the SKIM model is the lowest of all the TSSR values for 6 countries, whilst the CE model gives the lowest TSSR for 3 countries.

Not only is the SKIM model the best as far as forecasting accuracy is concerned, but it also proves to behave very well with respect to estimation.

After carrying out a total of 72 estimations (one equation for each commodity group and for each of the 9 countries) and by referring to the tables 3 to 10 we can make certain observations:

1.- All the $ß_0$ values are close to 0, and all the $ß_1$ values are close to 1 and are positive as was to be expected. In accordance with the model´s logic, this is correct. After testing the two null hypotheses: H_0: $ß_0=0$ and H_0:$\beta_1=1$, we have had to accept them in the most of the times.

2.- With regard to β_3, and with only two exceptions: Denmark and Spain in the medical care and health expenses group, all the estimated values within this parameter are positive.

3.- Price elasticities for each commodity group should be negative. The estimated values of $\beta 2$ are, in most cases, appropriate, and there are only 15 exceptions among 72 values, almost all in the groups transport and communication and medical care and health expenses.

4.- With regard to goodness of fit, all the adjusted R-squared values are greater than 0,99 with only two exceptions.

5.- BIBLIOGRAPHY

ARRANZ, M. (2002). Evolución del Consumo Privado en los países de la OCDE en el período 1970-94: Análisis de elasticidades. Working Papers Series *Economic Development* number 56, free downloadable at ideas.repec.org and at http://www.usc.es/econo met/eaa.htm.

BARTEN, A. P. (1964): "Consumer Demand Functions under Conditions of Almost Additive Preferences". Econometrica, 32, nº 1-2, pp. 1-38.

BARTEN, A. P. (1967): "Evidence on the Slutsky Conditions for Demand Operations". The Review of Econometrics and Statistics, 49, pp. 77-84.

BARTEN, A. P. (1968): "Estimating Demand Equations". Econometrica, 36, nº 2, pp. 213-251.

BARTEN, A. P. (1969): "Maximum Likelihood Estimation of a Complete System of Demand Equations". European Economic Review, 1, nº 1, pp. 7-73.

DEATON, A. S. (1974): "The Analysis of Consumer Demand in The United Kingdom, 1900-1970". Econometrica, 42, nº 2, pp. 341-367.

DEATON, A. S. y J. MUELLBAUER (1980): "An Almost Ideal Demand System". The American Economic Review, 70, nº 3, pp. 312-326.

GUISAN, M.C.(2001). Causality and Cointegration between Consumption and GDP in 25 OECD countries: limitations of the cointegration approach. *Applied Econometrics and International Development,* Vol.1-1, pp. 9-37. Free downloadable at http://www.usc.es/econo met/eaa.htm

GUISAN, M.C. and ARRANZ, M.(2001). Consumption Expenditure in Health and Education: Econometric Models and Evolution in OECD countries. Working Papers Series *Economic Development* number 50, free downloadable at http://www.usc.es/econo met/eaa.htm.

HOUTHAKER, H. S. (1960): "Additive Preferences". Econometrica, 28, nº 2, pp. 244-257.

HOUTHAKER, H. S. (1965): "New Evidence on Demand Elasticities". Econometrica, 33, nº 2, pp. 277-288.

OECD. National Accounts Statiticits, several years, Paris.

STONE, R. (1954): "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand". The Economic Journal, 64, pp. 511-527.

THEIL, H. (1965): "The Information Approach to Demand Analysis". Econometrica, 33, nº 1, pp. 67-87.

THEIL, H. (1967): "Economic and Information Theory". North Holland. Amsterdam.