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Convergence of Health Care Spending and Health Outcomes in the European Union, 1960-95

John Nixon

DISCUSSION PAPER 183

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December 2000

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THE AUTHORS

John Nixon is a Research Fellow in the NHS Centre for Reviews and Dissemination working on the NHS EED project. His D/Phil thesis is an analysis of a convergence in the health care systems of the European Union.

ACKNOWLEDGEMENTS

Special thanks to Dr. Theodore Hitiris, Professor Jos Kleijnen and Professor David Mayston, University of York.

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SUMMARY

Convergence in health expenditure in the countries of the European Union (EU) has been demonstrated to be occurring in previous studies. The aim of this paper is to identify and discuss the reasons for this finding and to present new evidence confirming convergence in health outcomes, as represented by life expectancy and infant mortality rates. The statistical methods used, σ and *β-convergence* analysis, are well established in macro-economic growth analyses and based on the neo-classical growth model which predicts convergence in income for homogenous countries such as those forming the EU. The analyses reveal a common trend in that Southern Mediterranean countries have generally exhibited upward convergence towards the mean in health expenditure, and convergence towards the EU mean in improving directions for health outcomes. In contrast, EU countries of the North, particularly those of Scandinavia, exhibit downward convergence towards the EU mean or below it in health expenditure, whilst their health outcome measures have generally been displaying a decreasing advantage over the EU mean over the periods of analysis. The results are briefly considered in relation to the factors that help to explain the results, including the question of whether a causal relationship between health expenditure and health outcomes exists, the nature and impact of health care reforms throughout the 1970s, 80s and 90s in countries contributing most to the observed convergence, and the predictions of the neo-classical growth model which underpin the results.

Keywords

convergence, divergence, health expenditure, health outcomes, causal relationship.

1. INTRODUCTION

Convergence, in sociological terms, is defined as 'the result of a process in which the structures of different industrial societies come increasingly to resemble each other' (Jary and Jary, 1991, p.121). The concept of convergence therefore, taking the term 'structures' in its broadest sense, can be applied to almost any situation in which there are forces encouraging individuals, peoples, societies, institutions or nations towards a common point. These forces may be social, political or economic in nature.

In terms of industrial development there is the potential for individuals, for example, to converge on centres of industrial production, to converge in their living arrangements, their incomes, their wealth and their lifestyles. On a macroeconomic basis, there is the potential for nation states to converge in terms of *per capita* GDP, inflation, output and a range of other indicators. Convergence, moreover, is a word which has implications for the re-distribution of wealth, for concepts of equality, for right of access to welfare and health and equity in terms of other socio-economic indicators related to individuals and states. Convergence towards total equality, however, has its limitations, as witnessed by the collapse of the command economies of the former Eastern Bloc countries, and indeed healthy differentials may be an essential ingredient of a successful modern industrial state. However, it is clearly the case that convergence towards certain minimum standards is a laudable goal in its own right and is being actively pursued and encouraged in the EU through a process of greater political, social and economic integration, laid down at its conception in the Treaty of Rome and re-enforced by the later Treaties of the EU (principally Maastricht and Amsterdam).

However, even though the various treaties and mechanisms of the EU tend to generate forces for convergence at the level of public health (Hitiris and Nixon, 2000b), in EU Social Policy matters there is no current overt aim to standardise health care systems (Hoffmeyer and McCarthy, 1994) and the principles of subsidiarity lie at the heart of EU health care policy. In spite of this, the Commission of the European Communities (1994) has pointed out the reforms that have been introduced by member states throughout the 1980s and 90s in response to crisis constraints (see also OECD (1992); OECD (1994a) and Ham (1997) regarding reforms of health care systems), brought about by the now well established demand drivers of new health technologies, ageing populations, and greater awareness of what interventions are available.

These, in conjunction with increased dissemination of information and movement of EU citizens and professionals, the Commission argued, may lead member states to seek 'long-term solutions in similar directions' (ibid, p.40). Abel-Smith *et al.* (1995) also considered a possible agenda for EU health care policy in relation to reforms and McKee *et al.* (1996) have examined the influence of European law on health care provision, both of which may well encourage greater convergence. As the EU also has a number of policy instruments to encourage greater re-distribution of wealth and investment throughout the EU[1], it is likely that this leads to convergence in GDP income which has knock-on effects for health care expenditure as these two variables have been shown to be highly correlated (Newhouse, 1977).

[1] Two prominent mechanisms exist: The European Regional Development Fund (ERDF) which provides grants for development projects in poorer regions. It has the expressed aim of reducing imbalances between regions of the EU (and therefore a force for convergence). The second is the European Social Fund which provides financial assistance for vocational training, retraining and job-creation schemes (Hitiris, 1998).

Previous studies have demonstrated that statistically significant convergence in GDP income and health care expenditure occurred in the current member states of the EU over the period 1960-95 (Nixon, 1999; Hitiris and Nixon, 2000a; Hitiris and Nixon, 2000b).

The aim of this paper is to briefly summarise these results and then go on to present the findings of convergence analyses of health outcomes in the member states of the EU using the same methodology. The paper begins with an overview of the theory of convergence and following this a brief description of the two statistical tests appropriate for the measurement of convergence is provided. After summarising the results for health expenditure convergence, the results for health outcomes, represented by life expectancy and infant mortality, are provided, followed by an analysis of the results in the light of the expectations of the neo-classical growth model, and an examination of the potential causal link between health expenditure convergence and health outcomes. Finally an outline is provided of health care reforms for countries contributing most to the observed convergence before coming to conclusions regarding the findings.

The present fifteen countries of the EU are identified in tables and outputs by their associated abbreviations; A = Austria, B = Belgium, D = Germany, DK = Denmark, E = Spain, F = France, FIN = Finland, GR = Greece, I = Italy, IRL = Ireland, L = Luxembourg, NL = the Netherlands, P = Portugal, S = Sweden and UK = the United Kingdom.

2. THE THEORY OF CONVERGENCE ANALYSIS

A more comprehensive description of the principal elements of theory is outlined elsewhere (Nixon (1999); Hitiris and Nixon, 2000a). In brief, the theoretical base of economic convergence derives from the neo-classical growth model which produces the result that in the long-run all countries tend to a common equilibrium level of income per head, the *steady state*, if: (i) competition is perfect and trade is free; (ii) technologies are common across states and exhibit constant returns to scale and capital productivity is decreasing; and (iii) countries share similar preferences, then growth rates of income per head across states are inversely related to initial conditions. Therefore, an initially poorer economy with a lower starting value of the capital/labour ratio tends to grow faster than a richer one.

Consequently, over time countries will tend to converge to the steady state with the same level of income per head, regardless of their initial conditions. Although it is evident that differences do exist across the member states of the EU, they generally meet the above conditions for convergence according to the neo-classical growth model by aspiring to: a reduction in heterogeneity across member states in respect of the structure of markets and institutions; an increase in competition and economic openness through trade in goods and services; the facilitating of factor movements and technology transfers; a promotion of policy harmonisation. Under these influences economic integration speeds up growth and facilitates the process of convergence (Sachs and Warner, 1995).

In terms of attempting to test the hypothesis of convergence it is necessary to utilise longitudinal and time-series data (Leonardi, 1995). The longitudinal aspect involves the chosen dependent variables, and the time-series aspect involves an examination of the data at chosen points in time. It is possible to examine the data cross-sectionally at discrete points in time or to utilise panel data, in which case the data set is examined every year. In so doing trends are sought in terms of changes over the overall period under examination. If the

dependent variables are either converging or diverging the aim would be to seek to explain these changes by an examination of explanatory variables and policy changes.

A number of methods are discussed in the literature which are used to test for the presence of convergence, and two principal concepts have been developed within the study of economic growth. These methods have been adapted for use in the present study and are briefly outlined in the following.

2.1 σ-convergence

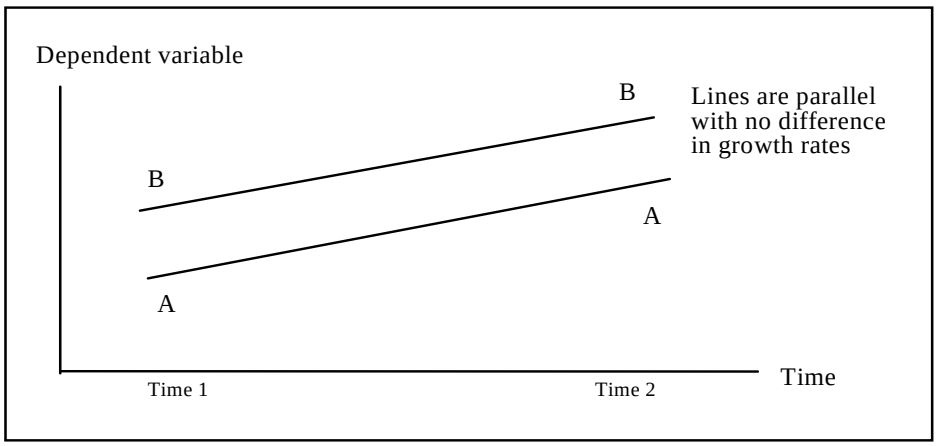
This approach concerns 'cross-sectional dispersion' in which convergence exists if, for example, the standard deviation (s.d.) (often its log) or coefficient of variation (c.v.) of a variable across a group of countries declines over time. Essentially, as standard deviation is a measure of the spread of data and is defined as 'a numerical measure of the average variability of a data set around its mean' (Sandy, 1990, p.52) if its value diminishes with successive measures over time this will support the hypothesis of convergence. This form of convergence is known as *σ-convergence* (Easterlin, 1960; Borts and Stein, 1964; Streissler, 1979; Barro, 1984; Baumol, 1986; Dorwick and Nguyen, 1989; Barro and Sala-i-Martin, 1991, 1992a, 1992b). In order to statistically test for *σ-convergence* it is necessary to analyse the variance in the data over two points in time, and a method for doing this has been developed by the author as outlined in the methods section.

