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ABSTRACT

Health Expenditure has been rising faster than the growth of income in most industrial countries. The objective of this paper is to discover what factors determined Health Expenditure per head of population in the G7 Countries and whether governments could control them. The analysis has identified three factors that affect Health Expenditure positively: income per head, the ageing population and the share of public expenditure on GDP. None of these variables can be controlled by the government for the sole purpose of containing the growth of Health Care Expenditure. Therefore, only reform of national Health Service Systems could effectively contain the growth of Health Spending. The reforms introduced by some countries in the early 1990s had no significant effect on cost containment with the result that health care expenditure continued to rise in some faster than before. The exception is Japan which managed to achieve a significant downturn in the growth of health expenditure.

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Keywords: Health care expenditure; cost containment.

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1. Introduction

During the last three decades, in every country with a Health Care System, Health Expenditure has been rising sharply. In recent years, (i) slow economic growth, (ii) privatisation and the trend for a smaller public sector, and (iii) policies to reduce the public sector borrowing and the public debt, have induced countries to adopt policies attempting to contain the rise of Health Expenditures. Another reason pointing to the same objective is the general feeling that at the margin the high cost of health spending at a time of shrinking budgets is not justified by the resulting benefit since "the additional gains from such spending are very low or nonexistent" (Cutler, 1995).

The aim of this study is to search for the common factors -shared among countries- which might explain the pervasive rise in health care expenditure that led countries to adopt "cost-containment" policies and to examine whether these policies have had the desirable effects. Several studies have attempted to investigate the determinants of health expenditures at cross-country level but all of them were hindered by the lack of reliable health statistics. In general, only developed countries publish data on health but not always of the right quality for analysis at the national level and for international comparisons. Among the causes of this problem is that "international agreements on methods in health statistics are few. Concepts with identical heading apply still to a multiplicity of realities." (OECD, 1995, p. 22). Moreover, "individual countries are continuously revising their underlying figures, often to as far as 1960" (OECD, 1990, p. 9), so that studies based on past publications of health statistics become obsolete every time revised data become available. Taking account of these problems, we confine our study of comparative health care to the sample of the top seven industrial countries, the G7 -Italy, Canada, France, Germany, Japan, United Kingdom and United States- which by sharing many common social, political and economic characteristics are expected to make up a relatively consistent group of countries.

After this introductory section, the study has five parts. Section 2 presents a brief review of

the Health Care expenditure problem of the G7 countries. In Section 3, we define the determinants of health-care expenditure. In Section 4, we describe the data set and estimate health expenditure functions . In Section 5 we use these functions to study the success or failure of the early results of policies which countries adopted in order to check the rise of health care costs. Section 6 presents the conclusions of our study.

2. Health Care Expenditure in the G7 Countries

In 1992, nearly 96 per cent of the population of the G7 countries were covered against medical costs (medical care, ambulatory care, and medical goods) by one of tree basic models:
National Health Service (NHS) model, characterised by universal coverage, tax financing, and public providers. The United Kingdom (UK) is the prime example of a country operating this type of system. Other countries which have adopted variants of this system are Canada (financed mainly by taxation with mainly private providers) and Italy (financed by social insurance, 52%, and by taxation, 48%, with mainly public providers).
Social Insurance (SI) model, characterised by compulsory universal coverage, financed by employer and employee contributions through non profit insurance funds, and public and/or private providers. Japan, Germany and France operate variants of this system.
Private Insurance (PI) model, characterised by elpoyer-based or individual purchase of private health insurance coverage financed by individual and/or employer contributions, and private providers. The United States (US) mainly uses this form of model.

Irrespective of the economic and health care structure, a characteristic common in the G7 countries, and the OECD countries in general, is the sharply escalating cost of health services. At real Purchasing Power Parity (PPP) 1990 values, the US spent in 1960 on average $614 per person on health care; by 1991 this figure had risen by more than 4.5 times to $2,781 per head -the highest in the world. This is followed by Canada's expenditure of $1,780 per person. The other G7 countries have also experienced sharply increasing health care costs with Germany spending $1,597, France $1,576, Italy $1,381 and Japan $1,228 per person in 1991, while the UK spent the least, only $936 per person. The average G7 annual percentage increase in real per capita spending on health in 1960-92 was 4.8. Even during periods of economic stagnation, the rates of growth of health care expenditure in the G7 countries surpassed those of income thus resulting in a gradual escalation of the share of GDP directed to health care[1].

