State size as measured in terms of public spending and world health, 1990-2000

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(Tamaño del Estado [gasto público] y salud en el mundo, 1990-2000)

Abstract

Objective: To determine the relationship between state size (measured in terms of public spending) and public health indicators in a sample of countries representing all regions of the world and from 1990-2000.

Methods: An ecological study was performed using data on Central Government Spending (CGS) and per capita Gross National Product (GNP) obtained from the International Monetary Fund, and on life expectancy, maternal, and infant mortality, provided by the World Health Organization. A multiple linear regression model was fitted to estimate the effect of CGS on health, which also took into consideration per capita GNP and geographical region.

Results: CGS varied little over the study period, with convergence around an average of 28%, but within a relatively wide range (7.80-53.0%); the countries with the strongest economies (according to per capita GNP) had the highest levels of CGS. The influence of this factor was particularly relevant for the infant mortality rate (r = 0.40; beta = −1.327; EE = 0.237; t = −5.590; p < 0.001). Per capita GNP and geographic location were also associated with variations in health; health indicators tended to be worse for poorer countries in Africa and Asia. In the adjusted model, CGS was statistically significant with regard to infant and maternal mortality rates.

Conclusion: The study suggests that state size (in terms of public spending) has an important influence upon health and particularly upon mortality. Although it is important to bear in mind the limitations of this study and the reduced time window used, these results should be taken into consideration in the current political and epidemiological debate.

Key words: Health. State. Public spending. Globalization. Ecological study.

Resumen

Objetivo: Determinar la relación entre el tamaño del Estado (medido como el gasto público) y los indicadores de salud en una muestra de países de todas las regiones del mundo, en la década de los noventa.

Métodos: Se realizó un estudio ecológico a partir de datos sobre gasto gubernamental central (GGC) y producto interior bruto (PIB) per cápita, obtenidos del Fondo Monetario Internacional, y de esperanza de vida, mortalidad materna y mortalidad infantil, de la Organización Mundial de la Salud. Se construyó un modelo de regresión lineal múltiple, para estimar el efecto del GGC sobre salud, y se introdujo también PIB per cápita y región.

Resultados: El GGC varía poco durante el período estudiado, convergiendo alrededor de una media del 28%, pero aún dentro de un amplio rango (7,80-53,0%); los países con economías altas (según PIB per cápita) presentan mayor GGC. Su efecto tiene especial importancia sobre la mortalidad infantil (r = 0,40; beta = −1,327; EE = 0,237; t = −5,590; p < 0,001). También el PIB per cápita y la ubicación regional se asocian a los cambios en salud, coincidiendo con el empeoramiento de los indicadores de salud en algunos países pobres de África y Asia. En el modelo ajustado, el GGC mantiene la asociación estadística con mortalidad infantil y mortalidad materna.

Conclusión: El estudio sugiere un efecto importante del tamaño del Estado sobre la situación de salud, específicamente sobre la mortalidad. Aunque tienen limitaciones, dada la reducida ventana temporal utilizada, estos resultados deben ser considerados en el debate político y epidemiológico actual.

Palabras clave: Salud. Estado. Gasto público. Globalización. Estudio ecológico.

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Introduction

The ideal size for the state has always presented theoreticians of social politics with difficulties of definition[1,2] and recent studies have tended to measure this concept as the percentage of public spending with relation to Gross National Product (GNP[3]). For over 20 years now, one sector of world opi-

nion has insisted on the need to reduce this ratio in order to promote more efficient management and improve economic performance[4]. Various international economic organisms such as the World Bank and the International Monetary Fund have even incorporated demands for reductions in public spending into their policies[5]. Other points of view maintain that the quality associated with the processes is more important than actual state size[6,7].

There are few references in the literature dedicated to state size, downsizing and the public sector. When searching the Ecolit, Medline, and Francis data bases for references to reductions in public sector and health spending over the past 10 years [(government expenditure OR public cost OR public expenditure) AND (public sector and health and downsizing)] we found references to: the crisis of the Welfare State as a consequence of globalization and its influence upon reductions in the size of the public sector[8]; the effects of global changes on employment stability[9], and the sensation of insecurity that they produce and their repercussions for health[10], and/or for safeguarding health[11]; more specific aspects in some works, including the implications of financial policies and other public sector spending cuts on health service reform in some countries[12,13], and on the mechanisms implemented by the institutions themselves to make their spending more efficient[14]. Other effects of the reduction of the state's role in public medicine referred to its psychological consequences[15], gender-related differences[16], and its consequences for the labour force, the economy and the relationship between the public and private sectors[17]. Other more general and theoretical analyses looked for indicators capable of showing the influence of globalisation and the liberalization of trade and finance on health[18].