In terms of graphical representations of convergence, Leonardi (1995) put forward a useful methodology for the study of economic and social convergence and the various hypotheses and scenarios he provides are described as: 1) the equivalent growth hypothesis, 2) the upward convergence scenario, 3) the downward convergence scenario, 4) the reversal of roles scenario, and 5) the divergence hypothesis. These are illustrated graphically in Figures 1(a) to 1(e) and are helpful in explaining the results of *σ-convergence* analyses.

2.1.1. Equivalent growth hypothesis

Figure 1(a) shows that although there is an absolute increase in the dependent variable for both A and B between time periods 1 and 2, there is no relative change between the two. In this case both A and B experience the same growth and convergence does not take place between the two time periods.

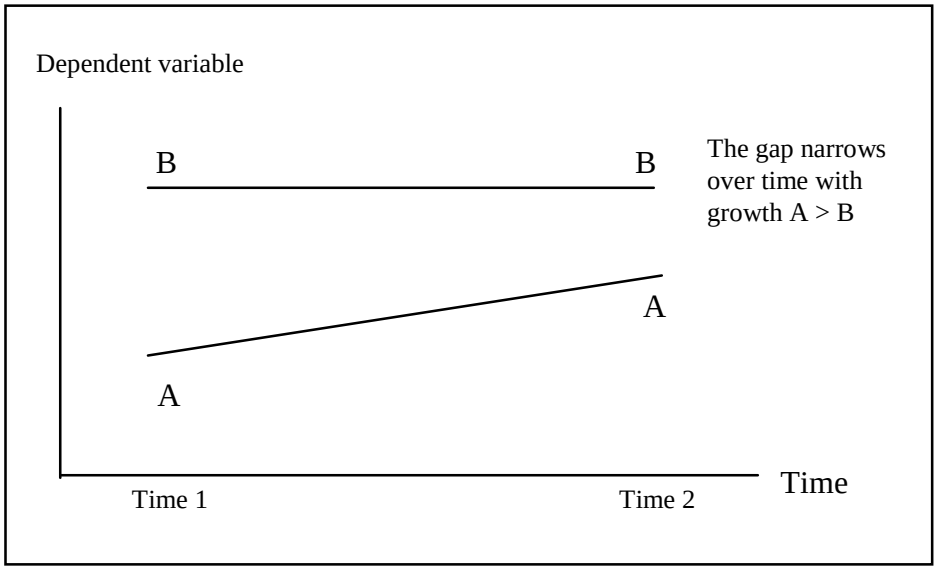
Figure 1(a) - Equivalent growth hypothesis



2.1.2. Upward convergence scenario

Figure 1(b) illustrates the case of upward convergence, based on neofunctionalist integration theories (ibid, p.66). Between time periods 1 and 2, B experiences low growth in real terms but A experiences real and upward growth towards the value attained by B. This scenario is therefore classified as *upward convergence* as the initially inferior position of A is increasing at a faster rate than B.

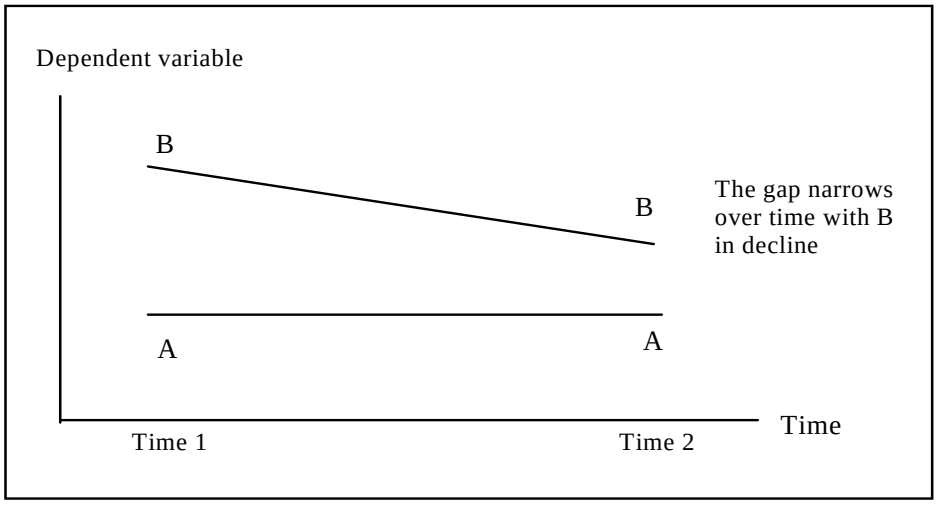
Figure 1(b) - Upward convergence scenario



2.1.3. Downward convergence scenario

In this scenario, as illustrated in Figure 1(c), the relative gap between A and B reduces between time periods 1 and 2, with A, the inferior, increasing in value and B, the superior, decreasing in value. In spite of this, the initial ranking of A and B is unaltered by the convergence process.

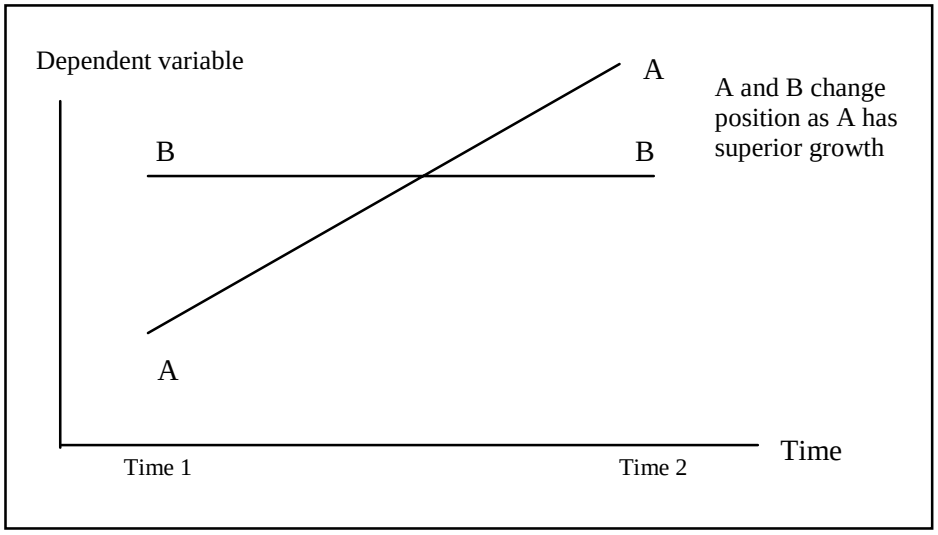
Figure 1(c) - Downward convergence scenario



2.1.4. Reversal of roles scenario

As the title implies, over time periods 1 and 2 there is a reversal in the rank order of the two values, A and B, as shown in Figure 1(d). This may be due to the dynamics of either growth or decrease in the value attained by A, or a growth or a decline in the value attained by B. The result is that absolute differences still exist between A and B.

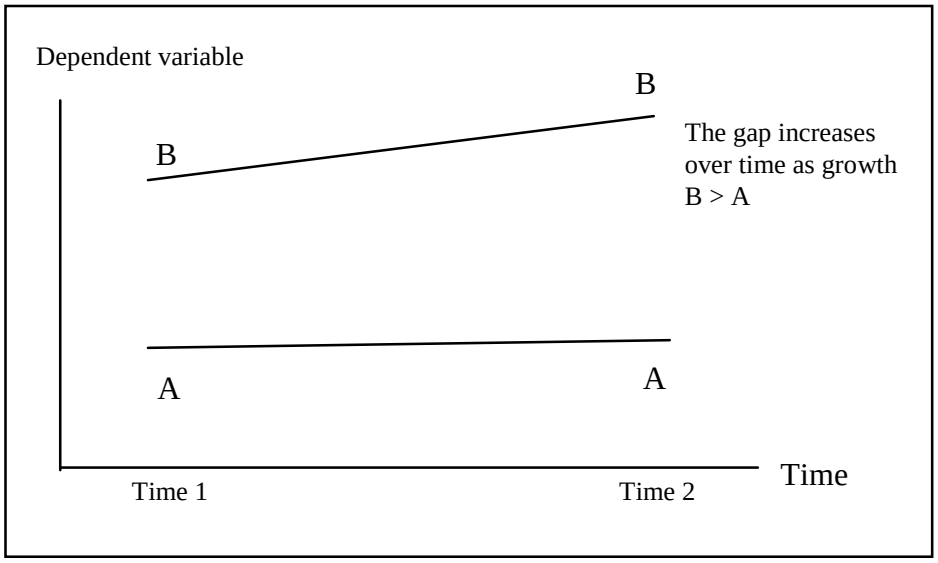
Figure 1(d) - Reversal of roles scenario



2.1.5. The divergence hypothesis

Figure 1(e) depicts this situation in which, over time, the absolute gap between A and B increases, even though growth may be taking place for both A and B. In this scenario the rate at which growth is occurring is sufficiently different such as to create a widening gap between the inferior and the superior.