International comparisons of health care spending confirm that different institutional and

medical care arrangements have much the same effects on spending. Conventional rationalisation attributes this high spending to the nature of the provision of Health Services which incites excessive private consumption at no direct cost to the consumer, who thus is not constrained by private budgetary considerations. But more specific explanations are also offered, such as: (1) improvements in high cost medical technology (both equipment and drugs: OECD, 1977); (2) increased effectiveness of medical diagnosis and more efficacious treatment, which expand the demand for health care by inducing patients to demand treatment by the latest equipment and method, regardless of cost; (3) the rising share of elderly in the population (from unweighted average 9.25 per cent in 1960 to 13.6 per cent in 1990 in the G7 countries) which is cost increasing; and (4) the spread of insurance that has steadily reduced price to the consumer and driven up demand for medical services. To these is added that, often for political and social reasons, governments respond positively to the pressures of demand by increasing public health care spending. Similarly, the private suppliers of health care, who often benefit from tax-subsidies, also contribute to the growth of health expenditure by promoting excessive investment and by inducing demand to protect their incomes (Pauly, 1986).

Despite the obvious differences in health system characteristics, most empirical studies implicitly assume that all countries (mostly the OECD countries for which data are available) constitute one homogeneous group. The only exception admitted is the highly centralised UK system which is assumed to benefit from economies of scale (Hitiris and Posnett, 1992). However, the homogeneity needs to be tested.

3. The Determinants of Health Expenditure

'Expenditure' evokes concepts invoking consumer and producer choice underlying demand and supply. The demand for health care would presumably depend on the conditions of an individual's health, medical costs and income. However, if public or private insurance meets the medical costs, the patient receives the direct benefit of health care but does not pay its full cost which is shifted to others. Thus in general a person's demand for health care is not limited by price, private budgetary considerations or in general ability to pay (Pauly, 1986). In countries providing centrally a national health care, only supply considerations would determine the size of public health care expenditure. Similar considerations apply to countries where the private provision of health care is developed as a substitute or a complement to public spending. Even in these countries the public expenditure on health is still high, averaging more than 75 per cent of

the total in the OECD countries (Schieber et al., 1994). Therefore, high rates of public revenue and expenditure growth is expected to induce high spending on health care. Starting from these premises, the relevant literature has identified seven sources of determinants[2] of the per capita health expenditure: (i) per capita income; (ii) demographic factors, such as the age structure of the population; (iii) the trend in public spending, often approximated by the share of public expenditure on GDP; (iv) the health-care structure of the country, as displayed by medical and nursing manpower, hospital beds, etc.; (v) non-medical health determinants, such as life style, consumption of tobacco and alcohol, calorific intake etc.; (vi) social characteristics, such as the distribution of income, distribution of education, skills, jobs, opportunities and expectations for the future; (vii) the health status and health improvement of the population, such as life expectancy and infant mortality.

Studies of health care expenditures by regression analysis, using small samples of cross-section observations (of about 20 OECD countries[3]), have identified income as the dominant cause of health care spending with "over 90 per cent of the variance in per capita medical expenditure ... explained by variation in per capita GDP" (Newhouse, 1977). But this "monocausal" explanation of health care expenditure (Culyer, 1988) stems from models that are probably misspecified and is subject to the uncertainties of small samples. We propose to identify the determinants of health expenditure among the G7 countries using a large sample of pooled time-series and cross-section data (OECD, 1995). The cost of pooling the data, however, is that we can make use only of statistics that are available in all the countries of the sample. This restriction affects the variables describing the health care structure, non-medical health determinants and the social characteristics of the population which are available only for some of the G7 countries[4]. From necessity, therefore, our empirical model takes the following parsimonious form:

$$\mathbf{H = a + b_1 Y + b_2\ P65+ b_3 G + u} \qquad \mathbf{(1)}$$

The cross-section analysis requires the transformation of data expressed in national currencies to comparable units of measurement across countries. For this, we converted the available constant price data expressed in the national currency units (NCUs) of each country (cross-sectional unit) to $US at Purchasing Power Parity (PPP) 1990 values. The description of the variables and data used in our estimations is as follows:

Dependent variable is the total real health expenditure per capita, **H**, in $PPP, 1990, derived

from real Health Expenditure in national currency, NCU, 1990, and medical $PPP,1990. The composition of health expenditure differs across countries but on average current expenditure accounts for more than 90 per cent of the total (and wages and salaries for about 60 per cent of the total).