The social sciences and epidemiology should support the management of public policies, explore connections between health indicators and macroeconomic determinants, and provide research results to enable well-informed decision-making. To date, however, few have taken into account global factors and their links with health. We therefore have only a few important approximations in the financial field, with examples such as the study carried out by the Commission of Macroeconomy and Health of the World Health Organization[19].

In the words of Beck, globalisation corresponds to "the processes through which sovereign states interact and, through the actions of trans-national agents and their respective possibilities, establish a series of different orientations, identities and networks[20]". According to the same author, the world market effectively ousts or substitutes the political role of the state. This is why research into public health should advance more along the lines of searching for indicators capable of relating changes in the role of the state or its public component (as a result of globalisation) to changes in health.

It has only been traditional to evaluate the effect of public and private spending on health, and the same has also been true of spending on education. However, during the last decade numerous studies have emerged that have sought to investigate the influence of public spending on health and expenditure on national health[21,22], its relationship with health sector reforms[23], the development of accounting systems to help improve the efficiency of health organizations and the health sector[24,25], and how to ensure health[26]. Nevertheless, some researchers have found that the impact of public spending on health is very small in comparison with other socio-economic factors such as per capita income, inequalities in the distribution of income and levels of education[27]. Very few investigations, however, have related total state or central government expenditure, or the implications of reducing their global role in the public sector, to its effects on the health of the population, which is what we intend to do here. Thus, our desired objective was to determine the relationship between state size —as expressed in terms of central government spending and measured as a percentage of its GNP— and a series of health indicators for a sample of countries from various parts of the world, based on data relating to the final decade of the 20th century.

Methods

An ecological study was carried out that established country categories that enabled internal comparisons to be made with respect to central government spending and per capita GNP (pc GNP) and which facilitated analysis of the behaviour of selected health indicators for these countries with respect to chosen socio-economic indicators and the region.

Population and Sample

For reasons of convenience, a sample of 90 countries was considered (table 1). These countries represented all regions of the world and belonged to a group of countries for which CGS information was available for the last decade[28]. The sample included 19 developed countries (D), 8 in economic transition (ET) and 63 developing countries; of the latter, 24 were located in Asia and Oceania (AO), 21 in Latin America and the Caribbean (LAC), and 18 in Africa (A).

Sources of Information

Data corresponding to CGS and pc GNP were obtained from a report by United Nations experts[28] and of-

Table 1. Countries Studied According to World Regions, Period 1990-2000

Developed	In Economic Transition	Asia and Oceania	Latin America and the Caribbean	Africa
Australia	Belarus	Bhutan	Argentina	Botswana
Austria	Bulgaria	China	Bahamas	Burundi
Canada	Czech Rep.	Cyprus	Bolivia	Dem. Rep. Congo
Denmark	Estonia	Fiji	Brazil	Egypt
Eire	Hungary	India	Belize	Ethiopia
Finland	Lithuania	Iran	Chile	Gambia
France	Poland	Israel	Columbia	Ghana
Greece	Rumania	Jordan	Costa Rica	Kenya
Iceland		Kuwait	Dominican Rep.	Madagascar
Luxembourg		Lebanon	Ecuador	Mauritius
Malta		Malaysia	El Salvador	Morocco
Netherlands		Myanmar	Grenada	Namibia
New Zealand		Nepal	Guatemala	Rwanda
Norway		Oman	Mexico	Sierra Leone
Spain		Pakistan	Nicaragua	South Africa
Sweden		Philippines	Panama	Tunisia
Switzerland		Rep. Korea	S. Vicente and Grenadines	Zambia
UK		Singapore	Trin. & Tobago	Zimbabwe
USA		Sri Lanka	Uruguay	
		Syria	Venezuela	
		Thailand	West Indies	
		Turkey		
		Arab Emirates		
		Yemen		

Source: United Nations Organization[28].

ficial statistics provided by the International Monetary Fund[29]. The health indicators were obtained from the United Nations Development Program[30] and from the World Health Organization. Data relating to these indicators was collected for years between 1990 and 2000, although availability varied from year to year (the years offering the most complete CGS information were 1990 and 1997). Data for the respective periods was first obtained for CGS and then for health.