Figure 1(e) - Divergence hypothesis



2.2 β-convergence

The disadvantage of *σ-convergence* is that it may be disproportionately influenced by discontinuities, outliers and short-run shocks. Additionally, the existence of a diminution of standard deviation or coefficient of variation does not confirm that a country approaching the sample mean will remain there as exemplified by the reversal of roles scenario described in Figure 1(d). The second approach limits these shortcomings, positing that convergence exists if a poor economy tends to grow at a faster (but diminishing) rate than a rich one such that the poor country tends to catch up in terms of *per capita* income or product. This property corresponds to the concept known as *β-convergence* (Barro, 1984; Baumol, 1986; DeLong, 1988; Barro, 1991; Barro and Sala-i-Martin, 1991, 1992a, 1992b; Sala-i-Martin, 1994; Boyle and McCarthy, 1997). *β-convergence* is also known as 'regression to the mean' (Barro and Sala-i-Martin, 1995, p. 383), which is a point of focus in the methods adopted in the present paper.

β-convergence is usually tested for by regression analysis of the log of first-differences of income per head, $Y_{t+1} - Y_t$, explained by the log of income levels, Y_t , a set of auxiliary conditional variables, X_t, and a set of dummy variables, D_i, standing for latent characteristics of the i=1, 2,... countries in the sample. Formally:

$$Y_{t+1} - Y_t = \alpha + \beta Y_t + \delta X_t + \gamma D_i. \qquad (1)$$

Evidence of *β-convergence* requires that the estimated coefficient, β, which measures the speed of convergence, is negative, $\beta<0$. Therefore, $\beta\geq0$ implies that no convergence occurs.

Within this method of analysis two forms of convergence are distinguished: c*onditional* and a*bsolute*. *Conditional* convergence occurs if the estimated coefficient or coefficients of the auxiliary variables are statistically significant, indicating that there are differences across countries which direct each one to converge to its own steady state, allowing the possibility of 'convergence clubs' to be formed[2]. Alternatively, *absolute* convergence indicates that all countries in the sample converge to the same steady state. Figure 2 illustrates the case of *absolute convergence* for countries which begin with different initial conditions but reach a common steady state in the long run.

A review of the literature shows that some debate exists as to the application and interpretation of these two forms of convergence measurement (Bernard and Durlauf, 1996; Friedman, 1992; Quah, 1993) but the methods adopted in the present paper seek to address, and as far as possible, minimise the effects of these issues.

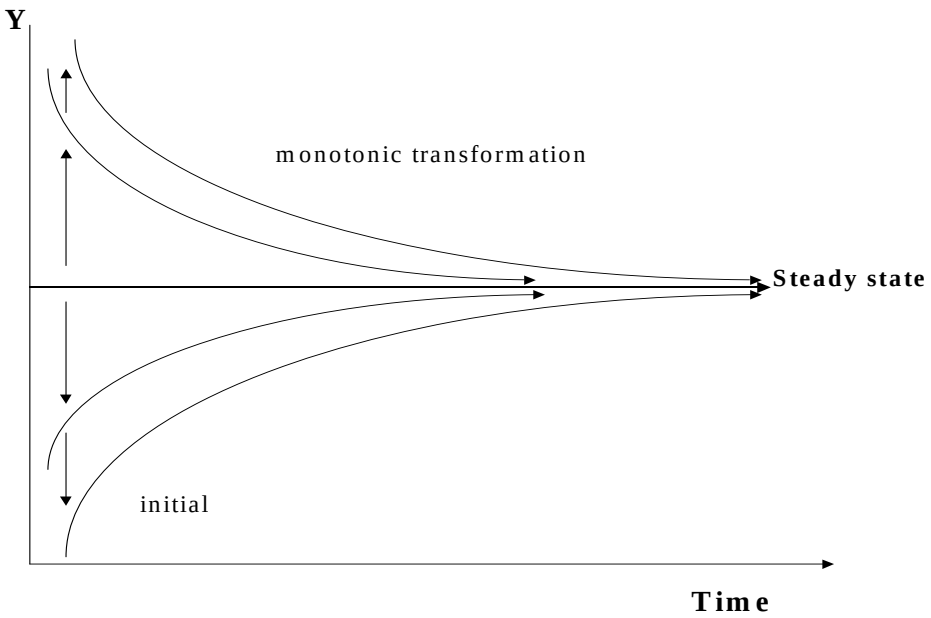
2.3 Data selection

Even with the best intentions and an intuitive feel for what is happening in a given situation, any research will stand or fall by the quality of its data. In this respect data should be *reliable*, *operationalised* over time, and *valid* (Leonardi, 1995, p.61). In attempting to measure convergence it is essential, therefore, that data are consistent between the entities being measured, and do not change over time such that the original comparisons become invalid. In attempting any cross-national analysis this is clearly problematic and rigorous

[2] Convergence clubs occur when sub-groups of countries in a sample converge to a similar level, which is different from the levels attained by other sub-groups in the sample.

testing for consistency may force the researcher to limit data to only that which meets the above criteria.

Figure 2 Graphical illustration of absolute convergence



The *source* of the data is therefore an important issue and should meet with the requirements identified above. This illustrates the principle of the need to obtain comparable data of the required quality over a sufficiently long period of time to asses the presence, or otherwise, of convergence.

2.4 Measuring the rate of convergence

The rate of convergence can be measured in two ways, namely in *absolute* or in *relative* terms. In the former the dependent variable is expressed in its current value and in the latter case values are ranked or given in relative changes on an index vis-à-vis a common reference point (ibid, p. 64). In this study an indexed mean of 100 is used as outlined in the methods section. Once these have been established, comparisons can either be made *externally* between all or selected member states or *internally* which provides a comparison with a state's own development over the time periods examined.

This brief review of the literature and principal methods used to test for convergence provides a means of analysing health care expenditure and health outcomes in the EU and to identify the specific countries that have been contributing most to any observed convergence. The particular methods adopted here allow for the testing of both *β-convergence* and *σ-convergence*.

3. STUDY METHODS

In this study use is made of OECD data on health (OECD/CREDES, 1997) which provides a reliable source in relation to the criteria identified in the theory sections above.

In the testing of *σ-convergence*, data are separated by a 10-year period for the first four and a five year period for the last two; 1960, 1970, 1980, 1990, 1995 (the earliest and latest years, at

analysis, for which a complete set of OECD data are available). The following hypotheses are applied to all health expenditure and health outcome variables for this form of analysis:

Null hypothesis, $\mathbf{H_o: \sigma^2_{60} \leq \sigma^2_{95}}$
Alternative hypothesis, $\mathbf{H_A: \sigma^2_{60} > \sigma^2_{95}}$

For α = 5% level of significance using the F-test,[3] = $\frac{s_{60}^2}{s_{95}^2}$, where s_{60}^2 is the standard deviation squared for 1960 of observations n = 15, and s_{95}^2 is the standard deviation squared for 1995 of observations n = 15. The rejection rule is to reject the null hypothesis if F>F(n-1, α). In order to overcome the effects of changing means over time which, without correction which leads to misrepresentations, the data used in the sample are converted to values around an indexed mean of 100 for each year. This method of calculation yields the *coefficient of variation (c.v.),* where $c.v. = \frac{s.d.}{\bar{x}} \times 100$, preventing the problems associated with Galton's falacy (Friedman, 1992). Graphical representations of the results are used to provide descriptive analyses in accordance with the five hypotheses/scenarios of Leonardi.

In order to test for *β-convergence* a panel data set was used from the same source (OECD/CREDES, 1997), covering a shorter period of 1980-1995, consisting of 16 time-series observations for each of the 15 EU member states (the cross-sectional units), i.e., 16x15=240 observations. The analysis is applied to all health expenditure and health outcome variables. The estimation was based on regression analysis in the form of equation (1) and the results were tested for compliance with both economic and statistical criteria[4]. In order to test the hypothesis of *absolute* convergence it is necessary to examine the value of β and its statistical significance, with negative values confirming the presence of *β-convergence*. To test the hypothesis of *conditional* convergence, in addition to the finding of β<0, the coefficients of the auxiliary variables will also need to be statistically significant. The principal variables which were subjected to both σ and *β-convergence* analysis were as follows:

Health care expenditure: total health care expenditure as a percentage of GDP; total *per capita* health expenditure in PPP$[5].

Health outcomes: life expectancy (females) at birth; life expectancy (males) at birth; infant mortality.

The auxiliary variable used in the health expenditure analysis was national income, and in the health outcome analysis these were GDP income, health expenditure, number of in-patient hospital beds, in-patient length of stay, in-patient admission rate, number of in-patient beds per head of population and number of physicians per head of population.

[3] The F-test (one-sided) is calculated by dividing the variance of one sample by the variance of a second sample.

[4] The econometric software package SHAZAM was used and the method of estimation takes account and corrects econometric problems arising from the nature of the sample of the pooled set of country data which is expected to be cross-sectionally correlated and time-wise autoregressive. For further details about the estimation and results see: Hitiris and Nixon (2000a).

[5] For the EU the share of this expenditure coming from public finances represents approximately 75% - for example Portugal = 61.2%, UK = 85.2% and Luxembourg = 90.3% for 1990 (OECD/CREDS, 1991).