The explanatory variables are: **Y** is per capita real GDP, in $PPP, 1990, derived from GDP in NCU, 1990 using the $PPP for the GDP. Since medical care is a normal good, growth in income would increase expenditure. Therefore, Y is expected to exert a positive influence on H, $b_1>0$. Among the G7 countries in 1990, the US had the highest income per head, $20,820, followed by Germany $18,369, Canada $18,304, Japan $17,596, France $17,347, Italy $16,286, and the UK $15,896.

P65 is the ratio of the aged in the population: 65+ yrs/Population, (%). In 1960, the mean value of P65 in the G7 countries was 9.2% and it is predicted to rise to more than 20% average by 2020, with fastest growth rates in Japan and Italy[5]. The influence of P65 on the dependent variable, H, is expected to be positive, $b_2>0$.

G is the share of public expenditure on GDP as a proxy for trends in public spending and an indicator of government involvement in the economy[6]. Assuming that the larger the public share in the economy the higher the spending on health care (Leu, 1986), the variable G is expected to be positively associated with the dependent variable, $b_4>0$. During 1960-91, the mean value of this variable in the G7 countries was 38.9%, with highest in Germany (46.8%) and lowest in Japan (30.9%). Finally, **u** is an error term[7].

3. Estimation of the Health Expenditure Function

The panel data set consists of 35-year observations, 1960-94 from the G7 industrial countries (OECD Health Data, 1995 and 1996, supplemented by OECD, 1993). The observations of the first 31 years, 1960-90, will be used in the estimation of the pre-reform structure of health spending. Thus, pooling the time-series data, t=31, of the seven countries, n=7, forms a sample of 217 observations. The exercise is repeated for the period 1960-94 (a sample of 245 observations) to test whether the introduction by some countries of policies for cost containment has had any significant effects on the pattern of health spending.

Before proceeding with the estimation we must examine whether the countries in the sample do constitute a homogeneous group. This question was dealt with by introducing in equation (1) a set of dummy variables to test for cross-section specific effects (Judge et al., 1988). The results

confirmed that the sample's cross-sectional units (the G7 countries) make up four distinct groups: a base cluster of four countries France (F), Germany (G), Italy (I) and Japan (J); and three *sui generis* countries: the United Kingdom (UK), with lower than average expenditure, and Canada (C) and the Unites States (US), with higher than average expenditure, C<US . Therefore, introducing dummy variables to account for the three outliers, the health expenditure equation takes the form:

$$\mathbf{H_{nt} = a + b_1 Y_{nt} + b_2\, P65_{nt} + b_3 G_{nt} + b_5 DUK + b_6 DUS + b_7 DC + u} \qquad \mathbf{(2)}$$

where the subscript **n** stands for country and **t** for time, and **D** stands for dummy variables taking the value: DUK=1 for the UK system, DUS=1 for the USA, DC=1 for Canada and zero otherwise. We expect a negative coefficient for DUK, and positive coefficients for DUS and DC, with DC<DUS.

The G7 group of countries is a specific non-random set and, therefore, the estimation concerns a *fixed effects model* with parameters fixed but subject to stochastic disturbances. As the statistical sample consists of fewer cross-sectional units than time periods, n<t, we applied a method of estimation which takes account and corrects econometric problems arising from the nature of the data in the sample (Kmenta, 1986). The chosen method of estimation postulates that, despite their differences, the economies of the G7 leading industrial countries are open and interdependent via direct and indirect links which would probably affect their public health care sectors in similar ways. Therefore, the pooled set of country data is cross-sectionally correlated and time-wise autoregressive. Consistent estimates are derived by applying the ordinary least squares method (OLS) to the pooled observations to calculate the corresponding residuals. These are used to transform the variables, remove the autocorrelation and by applying generalised least squares (GLS) obtain asymptotically efficient estimates of the regression coefficients and their variances.

