

ECONOMETRIC MODELS OF PRIVATE AND PUBLIC HEALTH EXPENDITURE IN OECD COUNTRIES, 1970-96

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Abstract

We analyse the evolution of Private Consumption on Health, having into account that there are substitution effects between public and private expenditure in OECD countries. From the analysis of the evolution of these variables our main conclusion is that the increase of expenditure on Health, with economic development, is generally positive for welfare and obeys to a rational behaviour of consumers. The findings of our econometric models support a distribution between private and public expenditure, in order to guarantee general assistance of population, to get high standards of consumers welfare and to avoid abuses in demand.

JEL classification: C5, C51, H51, H52, I1, I2, O51, O52, O57

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1. Introduction

Econometric models of consumer behaviour such as systems of demand analysed in Arranz(1996) and (2002), show that there are two special groups of expenditure, Education and Culture, on one hand, and Medical care on another one, where there are big differences in the answer to increases in family income, due to the substitution effects of public consumption expenditure. So we should

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observe jointly the evolution of Private and Public Consumption, in spite of the scarcity of statistics for these groups. Really there are few statistics on Public Consumption and the discrepancies are very big even from the same institution, as we shall see on section 3.

In this article we present some estimations of Private and Public Expenditure on Health, based on a mix of OECD National Accounts Statistics and OECD Purchasing Power Parities and Real Expenditures Statistics, as both sources seems reliable but with different criteria for distinguishing between Private and Public Services and Goods.

In section 2 we present a view of the evolution of real Private Consumption Expenditure per capita on Medical Care during the period 1970-94, and in section 3 we present an analysis of Private and Public Consumption Expenditure in the years 1990 and 1996, based on a comparison between different OECD sources. In section 3 we present some econometric models, with a cross-section sample of OECD countries, which relate private expenditure on health with total private expenditure and with the level of public expenditure on the own group. Finally, in section 4 we present the main conclusions.

2. Private Consumption Expenditure on Medical Care, 1970-94

Table 1 present the real values of Private Consumption Expenditure on Medical Care and Health, based on OECD National Accounts Statistics, Arranz(1997), and Guisan and Arranz(2001). Variables in this table are expressed in per capita terms at 1990 prices and purchasing power parities, PPPs. The last column is the percentage of increase during the period 1970-94, and the figures for Germany correspond only to Western Germany.

The figures at National Accounts for Private Consumption seem generally more reliable than another statistical sources when there are contradictions between two or more sources, although some problems probably subsist even in high quality statistics, because sometimes it seems difficult to get information about direct public subsidies to families.

Those aids and subsidies for some specific expenditures, such as pharmaceuticals, are really public expenditures, because the source of financing, but sometimes appear as private ones because the way of buying. It should be desirable, for international comparisons, a higher degree of information on these subjects.

Table 1. Private Expenditure on Medical Care
(dollars per inhabitant at 1990 prices and PPPs)

Country	1970	1975	1980.	1985	1990	1994	%Δ
Belgium	454	699	865	978	1119	1183	161
France	321	461	554	728	981	1114	247
Germany	173	200	247	291	333	376	117
Ireland	118	131	139	213	245	264	124
Italy	244	359	412	481	671	715	193
Netherlands	762	895	1013	1065	1179	1279	68
Spain	130	186	221	203	300	397	205
Denmark	127	133	149	158	190	200	57
Greece	151	168	174	182	185	222	47
UK	62	64	76	104	139	150	142
Japan	434	666	808	897	971	1089	151
Mexico	219	193	176	168	144	137	-37
USA	1270	1593	1882	2096	2392	2509	98

In table 1 we can see that there are important differences among countries with similar levels of economic development, what very often is due to different levels of public expenditure. So the important difference between UK and Japan, for example does not mean that British citizens have poor health services but only that Private Consumption in UK has a lower value because people receive a higher level of Public Expenditure on Health.

The highest position for Private Expenditure on Medical care in 1994 corresponds to the USA with 2509 dollars of 1990, followed by Netherlands, Belgium, France, and Japan, with more than 1000 dollars each of them. Many countries have experienced percentage increases higher than 50% in real Private Consumption per head during the period 1970-95. The differences in private consumption

among countries, total and in health expenditure, are due on one hand to the differences in the levels of development and, on another hand, to the differences in public policies of expenditure on public consumption. The level of development is more related with total individual consumption than only with private consumption, as it is shown in Guisan(2001).