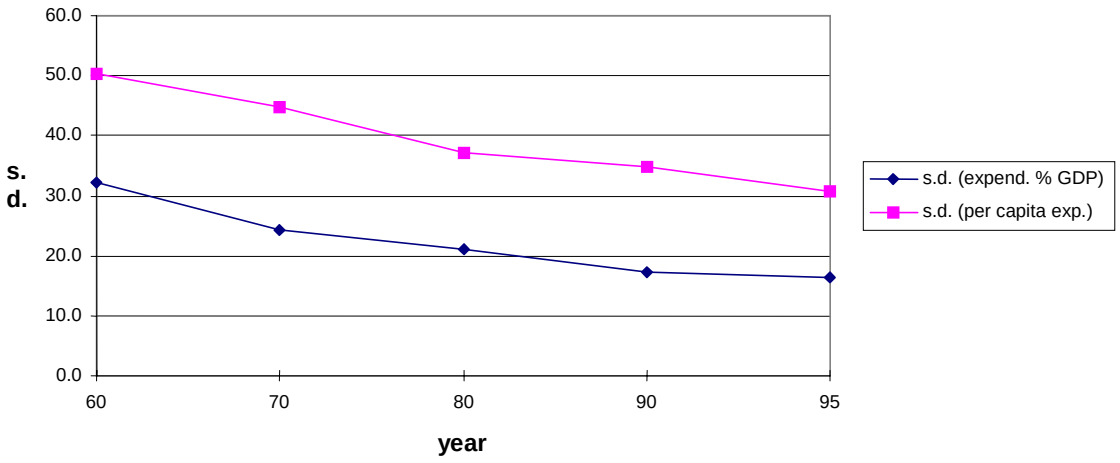
4. RESULTS

4.1 σ-convergence for health expenditure

The results for *σ-convergence* for both health care spending as a percentage of GDP and *per capita* spending are shown, by means of the trends in standard deviation (i.e. coefficient of variation resulting from the indexing described above) of the indexed scores, in Figure 3.

In the case of spending as a percentage of GDP it can be seen that from 1960 the s.d. (c.v.) fell continuously from a figure of 32.2 in 1960 to 16.3 in 1995. For *per capita* PPP$ spending a similar trend is observed with s.d. (c.v.) falling from a figure of 50.23 in 1960 to 30.61 in 1995. It is interesting to note that there is a greater spread of data as shown by the standard deviation differences, in other words greater inequality, in *per capita* spending. This indicates that the differences at the policy level (share of GDP allocated to health care) are less than those achieved in *per capita* terms, reflecting the relative strengths of EU countries in terms of GDP income in relation to their population sizes and spending preferences for health. This implies that use of health care spending as a percentage of GDP, the most widely used in international comparisons, has some limitations in reflecting what is spent at the citizen level. Expenditure per head in standard units of money is therefore perhaps a better indicator of convergence.

Figure 3 - Standard deviation of health expenditure as a share of GDP and *per capita* PPP$ - 1960-95.



The F-test results indicate that it is possible to reject the null and accept the alternative hypothesis that $\sigma^2_{60} > \sigma^2_{95}$ ($p = 0.008$) for % of GDP and ($p = 0.039$) for *per capita* spending. These results thus provide statistically significant evidence to show that this form of convergence occurred between 1960 and 1995 in both measures of health care expenditure.

4.2 β-convergence for health expenditure

The results of the *β-convergence* analysis show that in the estimation of *absolute* convergence the β coefficient is both negative and statistically significant. For percentage of GDP $\beta = -0.107$ (standard error, 0.021) $p<0.05$; for *per capita* health expenditure $\beta = -0.027$ (standard error, 0.009), $p<0.05$. These results confirm those of the *σ-convergence* analysis and as the magnitude of β is greater for the dependent variable share of GDP it indicates that this variable is converging at a faster rate than *per capita* expenditure.

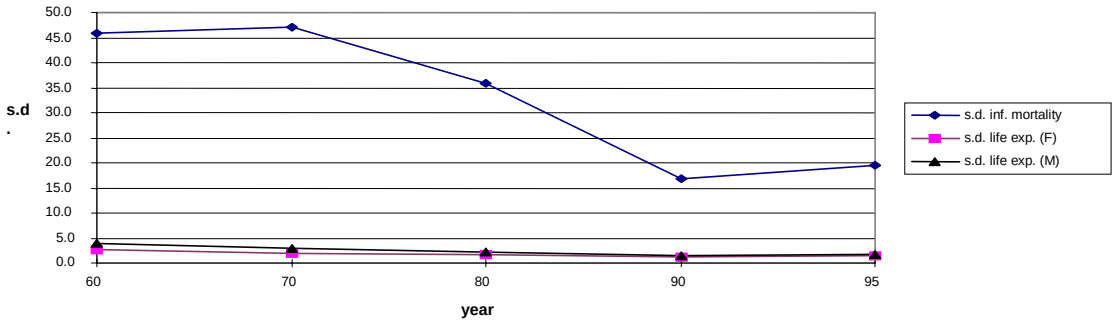
The results for *conditional* convergence, taking GDP income as the auxiliary variable, show that for share of GDP the results are not statistically significant, confirming absolute convergence at the policy level. However, for *per capita* expenditure there is evidence of strong *conditional* convergence with $\beta = -0.064$ (standard error, 0.014), $p<0.05$. This result reflects the findings of the *σ-convergence* regarding greater differences between EU countries in terms of this variable in comparison with percentage of GDP. The findings indicate, therefore, that in the long-run a number of *per capita* health expenditure clubs may be in evidence, and although they will tend to converge to their own steady state, they will go to different levels because of differences in GDP income across the EU.

4.3 σ-convergence for health outcomes

The results for *σ-convergence* for all three health outcome variables are shown by means of the trends in s.d. (c.v.) of the indexed scores as recorded in Figure 4.

The s.d. (c.v.) of the indexed values for infant mortality rose from 45.9 to 47.1 between 1960 and 1970 ($p = 0.54$, NS), and also rose from 16.8 to 19.6 between 1990 and 1995 ($p = 0.71$, NS), indicating two periods of non-significant divergence. However, between 1970 and 1990 there was sustained convergence from an s.d. (c.v.) of 47.1 to a figure of 16.1 ($p = 0.0002$), indicating statistically significant *σ-convergence*. It is therefore possible to reject the null and accept the alternative hypothesis for infant mortality for this period of analysis.

Figure 4 Standard deviation (s.d.) trends in health outcomes - 1960-95.



For life expectancy (females) the s.d. (c.v.) scores show that overall and continuous convergence occurred between 1960 and 1990 with the s.d. (c.v.) falling from 2.8 in 1960 to 1.3 in 1990 ($p = 0.15$, NS). For the period 1990-95 there was a slight degree of divergence as the s.d (c.v.) rose to a figure of 1.4 ($p = 0.59$, NS), although neither of these changes are statistically significant. These results indicate that a high degree of convergence has been established in life expectancy for females (c.v. values are small in comparison with infant mortality) and that there is limited room for significant reductions in differences across the countries of the EU.

The results for life expectancy (males) reveal that continuous *σ-convergence* occurred between 1960 and 1990 with the s.d. falling from 4.0 in 1960 to 1.6 in 1990 ($p = 0.001$), a statistically significant change. Between 1990 and 1995 no convergence or divergence occurred as the values are identical for both years. Over the period 1960-95, it is possible to reject the null and accept the alternative of *σ-convergence* for male life expectancy and

therefore differences in this variable have been diminishing but again, little room seems to remain for significant further convergence as the s.d. (c.v.) in this variable is very low.

4.4 β-convergence for health outcomes

The results of the *β-convergence* analysis for infant mortality revealed significant findings for *absolute* convergence but not for *conditional* convergence. The β coefficient is negative and statistically significant with value β = -0.163 (standard error, 0.026), $p<0.05$. Therefore, the hypothesis of *β-convergence* is confirmed. The results satisfy the conditions for strong convergence and suggest that in the long-run steady states apply to all EU countries for infant mortality.

Similar results are found for life expectancy in females for only *absolute* convergence producing statistically significant results, with β = -0.262 (standard error, 0.036), $p<0.05$. Again the results allow us to accept the hypothesis of strong *β-convergence* for this health outcome.

4.5 Graphical analysis - health expenditure

In order to identify the countries which have contributed most to the observed convergence in health expenditure two histograms are first provided covering the period 1960-95 and including all 15 countries, associated with the *σ-convergence* results. Although not presented here, the graphs for *β-convergence* and the associated panel data re-enforce the following observed trends.

The standardised results for s.d. (c.v.) for percentage of GDP and *per capita* spending are shown in Figures 5 and 6, respectively.

In terms of the equivalent growth hypothesis it can be seen from Figures 5 and 6 that no countries achieve this although France and the Netherlands perhaps come closest to achieving it in terms of health care spending as a percentage of GDP (Figure 5) and France for *per capita* spending (Figure 6). These countries have therefore achieved the greatest stability in relation to the EU mean for these variables.