Previous research in this field has invariably shown preference for the log-linear rather than the linear functional form of health care expenditures. There are two reasons, however, why this might be incorrect: (a) Many of the explanatory variables are expressed as percentages and it is therefore inappropriate to convert them to logs; (b) Expenditure on health care is one of the components of total national expenditure and thus it should satisfy the 'adding up' constraint. At the level of aggregation used in this study, total expenditure comprises health care expenditure and

other expenditure. If the functional form of the former is set as log-linear, then the adding up restrictions would necessarily mean that the functional form of the other expenditure is non-linear (Anderton et al., 1992). Since there is no reason to assume that health expenditure is different from other expenditures, the loglinear form is an inappropriate functional specification. Accordingly, the estimation of the linear specification of the health care expenditure provided the following equation:

$$H = -0.890 + 0.074Y + 0.046A + 0.006G - 0.255\,DUK + 0.803DUS + 0.266DC \qquad (3)$$

(0.090) (0.005) (0.009) (0.006) (0.024) (0.200) (0.046)

R^2 (Buse) = 0.839, R^2 (observed/predicted) =0.936, σ = 0.873, SSE = 160.20,

standard errors in parentheses.

The estimation yielded high goodness-of-fit statistics[8] . The estimated coefficients satisfy the *a priori* set of economic and statistical criteria, that is they are statistically significant and have the expected signs, including the shift-dummy variables for the United Kingdom, DUK<0, and the United States and Canada, DUS>DC>0. A test of the joint significance of the shift dummy variables confirmed the heterogeneity of the countries in the sample[9], suggesting that the chosen specification of the health care expenditure function is admissible and the estimates reliable[10].

In the linear functional form of the model, the elasticities of the dependent variable with respect to the explanatory variables are of course variable. At the point of sample means, the estimated income elasticity is 1.07, confirming the predominance of GDP in the determination of health spending. Government expenditure, with elasticities 0.27 also has positive, relatively small but statistically significant effects on the growth of health expenditure. Ageing, A, with elasticity 0.59 shows that an increase in dependancy would raise health expenditure. This conclusion, which accords with a priori expectations and stylized facts, contrasts with previous research[11] which has

concluded that "on balance, neither the direct nor the indirect effects of aging on expenditure appear to account for much of the sustained rise in medical expenditure" (in the US; Newhouse, 1992, p. 6). In general, empirical observations confirm that the ratio of old (+65) in the population is rising in most developed countries and that spending for the elderly has been rising over time. On average, spending for a person more than 85 is more than 5.2 times the average spending for a 35-44 year old[12] (Cutler and Meara, 1997). Also, the health care cost for a 70-year-old is 50 per cent higher than for a 60-year-old which has health care cost twice that of a 40-year-old (Denton and Spencer, 1975). Since the population of the OECD countries has been ageing since the 1960s, the rise in national health expenditures can be partly attributed to the care of the elderly. By the year 2020 the ratio of the old over the labour force in the G7 countries is estimated to reach 40 per cent, nearly double of what it was in 1990. Therefore, under the 1980s regime of health care, about 50 per cent of the total health spending would be directed to the care for the elderly and thus health expenditure would continue to rise faster than the projected growth rate of income in most of the OECD (and G7) countries.

The negative sign and the size of the coefficient of the UK dummy variable confirm the findings of previous studies, that the United Kingdom displays lower per capita health spending. This has been attributed to scale economies associated with the rigidly centralised NHS system of the UK (Leu, 1986). But, since Canada, which has a system more akin to the UK model than to the US model (which could be argued that is subject to diseconomies of scale arising from its extreme decentralisation), is included among the high spenders, there seems to be no systematic unidirectional association between the type of health care system and economies/diseconomies of scale.

5. Reform and Cost Containment

Our objective was to identify the factors that made health expenditure grow fast. The empirical analysis has confirmed that health expenditure increases when income and government expenditure increase and population ages. However, in the 1970s and 1980s the rate of growth of health care expenditure exceeded by far the rate of growth of income. For example, while the average rate of income growth in the G7 countries in 1970-79 was 2.85, that of health care expenditure was 5.50. Naturally, this situation could not last.

This problem has partly arisen from the organization of health care systems which was designed at a time of different demographic structures and better prospects for employment and income growth. When the conditions changed and health spending accelerated, the main response of governments consisted of adopting a series of *ad hoc* cost containment measures. These were applied to both the supply and the demand sides of the market. On the supply side they included expenditure ceilings through prospective budgets and price controls. On the demand side, they took the form of cost-sharing. Although some of these measures were successful in the short-run, most of them have proved ineffective and distortive, increasing the inefficiencies of the system.