Indicators

State size was measured from CGS as a percentage of GNP. CGS included not only social expenditure (health, education, social security, pensions, subsidies, etc) but all government expenditure, investment, and transfers. Other indicators were also taken into consideration, including pc GNP (expressed in American dollars/ inhabitant/ year) and region, because they constitute potential confounders.

The region was registered in the study according to an international classification of countries according to their socio-economic conditions within a global structure, as described in the report made by United Nations experts[28]. In this way, they were defined as developed countries, countries in economic transition and

developing countries, with the latter group being further sub-divided on the basis of geographical location. Specific indicators were sought to reflect health: life expectancy (expressed in years), infant mortality (per 1,000 live births), and maternal mortality (per 100,000 live births).

Statistical Analysis

With the aid of the SPSS statistics package for Windows, we conducted an exploratory analysis of the pc GNP and the evolution of CGS as a percentage of GNP. The latter variable was measured in two ways in the study: as a continuous variable and as a categorical variable. State size, taken as a categorical variable, was measured by grouping countries according to CGS [*average*, those whose values were close to the average CGS (28%) ± a standard deviation (11); *small*, those whose values were below this range; and *large,* those with values above it].

Data were analysed taking into account the whole period and CGS relationships were estimated with respect to each of the public health indicators (dependent variables) by means of correlation coefficients and linear regression coefficients. Finally, the multiple linear regression model was applied in order to independently estimate the effect of CGS on each of the health indi-

cators (life expectancy, infant mortality, maternal mortality), making evaluations according to the coefficient of determination (R^2). The pc GNP, CGS, and region were introduced into the model according to the backwards method, being entered as continuous variables; the region was transformed into 4 dummy variables due to its qualitative condition, with the condition of the most developed region (D) being compared with each of the others. Finally, the performance of the health indicators was analysed, with comparisons being made by groups of countries, according to state size categories within each of the regions.

In all cases in which the multiple linear regression models were adjusted, the assumptions and conditions of the regression were evaluated on the basis of an analysis of residuals, as were normality, linearity, homocedasticity, and non-auto correlation. These requirements were fulfilled in the majority of cases, except that of life expectancy, for which it was necessary to carry out logarithmic transformations, although the effects showed little variation. The ANOVA regression test was also applied (see statistics in results).

Results

Descriptive Analysis

Table 2 presents a summary of data relating to the indicators studied in the 90 countries selected. Extreme values for the health indicators analysed in the study period ranged from 3 (Sweden, Switzerland) to 180 (Sierra Leone) for infant mortality, with an average of 39 per 1,000 live births and from 1 (Greece) to 1,800 (Tunisia) for maternal mortality, with an average of 216 per 100,000 live births. Life expectancy oscillated between 37 (Sierra Leone) and 79 (Sweden) years, with an average of 67 years.

Table 2. Behaviour of the Indicators Studied in 90 Countries, 1990-2000

	CGS[a]	Per Capita GNP[b]	Infant Mortality[c]	Maternal Mortality[d]	Life Expectancy[e]
Average	28	5,717	39	216	67
Standard deviation	11	7,573	37	348	11
Minimum	6	97	3	1	37
Maximum	69	28,114	180	1,800	79

[a]Central Government Spending as a percentage of Gross National Product.
[b]Gross National Product per capita (in USA dollars/inhabitant/year).
[c]Infant Mortality Rate = deaths of children under one year old for every 1,000 live births.
[d]Maternal mortality rate = maternal deaths for every 100,000 live births.
[e]Life Expectancy = expectation of life at birth, in years.