Figure 5 Standardised health expenditure as a percentage of GDP - 1960-95

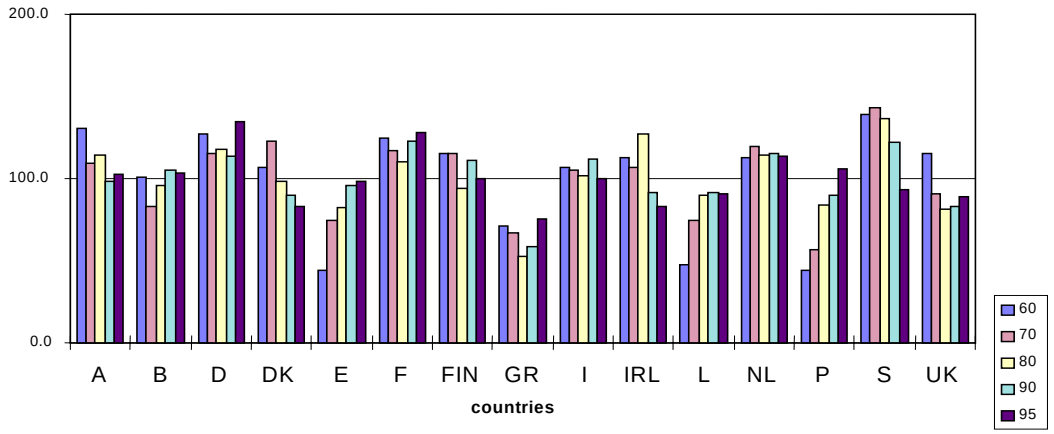
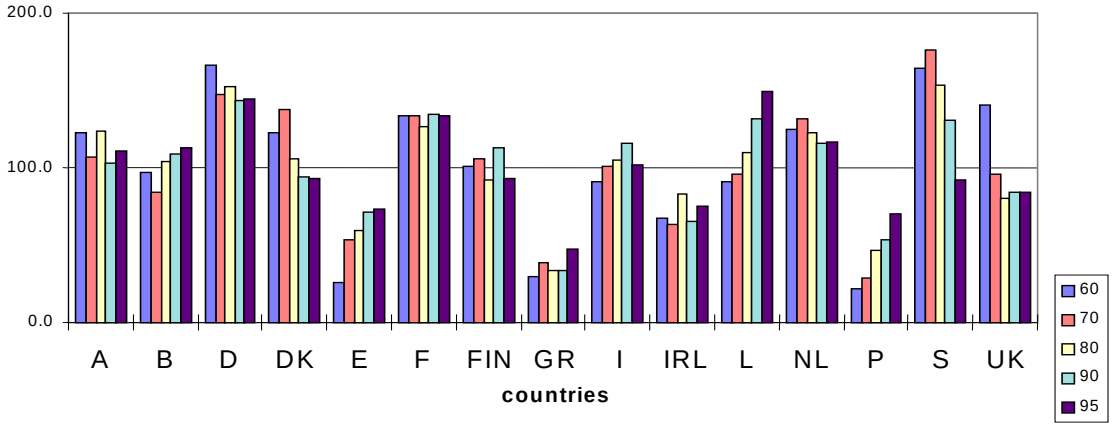


Figure 6 Standardised *per capita* spending on health (PPP$) - 1960-95



In terms of the upward convergence scenario, for health care expenditure it can be seen from Figure 5 that four countries achieved upward convergence, namely Belgium (1970-90), Spain, Luxembourg (1960-90) and Portugal, with both Belgium and Portugal achieving reversal of roles to a value above the EU mean in 1995. All four countries reached values close to the mean in 1995 from a position at the bottom of the scale with values below half the mean in 1960.

When we examine Figure 6, it is evident that this upward convergence is also reflected in *per capita* spending for these four countries, although the relative weakness of the currencies of Spain and Portugal, in contrast to the strength of the currency of Belgium and Luxembourg, becomes apparent. Spain and Portugal, in 1995, achieved only approximately 75% of the EU mean in *per capita* spending whilst Belgium had close to parity between % of GDP and *per capita* spending, but Luxembourg achieved a value of approximately 149.6% of the EU mean, even though in % of GDP terms, all these countries were spending something close to the mean. It is recognised here, however, that growths in the size of population will reduce the value of *per capita* PPP$ values as well as relative purchasing power. Thus although these countries have clearly introduced policies and reforms to increase their overall spending, their comparative impact on individuals has been somewhat suppressed in the cases of Spain and Portugal, but greatly enhanced in the case of Luxembourg. These results confirm the upward convergence scenario in the case of Belgium, Luxembourg, Portugal and Spain, with cross-over in the cases of Belgium and Portugal (% of GDP) and Belgium and Luxembourg (*per capita* spending).

In looking for countries that reflect the downward convergence scenario, for both health care as a percentage of GDP and *per capita* spending, no countries strictly achieved this, although the Netherlands achieves this between 1970 and 1990, and Germany between 1980 and 1990 for *per capita* spending, as shown in Figure 6. In contrast to Portugal and Spain, for *per capita* spending the amounts achieved by these two countries are above the corresponding values for percentage of GDP spent on health care. Thus for Germany, percentage of GDP lies in the range 115.1% to 134.6% of the EU average, whilst its *per capita* spending lies in the range 143.8 to 166.5% between 1960 and 1995, indicating evidence of a strong purchasing power in relation to population size. A similar but less striking relationship is also observed for the Netherlands with a range of 112.6% to 114.5% for % of GDP and 116% to

131.6 for *per capita* spending between 1960 and 1995. These results show that both countries spend well above the EU mean and also have currencies with strong PPP$ values.

Countries which meet the reversal of roles scenario will cross the line of the EU mean, either in a downward or upward direction, over the periods examined. Taking reversal of roles in the former case it can be seen that for health care spending as a percentage of GDP (Figure 5) this was achieved for Denmark (between 1970 and 1995), Finland (between 1970 and 1980, and 1990 and 1995), Ireland (between 1980 and 1995), Sweden (between 1970 and 1995 and the UK (between 1960 and 1980). For *per capita* spending (Figure 6) this was achieved by Denmark (between 1970 and 1995), Finland (between 1970 and 1980, and 1990 and 1995), Sweden (between 1970 and 1995) and the UK (between 1960 and 1980). These findings show that Scandinavian countries in particular, which are traditionally associated with strong Socialist attitudes to taxation and welfare spending (Esping-Andersen, 1990), have been successful in introducing effective policies that have reduced their total expenditure on health care in relation to the EU mean. Moreover, when the UK is included, all these countries operate NHS typologies which have been shown to be more effective in controlling expenditure due to their centralised and supply-side control mechanisms (OECD, 1994b; OECD, 1992; Nixon, 1999).

When examining *per capita* spending for these countries some interesting observations are noted. For Denmark, spending as a percentage of GDP falls from 123.1% (1970) to 82.8% of the EU mean in 1995, while its *per capita* spending falls from approximately 138.1% to 92.8% of the EU mean in 1995 (close to parity). For Finland between 1970 and 1995 spending as a percentage of GDP falls from 115.1% to 99.7% of the EU mean which corresponds to a fall in *per capita* spending from approximately 106% to 93.1% over the same period, indicating that purchasing power for the Finnish currency was below % of GDP values. The most visible variations, however, in the relationship between these two variables are observed for Ireland in which, for the years 1980 to 1995, its health spending as a percentage of GDP achieved a downward reversal of roles, falling from 127.5% to 82.8% of the EU mean, while its *per capita* spending changed from 83.1% in 1980 to a value of 75% of the EU mean in 1995, providing evidence of a developing economy and a strengthening of its currency. In the case of Sweden we observe that in 1970 Sweden both spent the most in terms of percentage of GDP and *per capita* spending, with values of 143.3% and 175.9 respectively. However, over the period 1970 to 1995 it can be seen from Figures 5 and 6 that both variables fell to values below the mean of 93.2% and 92.3%, respectively. Sweden, therefore, has been successful in implementing policies to curtail spending on health care which have brought it down from its premier position in 1970 to below the EU mean in 1995, and there is evidence of a weakening of its economy between the two periods.

Turning now to reversal of roles in an upward direction we can see from Figure 5 that this was achieved for only Portugal in terms of % of GDP, with its value rising from a mere 44.5% of the EU mean in 1960 to 106.1% of the EU mean in 1995. However, again we observe the relative weakness of the Portuguese economy as, for *per capita* spending, this translated itself into figures of 22% in 1960 to 70.2% in 1995. Spain followed an almost identical trend but fell just short of achieving reversal of roles for % of GDP with its figure rising from 44.5% of the mean in 1960 to 98.4% in 1995. These figures for *per capita* spending were translated into values of 25.6% to 72.9% in 1960 and 1995 respectively. It can also be seen from Figure 4 that Italy experienced reversal of roles, or cross-over, between 1960 and 1990, reaching figures close to parity for *per capita* spending and % of GDP.

In terms of the divergence hypothesis it can be seen that this has been occurring in some countries of the EU but not in a consistent manner as there is evidence of movement in both directions with respect to the EU mean for a number of countries. France and Germany provide two examples of this in that between 1980 and 1995 there was upwards divergence away from the mean in % of GDP spending for France, whilst this occurred for Germany between 1990 and 1995. This indicates that both countries have been committing increasing amounts of their GDP for health care.

Belgium and Luxembourg have also achieved divergence in *per capita* PPP spending for the time period 1980-95 (also cross-over as discussed earlier), and especially in the case of Luxembourg. Figure 6 indicates the relative strength *per capita* spending for Luxembourg which was at a value, in 1995, of 149.6% even though its spending as a percentage of GDP was only at 90.6% of the EU mean. Greece experienced downward divergence for the period 1960-80 but achieved upward converge towards the EU mean in both percentage of GDP and *per capita* PPP spending for the period 1980-95. As in the case of Portugal and Spain, the relative position of Greece has been at the bottom of the EU for these two variables since 1980. Moreover, the poor purchasing power for Greece is reflected in the fact that although it was spending figures around the 60% (range = 52.2 to 75.1%) mark for percentage of GDP between 1960 and 1995, it only achieved figures of approximately 40% (range = 29.3 to 47.7) in terms of *per capita* spending. Thus, whereas other countries have demonstrated large swings in their spending on health care the Greek situation has remained relatively stable and well below the mean for both spending as a percentage of GDP and *per capita* spending.

Finally in this section the UK experienced divergence below the EU mean in both percentage of GDP and *per capita* spending between 1970 and 1980, but has begun to converge towards the EU mean since then, albeit at a slower rate. It is interesting to note in Figures 3 and 4 that for the UK the relative magnitudes and directions of movement are almost identical, showing a strong degree of parity between both variables.

In summary, there are countries which have reduced their expenditures, those which have increased their expenditures and those which have remained close to the EU mean. Countries which have achieved increased spending in both percentage of GDP and *per capita* PPP include Belgium, Spain, France, Luxembourg and Portugal. Countries which have achieved reductions relative to the mean for both variables include Austria, Denmark, Finland, Sweden and the UK.