From the mid-1980s, growing consensus regarding the need to contain costs and ensure microeconomic efficiency induced governments to contemplate more radical reforms of their health care systems. In the early 1990s, some countries started to implement these reforms policies of cost containment. Canada based its reforms to decentralisation by providing effective management of the policies for cost-containment to provincial governments which will aim at a financing framework with build-in checks and balances. As a result, some provinces have reduced the number of supplementary services and introduced rationing[13]. In France, the discussions about reforms have focused on the costly fragmentation of the health care system but as yet without any significant implementation of expenditure saving policies. In Italy, reforms introduced in the end of 1993 aim at a solution of the chronic problems of deficits and inefficiencies. In Germany, the main problem has been oversupply of services with few incentives for the efficient use of

resources. Recently, the government passed an act aiming at structural reform of the system. Japan introduced a policy for cost containment in the mid-1980s, restricting the rate of growth of national medical expenditure to the rate of growth of national income. More recent reforms include ceilings on the hospital and physician fee schedules, reduction in long hospital stays and in the overuse of examinations and drug prescriptions[14]. In the United Kingdom, the centralisation of the system means that the policies of public expenditure cuts works but the drawback is recurrent underfunding. The reforms introduced at the beginning of the 1990s intended to establish a quasi-market in the NHS, but the system remained cash-limited, characterised by overtly long patient waiting lists. The United States spends a higher percentage of its wealth on health than any other country. Since the 1980s, there has been constant pressure to contain the expenditure on Medicare and Medicaid programmes. Reforms were planned based on competitive principles, but Congress objections have meant that the proposed legislation has not been enacted. Hence, despite the pressure for fundamental reform, major changes in the US health care system have not yet occurred.

In this section we will examine how health care expenditure fared in the 1990s and whether there is evidence of any reversal or early success of the cost-containment policies in the countries that have implemented them. For this, we extended the statistical sample to 1994 and re-estimated the health expenditure function after assigning to each of the G7 countries a time-shift dummy variable, d, taking the value d=1 in the "policy-on period" 1991-94 and d=0 otherwise. Since not all the G7 countries have implemented cost containment policies and, where these policies have started, they may have not yet produced the desired outcome, some of the coefficients of the d-variables are expected to be statistically non-significant, while others would be significant, negative if the policies have worked or positive otherwise. After eliminating the statistically non-significant dummy variables, the estimated equation is:

$$H = -0.842 + 0.091Y + 0.025A + 0.006G - 0.241DUK + 0.502DUS + 0.179DC \quad (4)$$

(0.077) (0.004) (0.007) (0.001) (0.020) (0.083) (0.036)

$$+0.134dC + 0.086dF - 0.124dJ + 0.361dUS$$

(0.029) (0.033) (0.032) (0.077)

R^2 (Buse) = 0.887, R^2 (observed/predicted) =0.951, σ = 0.821, SSE = 157.79, standard errors in parentheses.

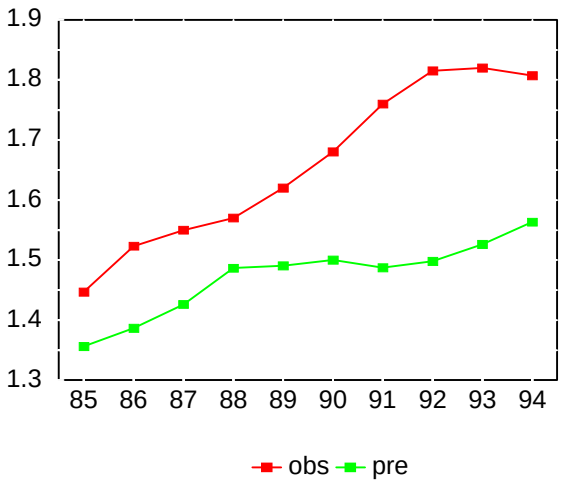
Once again, the estimated coefficients conform with the standard statistical and economic criteria of acceptance[15]. The results confirm that while Germany, Italy and the United Kingdom do not seem to have changed significantly their pattern of health spending during 1992-94, Canada (C), France (F) and the United States (US) have increased their health spending significantly, while Japan (J) is the only G7 country that has managed to reduce it. Therefore, the early years of the 1990s show that, with the exception of Japan, cost containment of health care expenditure has not yet been achieved in the G7 countries.