CGS converged, at the end of the period, towards an average value of 28% (s = 10.3; cv = 36.8%), but there was still a wide range (7.8-53.5%) from country to country. Within the decade studied, extreme values ranged from 5.7% for Sierra Leone to 69.3% for Kuwait. The countries with some of the highest CGS values (more than 50%) included France, Bulgaria, the Netherlands, and Hungary; those with the lowest (less than 10%) included Nicaragua, China, Columbia, Myanmar, Guatemala, and the Republic of Congo.

There was a statistically significant relationship between CGS and the region, with a different state size being obtained for rich countries and a smaller one for poorer countries. On examining the respective economies on the basis of pc GNP, it was found that the countries with the highest indexes of wealth also had the greatest CGS values.

The differences between countries with respect to pc GNP were considerable, with values ranging from a minimum of 97 dollars in the Democratic Republic of Congo to a maximum of 28 114 dollars in Switzerland: the average value for the whole study period was 5,717 dollars.

Relationship Between Socioeconomic Indicators and Health

A relationship was found between the independent variables; CGS and pc GNP and the health indicators. In a primary exploration, employing simple correlations, changes in health were assumed to show a greater relationship with pc GNP than with CGS, although both showed a certain degree of correlation.

On applying the simple linear regression model to the aggregate data from the study period, statistically significant relationships were revealed ($p < 0.001$) between CGS and the indicators of life expectancy (r = 0.30; beta = 0.283; EE = 0.069; t = 4.120), infant mortality (r = 0.40; beta = −1.327; EE = 0.237; t = −5.590) and maternal mortality (r = 0.27: beta = −8.088; EE = 2.419; t = 3.343).

On adjusting the multiple linear regression models (table 3), we observed that the three explanatory variables (CGS, pc GNP, and region) showed a significant linear relationship for *infant mortality* ($p < 0.01$). The influence of the region only proved highly significant when comparing developed countries to African countries. On adjusting the effects of the explanatory variables for *maternal mortality*, associations of pc GNP, and CGS with respect to the region remained significant (for developed countries compared with Africa) within the model ($p < 0.01$). For *life expectancy*, the coefficient of determination for the complete model was the highest obtained in the study, but the CGS effect was lost (non-significant coefficient), while the pc GNP effect and region effect persisted (comparing developed and African countries). Figure 1 compares the health indicators, accor-

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Table 3. State Size and Health in 90 Countries (1990-2000). Linear Regression Models Adjusted for Per Capita Gross National Product and Region

Indicator	Model*	
	Coefficient of Association (B)	Coefficient of Determination (R²)
Infant mortality, per 1,000 live births	−0.795 · GGCª	$R^2 = 0.590$ (DW = 1.8; F= 73.419; $p < 0.001$)
Life Expectancy, years	+0.110 · GGC	$R^2 = 0.632$ (DW = 1.341; F = 53.309; $p < 0.01$)
Maternal mortality, per 100,000 live births	−5.695 · GGCª	$R^2 = 0.394$ (DW = 1.847; F = 16.899; $p < 0.001$)

ªThe coefficients marked in the model are statistically significant, $p < 0.01$. CGS indicates Central Government Spending.

ding to their regions and state sizes, aggregated for the period 1990-2000. Additionally, the study suggests a closer relationship between CGS and the health indicators in the poorest countries.

Discussion

In most countries the values fluctuate between 10% and 40% of GNP: these data coincide with those of World Bank[5] and the Inter-American Development Bank[31]. The most interesting aspect is the tendency for convergence with the world average observed in all regions, although the relationship between state size and region is maintained, with this being greatest in the rich countries and smallest in the poorest ones.

Thanks to the multiple relationships of CGS, state size as examined here suggests important connections between the state and health, in some cases with interaction with the region to which these countries belong and to the distribution of wealth among them, with obvious disparities, as also shown in other analyses[32].

The association between the region and pc GNP with health coincides with trend previously described in other analyses[33]. However, we must add to this the great variability observed between countries, which may possibly be related to state size. The effect of CGS (linear regression model) is particularly important for infant mortality, although it also demonstrates a high degree of association with infant mortality.