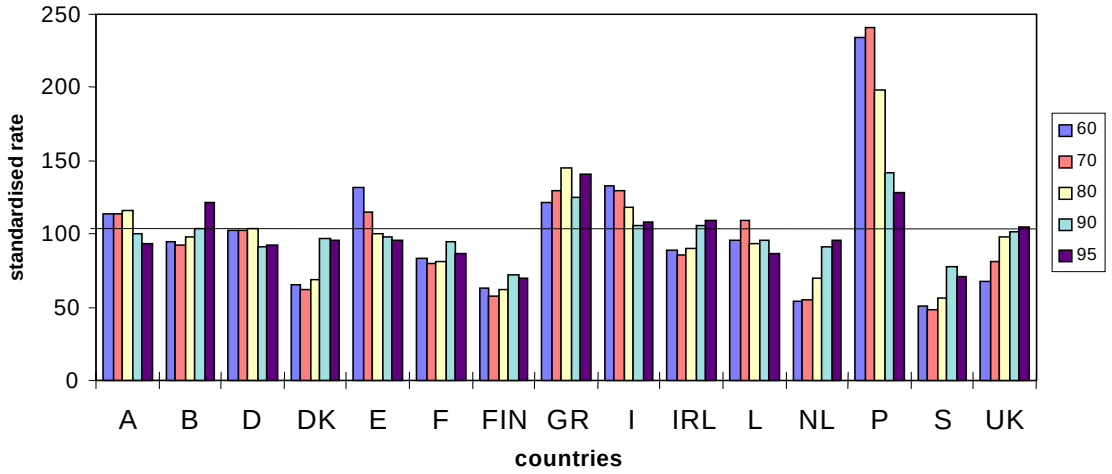
Both Italy and Ireland achieved a reduction in percentage of GDP spending but an increase in *per capita* PPP$.

The countries, from these data, which achieved the smallest changes and therefore greatest stability would appear to be France and the Netherlands.

4.6 Graphical analysis - health outcomes

The results of the statistical analyses for health outcomes are shown graphically in the following section and based on the *σ-convergence* between 1960 and 1995. The trends for infant mortality, life expectancy (females) and life expectancy (males), again based on an EU mean of 100, are shown for the period 1960-95 in Figures 7, 8 and 9, respectively.

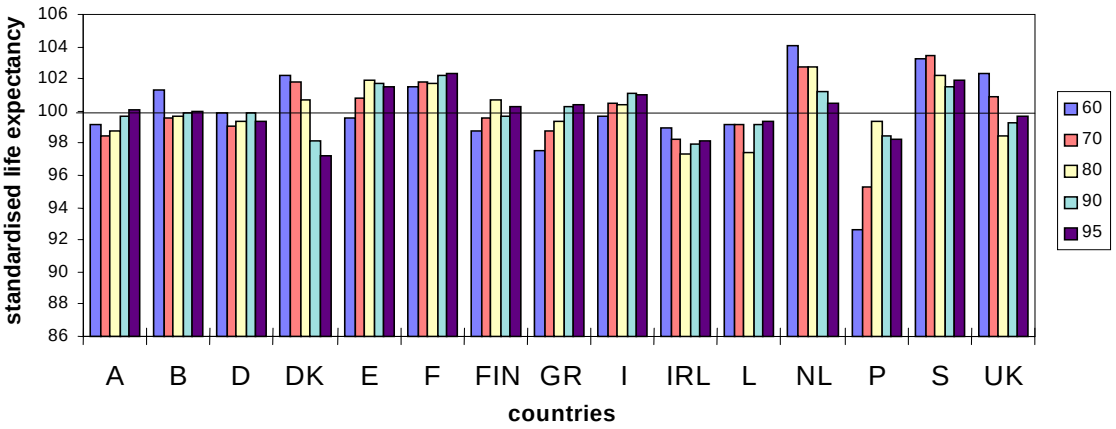
Figure 7 Trends in EU indexed infant mortality rates, 1960-95.



In terms of countries meeting the equivalent growth hypothesis, for infant mortality no countries achieved this although Germany comes closest, particularly between 1960 and 1980, from which point on the figures fall but remain parallel to the mean for 1990 and 1995. It is likely that re-unification of the German states in 1989 had an impact on this step improvement in infant mortality.

Again, for life expectancy Germany comes closest to equivalent growth for females as shown in Figure 8. In terms of life expectancy for males, the countries closest to fulfilling this hypothesis are Belgium, Germany and the UK, all remaining just below or just above (UK) the standardised mean of 100 as shown in Figure 9.

Figure 8 Trends in indexed EU life expectancy (females), 1960-95.

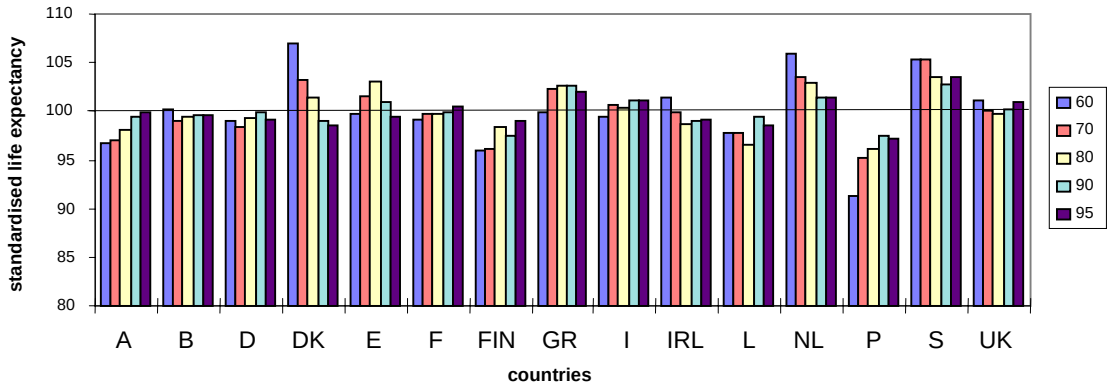


Countries which meet the upward convergence scenario would indicate a worsening in their infant mortality rates with respect to the EU mean. This occurred for Denmark, the Netherlands, Finland (between 1970 and 1990) and Sweden (also between 1970 and 1990). In examining life expectancy for females (Figure 8), it can be seen that upward convergence was achieved by Austria between 1970 and 1995, Belgium between 1970 and 1995, Portugal between 1960 and 1980, and the UK between 1980 and 1995. For male life expectancy it can

be seen that upward convergence occurred in Austria between 1960 and 1995, Finland between 1960 and 1980, and again between 1990 and 1995, and in Portugal between 1960 and 1990.

When considering the scenario of downward convergence, from Figure 7 it can be seen that this was achieved in terms of infant mortality for Italy (between 1960 and 1990) and Portugal. The most dramatic improvement was achieved by Portugal which, in 1970, had a standardised infant mortality rate almost two and a half times greater than the mean. Although in 1995 it was still above the standardised EU mean, it had figures comparable to Greece and Belgium. In examining life expectancy for females (Figure 8) it can be seen that downward convergence occurred in the Netherlands between 1960 and 1995, and in Sweden between 1970 and 1990. For males (Figure 9), downward convergence occurred in the Netherlands between 1960 and 1995, and in Sweden between 1970 and 1990.

Figure 9 Trends in indexed EU life expectancy (males), 1960-95.



In terms of the achievement of the reversal of roles scenario, countries achieving this would change positions over the period examined with respect to the standardised EU mean, in either an upward or downward trend. When infant mortality is considered, Figure 7 reveals that the UK experienced upward (worsening) convergence in infant mortality between 1960 and 1980 and then reversal of roles between 1980 and 1995. This also occurred for Ireland between 1970 and 1995, and Belgium between 1970 and 1995. Countries experiencing a downward (improving) reversal of roles were Austria between 1980 and 1995 and Spain between 1960 and 1995. For life expectancy in females it can be seen that Denmark experienced a reversal of roles in a downward (worsening) direction between 1960 and 1995, and the UK between 1960 and 1980. In terms of improving reversal of roles, this occurred in Spain between 1960 and 1980, in Finland between 1960 and 1980 and again between 1990 and 1995, in Greece between 1960 and 1995, and in Italy between 1960 and 1990. For male life expectancy, downward (worsening) reversal of roles occurred in Denmark between 1960 and 1995, in Ireland between 1960 and 1980, and in the UK between 1960 and 1980. In terms of upward (improving) reversal of roles this occurred in France between 1960 and 1995, Italy between 1960 and 1995, and the UK between 1980 and 1995.

In terms of infant mortality it can be observed that upward (worsening) divergence occurred in the case of Greece between 1960 and 1980 and again between 1990 and 1995, Belgium between 1990 and 1995, Ireland between 1990 and 1995 and marginally for the UK between

1990 and 1995. In terms of downward (improving) divergence this occurred for Spain between 1990 and 1995 and in Luxembourg between 1990 and 1995.

For female life expectancy the data show that upward divergence (improving) occurred in the cases of France and Italy between 1980 and 1995. Downward convergence (worsening) occurred for Germany and Denmark between 1990 and 1995, and Portugal between 1980 and 1995. For male life expectancy the results show that upward divergence (improving) occurred in the cases of Spain between 1970 and 1980, Italy between 1980 and 1995, and the UK between 1990 and 1995. Downward convergence (worsening) only occurred for Denmark between 1990 and 1995.

In summarising the results for health outcomes in terms of their changes with respect to the standardised mean over the period 1960-95, the countries with worsening trends in infant mortality levels include Belgium, Denmark, France, Finland, Greece, Ireland, The Netherlands, Sweden and the UK. Improving trends with respect to the mean were achieved by Austria, Germany, Spain, Italy, Luxembourg and Portugal.