The results for Canada, France, the United States and Japan are depicted in Figure 1 which illustrates the relationship between the predicted and observed health care spending values during 1985-94. The analysis is based on ex post forecasting (unconditional forecasting) of the dependent variable, H, by using the actual values of the explanatory variables. The maintained hypothesis is that *ceteris paribus*, if the spending on health care had followed the established pattern, governments would not have urgent reasons to reform the health care system. Thus, using the pre-1985 pattern of health expenditure to forecast the post-1985 period, we should find whether the policies of cost containment have had the desirable effect. Figure 1 confirms graphically that this was not the case.

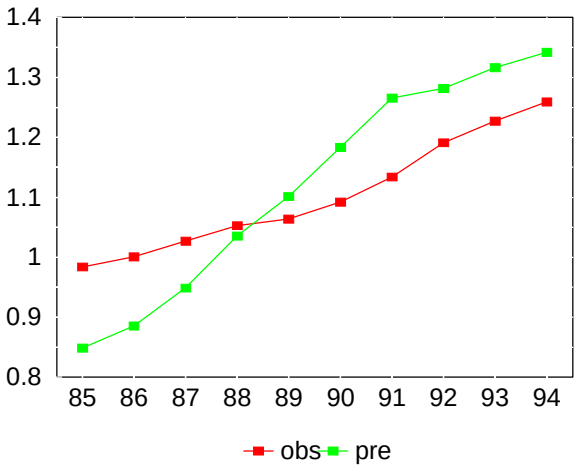
6. Conclusions

The results of this study show that the key determinants of real per capita health expenditure in the G7 countries are (i) the level of income; (ii) ageing; and (iii) the public involvement in the economy and health care. The first two account for about 90 per cent of national health expenditure. Except for government spending, which to some extent can be regulated by policy, the other two determinants of health expenditure, income growth and population ageing, for the purposes of health care cost containment are not under the direct control of the government. This explains why in three decades of health care provision health expenditure continued to rise rapidly, in some cases despite the cost containment measures adopted by governments. New policies introduced from the beginning of the 1990s have meant in most countries that health care spending is no longer soaring, but at a cost. In some countries (such as the UK and Canada), the cost containment policies have lead to financial crises and rationing in the provision of health care. In other countries cost containment has been achieved by heavy regulation (such as price fixing in Japan) but at the cost of increasing inefficiencies. Several other countries (US, France, Germany) have postponed yet again the reform of their health care systems and expenditures. In the future countries will face increasing challenges from an ageing population and rising expectations concerning health spending at a time of diminishing prospects for economic growth. Therefore, the existing structure of health care systems cannot survive without radical reforms. The message of the last 30 years is that if Health Care does not adapt to the changing social, demographic and economic conditions, it would progressively fail to meet its objectives.

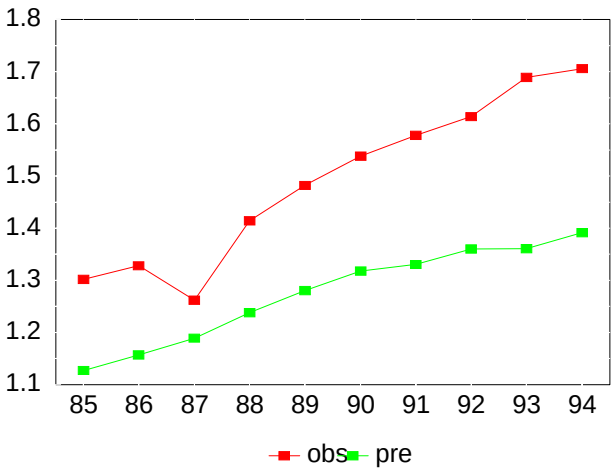
Figure 1: Actual (obs) and Predicted (pre) Values of Health Care Expenditure, 1985-1994



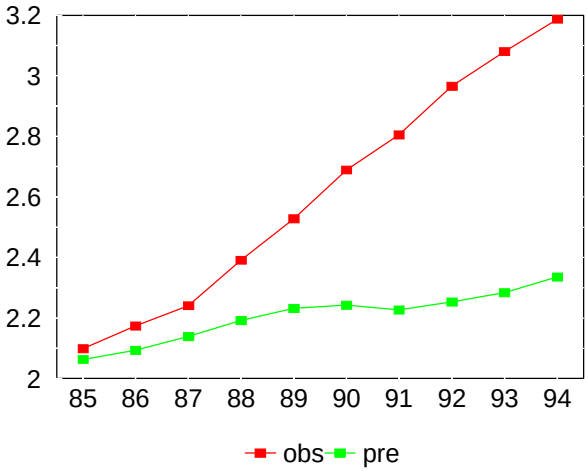
Canada



Japan



France



United States

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Notes

1. Thus the ratio of the health care expenditure rate of growth over the rate of income growth (the unweighted income elasticity of health care expenditure) in the G7 countries is greater than one: 1.6 in 1960-69, 1.9 in 1970-79, and 1.5 in 1980-92.