Table 2. Total Private Consumption
(dollars per inhabitant at 1990 prices and PPPs)

Country	1970	1975	1980.	1985	1990	1994	%Δ
Belgium	6077	7436	8633	8912	10129	10560	74
France	6164	7456	8520	9185	10411	10592	72
Germany	6011	6859	8085	8422	9785	9991	66
Ireland	4580	4811	5619	5575	6700	7289	59
Italy	5981	6652	7786	8423	10052	10266	72
Netherlands	6521	7379	8378	8326	9254	9823	51
Spain	4854	6066	6246	6359	7696	8009	65
Denmark	6864	7248	7576	8425	8484	9410	37
Greece	3329	4186	4708	5006	5444	5637	69
UK	5946	6570	7215	7998	9761	9903	67
Japan	5313	6554	7515	8379	10089	10735	102
Mexico	3001	3335	3803	3631	3676	3790	26
USA	9856	10811	11949	13277	14641	15100	53

Source: OECD National Accounts Statistics.

3. Public and Private Expenditure on Medical Care in 1990-96

The figures in table 3 were elaborated, based on OECD statistics: 1) We have taken Individual Consumption in Medical Care from the OECD Purchasing Power Parities and Real Expenditure Statistics, 2) We have elaborated an estimation of real Private Consumption per inhabitant in Medical Care from OECD National Accounts Statistics, and 3) We have estimated Public Consumption Expenditure on Health as the difference between both values.

Table 3. Expenditure on Medical Care in 1996
(dollars per inhabitant at 1990 and 1996 prices and PPPs)

Country	At 1990 prices and PPPs			At 1996 prices and PPPs		
	Total	Private	Public	Total	Private	Public
1. Austria	1613	341	1271	1895	418	1477
2. Belgium	1738	371	1367	2043	467	1576
3. Finland	1313	270	1043	1543	346	1197
4. France	2276	376	1900	2674	434	2240
5. Germany	1895	378	1518	2227	474	1753
6. Ireland	1371	238	1133	1611	279	1332
7. Italy	1514	324	1190	1779	400	1379
8. Luxembourg ¹	1479	1450	29	1738	1734	34
9. Netherlands	1748	360	1388	2055	439	1616
10. Portugal	784	507	277	921	648	273
11. Spain	862	272	590	1013	327	686
12. Denmark	1321	231	1089	1552	288	1264
13. Greece	946	414	532	1112	564	548
14. Sweden	1251	178	1073	1470	219	1251
15. UK	1385	132	1252	1627	155	1472
16. Iceland	2734	242	2493	3213	323	2890
17. Norway	1425	257	1168	1674	314	1360
18. Switzerland ¹	1901	1825	77	2234	2144	90
19. Turkey ¹	152	106	46	179	125	54
20. Australia	1751	361	1391	2058	446	1612
21. N. Zealand	1269	671	598	1491	819	672
22. Japan	3189	310	2878	3747	386	3361
23. Canada	2111	367	1744	2480	451	2029
24. USA	2896	2807	89	3402	3298	104

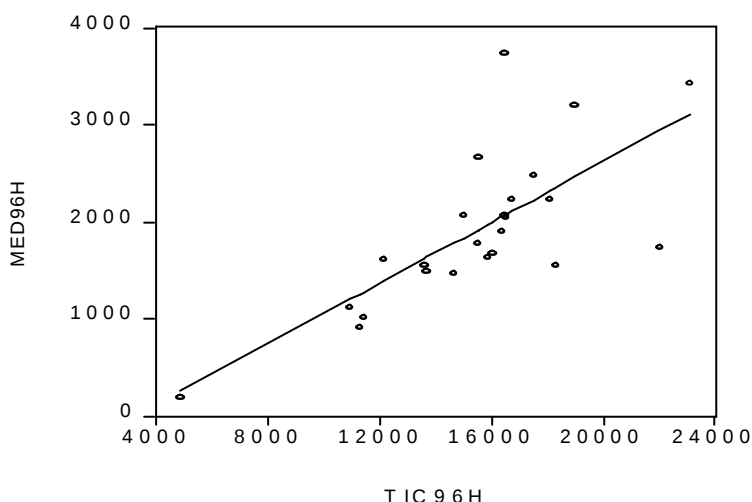
Notes: Own elaboration from OECD National Accounts, for Private Consumption, and from OECD Purchasing Power Parities and Real Expenditure, for Total Individual Consumption on Medical Care. ¹The figures for Luxembourg, Switzerland and Turkey do not follow the general procedure and are only based on the second source.