In terms of life expectancy countries with improving (positive) levels include Austria, Germany (males only), Spain (females only) France, Finland, Greece, Italy, Luxembourg and Portugal. Countries which achieved worsening (negative) levels include Belgium, Germany (females only), Denmark Spain (males only), Ireland, the Netherlands, Sweden and the UK.

Collectively, these trends have led to, and explain, the observed convergence in the two statistical tests applied to the health outcome data. It must be stressed here, however, that 'worsening' and 'improving' do not reflect actual changes but represent trends with respect to the standardised EU mean.

5. FACTORS INFLUENCING CONVERGENCE

Although it is beyond the scope of this paper to address all the possible reasons that might explain the observed convergence, a brief summary of some key issues, of which some relate to membership of the EU, will assist in explaining the findings. Three principal areas are discussed, namely theoretical issues which come from the neo-classical growth model and its prediction of convergence (Barro and Sala-i-Martin, 1995) in GDP income (and therefore convergence in health expenditure), the possible association between the observed health expenditure and health outcomes, and in relation to health care systems for those contributing most to the results, the health care reforms that were introduced over the period examined, principally relating to the 1970s, 80s and 90s.

5.1 Neo-classical growth and observed health expenditure convergence

The principal points to take from the theoretical base of this paper are that economies with similar tastes and technologies tend to converge to the same steady state, economies which start out proportionally below their steady states tend to grow faster than rich ones, and regional convergence within countries is more easily achieved than across countries due to the presence of homogeneity of culture, religion, language, law and politics. The latter points in particular have a controlling effect on the mobility of capital and labour and the principle to grasp here is that the allowance of migration in neo-classical growth models tends to accelerate the process of convergence. Before its conception, former EU countries were far more closed and homogenous, and lacked the means to achieve greater convergence as independent states. However, EU membership not only allows for but actively encourages

barriers to convergence to be broken down. Many aspects of EU social and agricultural policy encourage the re-distribution of wealth by offering subsidies and financial assistance to poorer regions of the EU. The principles of worker mobility and free trade as laid out in the 'four freedoms' of the 1985 Single European Act and the 1991 Maastricht Treaty increasingly mean that citizens of the EU have, through increased knowledge, education and mobility, come and continue to expect similar rights and provision in terms of economic opportunity. The underlying principles of the neo-classical growth model therefore have applicability to the study of convergence in health care expenditure as there is a strong correlation between the latter and GDP income (Hitiris, 1997; OECD, 1995). The data on GDP income were also analysed for convergence for the period 1980-95 and this confirmed that faith in the neo-classical growth model for EU countries is justified. The findings provided statistically significant evidence for *β-convergence* and this is likely to be a prime driver of the results of health expenditure convergence[6].

5.2 Associations between health expenditure and health outcomes

The question one might wish to pose based on the finding of convergence in both health care expenditure and health outcomes is, 'does a causal relationship exist between them?'

As Goldacre (1996, p.69) points out, however, 'the difficulty of isolating the contribution of the health service 'input' as a determinant of health status 'output' is one which frustrates attempts to measure the overall effectiveness and efficiency of health care.' As he argues, in comparing trends within a country over time there is no experimental control group providing comparable data in the *absence* of health services. Only a few studies have been successful in finding a causal link between health expenditure and health outcomes as other factors such as diet, lifestyle and environment are often taken to be the principal factors affecting health outcomes, particularly when considering life expectancy (Folland *et al*, 1993). Another restricting factor that has been cited is the heterogeneity in data used in cross-national studies (Cremiéux *et al*., 1999). Moreover, a full investigation of this potential link for the above analyses is not feasible within the constraints of the present study.

In the following, therefore, only a brief summary of trends in health expenditure in comparison with health outcomes, and correlation values for each, are provided.

The results have shown that six countries achieved increases in *per capita* health expenditure with respect to their standardised values between 1960 and 1995. These countries are (relative changes for standardised values in brackets) Belgium (+16.0), France (+0.2), Spain (+47.3), Greece (+18.4), Italy (+10.8), Ireland (+7.3), Luxembourg (+58.2) and Portugal (+48.3). It is worth noting that all the countries of the Southern Mediterranean are included in this category. Among these, increased expenditure has resulted in improvements in all three health outcome measures for Italy, Luxembourg and Portugal, improvements in both life expectancy indicators for Greece, and improvements in life expectancy for females as well as infant mortality in Spain. It is also interesting to note that increased expenditure for Belgium and Ireland was associated with a worsening trend of all three health outcome indicators in relation to the standardised EU mean.

In contrast the results show that 8 countries experienced a reduction in their standardised *per capita* health expenditure levels between 1960 and 1995. These countries are Austria (-11.7),

[6] See Hitiris and Nixon (2000a) for the details of this analysis.

Germany (-21.7), Denmark (-29.8), Finland (-7.5), the Netherlands (-7.2), Sweden (-72.4) and the UK (-56.3). It is notable that all the countries of Scandinavia (including Finland) are in this group. Decreased standardised *per capita* expenditure resulted in a worsening (with respect to the EU mean) of all three health outcome measures in Denmark, the Netherlands, the UK and Sweden. Both France and Finland had worsening infant mortality rates and Germany had a slight worsening in its life expectancy for males.

A correlation coefficient was determined for each health outcome with respect to *per capita* health expenditure. Between *per capita* health expenditure and infant mortality a high correlation was observed at a value of **-0.58**. This tells us that as *per capita* health expenditure increases, infant mortality decreases, and vice-versa.

For life expectancy the results are less convincing, with a value of **+0.289** for female life expectancy, showing that as *per capita* health expenditure increases so does female life expectancy, but to a lesser degree compared with infant mortality. For male life expectancy, the correlation coefficient was only **-0.05**, indicating virtually no correlation.

The signs of these correlations are generally supportive of an association between health expenditure and health outcomes but statistical tests of significance for a causal link will require more detailed analyses.

5.3 Health Care Reforms

Reforms of health care financing have been examined in a number of studies attempting to analyse their effect (Ham *et al.*, 1990; OECD, 1992; OECD, 1994b*).* The principal aim of the reforms has been to achieve efficiency at both the macro-economic and micro-economic levels. Ham (1997) and other authors from selected countries of the EU provide a valuable and up to date summary of reforms over the period of interest. The general theme raised by these reforms is that most countries are under continuing pressure to 'contain costs, increase efficiency and raise service standards' (ibid, p.1). Four countries included in the analysis are full members of the EU and as Ham suggests, reforms introduced in these countries provide general principles that can be applied in various ways to countries embarked on the agenda identified above, and that they contain a range of typologies in the delivery of health care (NHS, social insurance and private insurance as well as public and private providers).

The specific strategies adopted by various member states of the EU have included the 'big bang' (Klein, 1995) market-type reforms of the UK in the 80s and 90s with the introduction of an 'internal market' approach which divided the NHS into 'purchasers' and 'providers'. In countries such as the Netherlands and Germany, however, the focus has been on an 'incremental' approach which has placed competition at the division between 'insurance companies' and 'providers,' reflecting the nature of these systems as social insurance models. Moreover, due to the differences in political systems between countries such as the UK and the Netherlands, namely majority government versus consensus government, the incremental approach has taken much longer to implement as exemplified by the Plan-Dekker, Plan-Simons reforms which created the foundation for reforms in the Netherlands but remain incomplete in terms of implementation (Van de Ven, 1997). The third type of reform has come about as a result of a 'bottom-up' approach as witnessed in the case of Sweden (Rehnberg, 1997), which is characterised by its use of county councils to implement health care at a local level.

In contributing to the downward and reversal of roles scenarios of convergence the countries of Scandinavia are highly relevant. In the case of Sweden, the most striking of all Scandinavian countries in terms of achieving cost containment since the 1970s, Rehnberg (1997) explains that the budget system used to allocate resources in the 1960s and 1970s suffered from overspending by clinical departments which the county councils in Sweden largely ignored. However, this situation was redressed by reforms in the 1980s that introduced global budgets which were capped. To further control health care spending, central government regulated total expenditure by placing limits on the amount of revenue that could be raised by county councils. Thus, unlike some other OECD countries, particularly those with private and social insurance systems, Sweden has been highly successful in containing its health care expenditure and is now not only close to the EU mean but is also close to the OECD mean (ibid). The analysis here confirms that Scandinavian countries in general, but Sweden and Denmark in particular, have introduced effective reforms to reduce their health care expenditures.

Moreover, analysis of health care expenditure shows that countries with NHS modes of delivery, such as Sweden, are associated with a lower mean value than those of social insurance models operated by other countries in the EU (Nixon, 1999). As such, they are more effective in controlling public expenditure on health care. This is reflected in Figures 5 and 6 for 1995 as the majority of EU countries with NHS typologies are below the EU mean for percentage of GDP (Denmark, Finland, Greece, Italy, Spain, Sweden and the UK) and *per capita* PPP$ (Denmark, Finland, Greece, Portugal, Spain, Sweden and the UK). In contrast all social insurance countries except Luxembourg are above the EU mean (Austria, Belgium, France, Germany and the Netherlands) for % of GDP and all are above the EU mean for *per capita* spending.

Studies by the OECD (1992; 1994b) add support to this analysis in providing evidence to show that integrated models appear to be the most successful in containing costs followed by contract models and reimbursement models. This is attributable to the economies of scale that more centralised, integrated models can achieve as well as centralised control of national expenditure.

In contrast, while some countries have been striving to contain public expenditure on health care, the Southern Mediterranean countries of Spain, Portugal and Greece (also Luxembourg), as demonstrated in the analysis, have been increasing their commitment towards health expenditure and have achieved upward convergence towards the EU mean, as well as reversal of roles above the mean, for at least one of the variables analysed. Essentially this is due to the fact that these countries started at a comparatively low point with respect to other EU (and OECD) countries in 1960 for various reasons. In the case of Greece, Spain and Portugal this was due to factors such as political turmoil, the after-effects of revolution or social inequalities and inward migration (in the case of Portugal), and poor GDP performance. In the section below the cases of Spain and Portugal are outlined.