2. For references see Hitiris and Posnett (1992).

3. For example: Newhouse (1977) with 13, Parkin et al. (1987) with 24, and Gerdtham et al. (1992) with 19 observations.

4. In our set of variables, data are unavailable or incomplete, for example of manpower, such as certified nurses, for Canada, France, the UK and the USA; and of active practising physicians for the UK. Data of in-patient care beds for France are not published. Data of alcohol consumption per capita are missing for Germany, Italy, Japan, UK and USA; and of tobacco consumption for Japan. Data on educational attainment in the population (%) are not available for any of the G7 countries. Data on the performance of health care systems are not available.

5. In the definition of dependent population it is usual to include the very young and the old. However, in the G7 industrial countries the ratio of the very young (0-4 yrs old) in the population is a constant equal to 1 per cent throughout the period under review. Therefore, its omission makes no difference.

6. Some authors (Gerdham et al, 1992) represent the public involvement in the health sector by the public share on total health expenditure. This variable, however, may be subject to endogeneity: when national health care expenditure rises, so does the public share of it.

7. In most G7 countries, the prices of health care services have risen faster than consumer prices. The labour cost components of health care services, such as salaries and wages, have risen even faster. But, unfortunately, we have no reliable data of the cost of health care labour, W. Another possible

explanatory variable of health care costs might be the infant mortality rate per 100 live births as an indicator of improvements in the health status of the population. However, there is a problem of ambiguity (and simultaneity) with this variable since high health expenditure may reduce infant mortality and, in turn, a low infant mortality may induce lower health care expenditure. Infant mortality has fallen dramatically in the G7 countries from an unweighted average of 3.02 per cent in 1960 to 0.73 per cent in 1990 with correlation between health care expenditure and the infant mortality rate in the G7 is -0.71. However, the US, which spends on health care per person more than any other country in the world, is not ranked especially high on reduced infant mortality or life expectancy.

8. For the estimation, the data are transformed and, therefore, the usual goodness of fit statistics are inappropriate. We have used instead the Buse R-square, which measures the part of the generalised sum of squares attributable to the influence of the explanatory variables (Buse,1973), and the R-square between observed and predicted values of the dependent variable.

9. With the dummies omitted, SSE=160.20. Therefore, the Chow test gives F=5.35, against tabulated F (6, 207) =2.14.

10. The use of time-series in the pooled data analysis raises questions about stationarity and cointegration. However, the existing econometric tests for unit roots of times series data are valid asymptotically and lack the necessary power in the case of small samples, over-rejecting the null hypothesis when it is true and under-rejecting it when it is false. With our sample of 30 or so observations, any outcome is possible (Stock, 1994). For example, after an exhausting investigation of this issue on a 32 observation sample for each of 18 OECD countries, Blomqvist and Carter (1977) conclude: “These contradictory results may well be the result of size distortions from applying these asymptotically based tests to such small samples” (p. 225). Therefore, although the question of

stationarity of the data is important, it cannot be answered satisfactorily with the currently available time series of health care statistics.

11. Such as Kleiman (1974), Leu (1986), Blomqvist and Carter (1997) and others who have used the proportion of elderly in total population as explanatory variable. In contrast, Harrisson at al. (1997) concluded that demographic changes in the UK, which will be modest, will require an extra 8.25% growth in real expenditure between 1994 and 2014.

12. This figure refers to USA 1987 and excludes long term-care services: see Cutler and Meara, 1997.

13. The details about health care reforms are in Hoffmeyer and McCarthy (1994) and OECD (1994).

14. Despite the reforms, in Japan hospitals and doctors have a financial incentive to over provide care. Hence, days in hospital and drug prescritions -from which doctors receive a substantial income supplement- are among the highest in the world.

15. The Chow test for the significance of all the dummies (K=7) is F=12.73 and for the significance of the additional dummies (K=4) is F=6.31, both of which reject the null hypothesis.