In the case of the USA we do not have taken the Total Individual Expenditure on Medical Care from the OECD PPPs

Statistics, but we have taken from that source only an estimation of Public Expenditure, and it was the sum of this quantity with the data of Private Expenditure on Medical Care from National Accounts our estimation of Total Individual Consumption Expenditure. The figures for Switzerland, Luxembourg and Turkey are only based on the second source.

Graph 1 shows the high positive correlation between Health Expenditure and Total Individual Consumption, TIC.

Graph 1. Medical Care and Total Individual Consumption in 1996 (dollars per inhabitant at 1996 prices and PPPs)



Regarding total consumption expenditure, both public and private, per inhabitant, the most outstanding countries are those with a value over 2500 dollars: France with 2674, Iceland with 3213, Japan with 3747 and the USA with 3402. A middle level of expenditure per inhabitant on Medical Care correspond to countries with values between 1500 and 2500 dollars. The lowest levels correspond to countries below 1500 dollars per inhabitant on individual Medical Care: Portugal with 921, Spain with 1013, Greece with 1112 and Turkey with 179, although this last figure could be undervalued.

4. Econometric Models of Health Expenditure

The well known articles by Newhouse(1977) and (1992) have been very influential for the estimation of a Health Expenditure function, and the most common regressions for that purpose include income per head, the ageing of population and the share of public expenditure on Gdp, as explanatory variables.

Hitiris(1999) present an estimation with a panel of observations of 7 OECD countries during the period 1960-90, with the purpose of analysing the factors that explain the fast rising of Health Expenditure in many countries, with a preoccupation about the cost containment.

However we think that the increase in the share of Medical Care on total individual Consumption is not a wrong feature of some countries but a natural and reasonable demand of advanced societies. In fact people generally make a positive assessment of policies focused on the improvement of Medical Care, and they are right, as socio-economic welfare depends very much on the good level of this important services and goods.

On the other hand Giannoni and Hitiris(1999) show that in the case of Italy the central government policies for containment of the growth of health care expenditure in combination with the decentralization in the administration and provision of health care have resulted in interregional inequality, aggravating the existing regional disparities.

Here we present some econometric models for Private Consumption Expenditure on Medical Care, with a sample of 24 OECD countries in 1996, having into account the level of family income, by means of the variable of total Consumption Expenditure, and the substitution relation of public expenditure and private one.

Another variables like ageing and relative prices of goods and services, could also have a role in explaining the differences among countries, but we deem that the two explanatory variables that

we include, together with the lagged value of the explained variable, are the most important for the purpose of explaining the main differences among countries, and in this paper we do not include ageing as explanatory variable.

We use the following symbols for the variables:

- 1) $D(X)$ = Difference of a variable, X , in 1996 and 1990
- 2) F = Family Expenditure = Private Expenditure
- 3) G = Government Expenditure = Public Expenditure
- 4) I = Individual = Private + Public = $F + G$
- 5) MED = Medical Care
- 6) TCF = Total Private Consumption Expenditure (familiar)
- 7) TIC = Total Individual Consumption (Private + Public)

We have included dummies $D17$ and $D22$ to have into account some special features of the data of Norway and Japan. In the case of Japan it seems that the values in PPPs could overestimate the expenditure on Medical Care.

The current sample correspond to the year 1996 and the lagged values to 1990. All the variables are expressed in dollars per inhabitant, indicated by H at the end of each variable name in PPPs. In the case of the sample of 24 OECD countries for Total Expenditure figures are expressed at current prices and PPPs, while in the case of the sample of 12 OECD countries for Private Expenditure figures are expressed at 1990 prices and PPPs.

Equations 1 to 3, show the results for Medical Care, with data from OECD PPPs statistics. The explanatory variables are the lagged value of dependent variable, the increase in Total Individual Consumption per inhabitant and the increase in Government Expenditure on Medical care during the period 1990-96.

A coefficient lower than unity, near 0.60, in equations 1 to 3 for the variable $D(MEDG)$ indicates that an increase of one unity in government expenditure on medical care implies a reduction of

private expenditure, with a final effect lower than unity on total consumption, showing the existence of some substitution effects.