Health care provision in the post-war period in Portugal was characterised by variable provision. The responsibility for paying for health care either lay in the hands of individuals or their families, the government for selected groups such as civil servants, or was met by the *misericordias* which were religious charity hospitals. The government's role was a secondary one in that it filled in the gaps left by private initiatives and gave priority to preventive services (OECD, 1994b). Moreover, the quality and quantity of health care was influenced by

geographical location, with the better quality services being located in Lisbon, Oporto and Coimbra. The need to expand its services can be illustrated by the low numbers of health professionals, which in 1970 included one doctor per 1,115 of population, of which there was one specialist per 2,636 of population, and only one fully qualified nurse per 1,600 of population (ibid). Essentially the standard of service was low, services were fragmented and dissatisfaction was felt by both consumers and professional with services provided by the government. However, in 1965 and 1968 laws were passed to provide powers for the financing and organisation of primary health care and in 1979 a national health service was introduced.

The trends in health care provision can clearly be seen from INE *Health Statistics* for 1970, 1980 and 1990 (OECD, 1994b, p. 252) which shed some light on the consequences of increased expenditure and the move, more latterly, towards private health provision in Portugal. If we examine the mix of health institutions, in 1970 there were 171 government hospitals, 284 *misericordias*, and 160 private hospitals. In 1980 these figures had altered to 394 government hospitals, 8 *misericordias* and 89 private hospitals and by 1990 the figures had altered dramatically such that there were only 145 government hospitals, no *misericordias* and a total of 95 private hospitals. Similarly, the number of doctors increased from 8,580 in 1970 to 28,852 in 1990 whilst the number of nurses increased from 10,000 to 27,652 over the same period. These statistics are indicative of a complete switch away from relying on charity hospitals to more pluralistic modes of meeting health care needs and increased health expenditures within the overall context of an NHS mode of delivery.

In the case of Spain before the reforms in the 1980s its health care system was also characterised by variability and dominated by a compulsory health insurance system, *Instituto Nacional de la Salud* (INSALUD), which was part of the social security system. INSALUD covered approximately 90% of the population and as such gaps existed in terms of provision, with the poor and unemployed in society being excluded from INSALUD-financed care. Other major weaknesses in health care in Spain at that time included complaints concerning the inadequate levels of public spending, a view that the public sector was inefficient and impersonal, long waiting lists and overcrowded emergency departments, and stresses and strains at the complex and permeable boundaries between public and private sectors caused by doctors dividing their attentions between them to the disadvantage of the public patients (OECD, 1994b; Miguel and Guillen, 1989; Rodriguez, *et al.*,1990). Brooks (1987) summarises the situation in the pre-reformed public sector as being fragmented, poorly co-ordinated, over-bureaucratic and under-managed.

The response of the Spanish government during reforms introduced in the 1980s included the consolidation of a National Health System, the extension of compulsory health to virtually the entire population, better planning and integration of both primary and hospital care, increased reliance on funding from general taxation and the beginning of the devolution of health care administration to the autonomous regions (OECD, 1992, p. 103). As a result both percentage of GDP and *per capita* spending rose as indicated by the results of this paper. Specifically referring to the concept of achieving greater convergence the 1992 Reform stated ‘Within the framework of a government strategy of European convergence, (there was a) decision to move towards a greater autonomy of hospitals, (to be) converted into quasi-public corporations’ (OECD, 1992, p.109).

Thus it may be reasonable to conclude that for countries such as Portugal and Spain, a number of factors relating to their economies and populations have meant that they have had a good deal of catching up to do but have been making inroads and are converging on and even exceeding (Portugal for % of GDP) the EU mean, at least over the period of analysis addressed in this paper. Greece, on the other hand, which shares a number of socio-economic features with Spain and Portugal, has achieve the same trend to a somewhat lesser degree. However, as many studies have shown (*c.f.* Hitiris, 1997; OECD, 1995), there is a strong correlation between health care expenditure and GDP wealth and Greece, in terms of this latter point, has not managed to achieve growths in GDP commensurate with its EU partners. As such, it might be concluded from the perspective of Greece, that whilst strong divisions remain in terms of GDP wealth in the countries of the EU, convergence will be limited.

6. CONCLUSIONS

The results have demonstrated that statistically significant convergence in health care expenditure and health outcomes occurred in the present countries of the EU over the period 1960-95 for σ-*convergence* and 1980-95 for β-*convergence*.

The first method tested for a reduction in standard deviation of the standardised values, around a mean of 100, which is equivalent to examining the coefficient of variation and overcomes the problems of changes in magnitude in variables over time. This method, however, has some limitations in that it looks at the data cross-sectionally at discrete time intervals and cannot determine if countries approaching the mean will reduce their rates of growth in order to follow a parallel path with the mean. This limitation is overcome by regression to the mean analysis, indicated by a negative value for β in the regression models used. The use of panel data also minimises the influence of inconsistent trends between points of analysis and outliers. As such both approaches are informative and complement each other in understanding the concepts of convergence analyses. The analyses presented here have also revealed which countries have produced such trends.

The results for health expenditure have shown that the countries of the Southern Mediterranean have been prominent in improving their expenditure levels over the periods of analysis and these have generally been associated with improvements in health outcomes, particularly in infant mortality rates. At the same time, the relative strengths of these countries' economies have revealed that although at a policy level (share of GDP) they are converging upwards towards the EU mean there is less of an impact at the *per capita* levels, although convergence is also maintained for this variable.

In contrast, countries of the North, Particularly Sweden and Denmark, have achieved greater control over their health expenditures and have converged markedly to a position on or below the EU mean over the period of analysis. Other countries, such as the UK, have also exhibited downward trends in their health expenditure levels but these have not been as great as those of the Scandinavian countries which have come down from much higher levels. In a similar manner health outcomes for those countries reducing their health expenditures have experienced worsening health outcomes in relation to the EU mean, although in absolute terms trends for these countries have continued to improve but with a diminution in advantage over the EU mean value.

When examining correlations between health expenditure and health outcomes the expected signs were achieved with a much higher correlation for infant mortality. The findings suggest

that infant mortality reduces with increasing health care expenditure and life expectancy for females increases. The correlation for male life expectancy, however, suggests little impact. It must be noted, however, that this association will need further regression analyses to establish a causal link and most studies in the past have failed to establish such a relationship.

In terms of explaining the results three factors were explored. The well-established link between income and health care expenditure in the context of convergence throughout the EU in GDP income confirms the predictions of the neo-classical growth model. This is the theoretical base of the study and is anticipated to be highly relevant to the countries of the EU which have a high degree of homogeneity in relation to technology and social structures, which, coupled with the freedom of movement of the factors of production and mechanisms for the re-distribution of wealth, tend to be drivers for greater convergence through a process of increasing integration.

For three countries which have contributed greatly to the observed convergence in health expenditure the reforms of the 1970s 80s and 90s were examined. Sweden has achieved effective reforms that have benefited from moves towards central planning and budgeting. In contrast, Spain and Portugal (to a lesser extent Greece), have increased their expenditure levels as a share of GDP towards the EU mean although these increases have not been met with such dramatic increases in *per capita* spending. Over the same period Luxembourg has achieved *per capita* spending levels well above its associated percentage of GDP spending. This point reveals an important finding of the analysis in that the relative strengths of currencies' purchasing power and the size of GDP in relation to population affect *per capita* spending figures.

In terms of reforms, even though the specific response has varied from country to country the same fundamental objectives have been evident, namely the need to contain costs, increase efficiency and raise service standards. Some countries with the characteristics of strong government in terms of decision-making, such as Sweden and the UK, have been able to introduce radical market reforms in a relatively short space of time which has led to the label of 'big bang' being attached to them. Sweden, with its bottom-up approach, has achieved effective control of its health care expenditure and has gone from being at the top of the tree in 1960 to a position just below the EU mean in 1995. Other countries with consensus governments, such as the Netherlands, have adopted an incremental approach which has resulted in a slower process in terms of implementation. In contrast, a number of countries have had a good deal of catching up to do and have increased their expenditures accordingly, noticeably the countries of the Southern Mediterranean.

The findings also suggest that greater convergence will occur in the future when greater equality in relation to the purchasing powers of EU currencies is achieved, which may well be a consequence of the process of Economic Monetary Union (EMU). The question of inequalities in GDP wealth remains a barrier to greater convergence due to the strong correlation between GDP and health care expenditure. For policy makers, the question of system typology should also not be ignored as previous analysis has shown an association between health care spending and NHS or social insurance models of delivery (Nixon, 1999). Over the period studied, the number of countries adopting NHS modes of delivery has increased (Italy, Spain, Portugal and Greece).

From a societal perspective the measurement of convergence in social welfare provision such as health care is by no means a futile exercise as its presence tells us that things are becoming more similar over time, which implies a greater degree of equality and integration is being achieved within the countries of the EU. However it remains to be seen if this is due to or in spite of EU social policy on health care as many countries have not been members of the EU throughout the period examined, no overt policy exists in terms of EU health care, and subsidiarity remains the guiding principle. However, the analyses conducted here show the relative positions of countries with respect to the EU mean and provides an indication of how greater cohesion can be achieved, perhaps aided by current and future measures that re-distribute wealth or resources within the EU. Further research will attempt more closely to identify economic and policy measures which have had an influence on the convergence demonstrated in this analysis. The methodology adopted here would be suitable for a wide range of applications in relation to analyses examining social and economic trends towards equality.

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