Equation 1. Mixed Dynamic Model for Medical Care

Dependent Variable: MED96H				
Method: Least Squares				
Sample: 1 24				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TICH)	0.096621	0.029970	3.223916	0.0045
D(MEDGH)	0.636565	0.142387	4.470654	0.0003
MED90H	1.074294	0.073995	14.51853	0.0000
D17	-748.1567	258.5601	-2.893551	0.0093
D22	1474.211	256.2432	5.753170	0.0000
R-squared	0.917117	Mean dependent var		1893.208
Adjusted R-squared	0.899668	S.D. dependent var		779.5996
S.E. of regression	246.9393	Akaike info criterion		14.03921
Sum squared resid	1158602.	Schwarz criterion		14.28464
Log likelihood	-163.4706	Durbin-Watson stat		1.744686

Equation 2. First Differences Model for Medical Care

Dependent Variable: D(MED)				
Method: Least Squares				
Sample: 1 24				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TIC)	0.122524	0.015257	8.030816	0.0000
D(MEDG)	0.597103	0.136883	4.362129	0.0003
D17	-752.4728	258.5768	-2.910055	0.0087
D22	1488.576	255.8954	5.817125	0.0000
R-squared	0.810083	Mean dependent var		533.2083
Adjusted R-squared	0.781596	S.D. dependent var		528.5032
S.E. of regression	246.9894	Akaike info criterion		14.00758
Sum squared resid	1220076.	Schwarz criterion		14.20392
Log likelihood	-164.0910	Durbin-Watson stat		1.752759

Equation 3. Mixed Dynamic Model for Medical Care, with White

Least Squares. Dependent Variable: MED96H				
Sample: 1 24. White Heteroskedasticity-Consistent Standard Errors				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TIC)	0.096621	0.033544	2.880475	0.0096
D(MEDG)	0.636565	0.113025	5.632090	0.0000
MED90H	1.074294	0.059348	18.10155	0.0000
D17	-748.1567	88.21423	-8.481134	0.0000
D22	1474.211	90.84579	16.22762	0.0000
R-squared	0.917117	Mean dependent var		1893.208
Adjusted R-squared	0.899668	S.D. dependent var		779.5996
S.E. of regression	246.9393	Akaike info criterion		14.03921
Sum squared resid	1158602.	Schwarz criterion		14.28464
Log likelihood	-163.4706	Durbin-Watson stat		1.744686

For a more clear conclusion on substitution effects we estimate an equations for Private Consumption Expenditure on Health. Equation 4 present the results of that estimation, which corresponds to the option with White heteroskedasticity standard errors, and the results should be quite similar in this case without this correction. The estimations was performed with data of only 12 OECD countries because availability of data. Countries included in the sample are those of tables 1 and 2 without Luxembourg.

Equation 4. Model for Private Consumption on Medical Care

Least Squares. Dependent Variable: MEDF96H				
Included observations: 12. White Heteroskedasticity-Consistent				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CTFH)	0.246328	0.060562	4.067404	0.0028
D(MEDGH)	-0.427403	0.133182	-3.209159	0.0107
MEDF90H	0.940876	0.134424	6.999323	0.0001
R-squared	0.923590	Mean dependent var		517.8958
Adjusted R-squared	0.906609	S.D. dependent var		725.2573
S.E. of regression	221.6376	Akaike info criterion		13.85228
Sum squared resid	442109.2	Schwarz criterion		13.97351
Log likelihood	-80.11370	Durbin-Watson stat		1.222677

The hypothesis of total substitution is rejected as the coefficient of the increase in government expenditure is significantly different of -1: $t = (-0.427403 - (-1)) / 0.133182 = 4.30 > t_{\alpha/2}$

These results confirm the existence of a high degree of substitution between public and private expenditure in medical care, although it is not a case of perfect substitution. This means that lowering public expenditure will reduce total expenditure, because private consumption does not substitute all the diminution, but this is not always good for social welfare because it generally will imply lower levels of medical care for poorest sectors of population.

5. Conclusions

Some of the main conclusions of this study, regarding private and public consumption expenditure on Medical Care are the following: 1) Expenditure on Medical Care is important and shows an increasing share in total individual consumption, with economic development, as the demand for these goods and services usually contributes to a higher quality of life and welfare. 2) The percentages of real increase of private expenditure on Medical Care per head usually has been higher than 100% during the period 1970-94 in OECD countries, although the real increase in total private consumption during that period has been general lower of 75%. 3) According to the selected statistics the highest levels of total expenditure per inhabitant on Medical Care, among 24 OECD countries in 1996, correspond to Japan with 3747 dollars, followed by the USA with 3402 dollars, Iceland with 3213, France with 2674, and Canada with 2480. 4) There are important differences between private and public distribution of Medical Care expenditure with countries like the USA where about 97% is private and other cases like Japan, France, and the majority of these 24 countries, where more than 80% is public. 5) Econometric models show that there is a high degree of substitution between Public and Private Expenditure on health and that the demand for Medical Care depends positively on the degree of economic development.

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