In the multiple linear regression model adjusted for pc GNP and region (table 3), it is much easier to observe the effect of state size on health: the increase in CGS is related to an increase in life expectancy and to a decrease in infant mortality and maternal mortality, with the greatest change being associated with the latter indicator, which is also statistically significant, as in the case of infant mortality. Apart from other possible analyses, this finding alone should prompt us to recommend actions aimed at improving government spending destined to promotion of impacts favourable to health indicators.
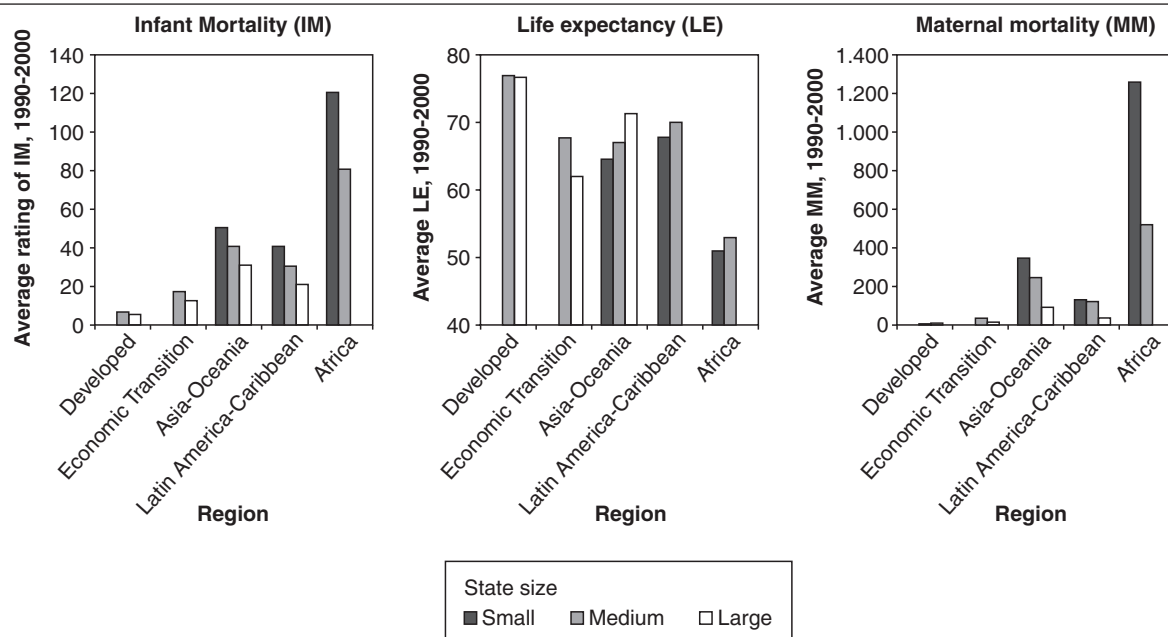
Nevertheless, the data presented in figure 1 show a somewhat paradoxical effect in the countries with the largest state size (developed countries and countries in the process of economic transition): here life expectancy shows a non-linear relationship with state size, with it being lower in larger states than in those of average size. This may suggest, on the one hand, that an increase in state size does not have a uniform effect on the health indicators in all regions, and on the other, that there may be an optimal state size, beyond which health conditions may be negatively affected. Furthermore, a more favourable relationship between state size and health can be observed in the poorest regions (in the case of infant mortality in African countries and maternal mortality in developing countries).

Nevertheless, it should be borne in mind that state size not only includes within its structure a number of factors such as education, health, and social security, which have been positively associated with health, but also military expenditure and other factors which may be counterproductive or may even confuse the analysis.

Other investigators have attacked the unfavourable effects of reductions in state spending on economic, financial, and health aspects, countering that it is possible to achieve economic growth even when maintaining policies of equity and parity[34,35]. Other authors conclude that if countries reduce their public spending they damage their basic indicators of health and education, associating these changes with the politics of globalization[36-38]. In this sense, other investigations—which like the present research—also explore the indirect implications of globalization, state size and the influence of the Welfare state on health, and which—as some have already done—identify links between other sectors of welfare and macro economy, will eventually prove important[39].

In summary, there is reason to affirm that state size is important, as opposed to the aphorism that "a minimal state is the biggest state that can be justified[40]". For other authors, the state is the main collective agent for guaranteeing social well-being, for ensuring equity of access to services and for overcoming the obstacles that impede this[41-43]; although its effectiveness in resol-

Figure 1. Health indicators[a] according to world regions and state size[b], 1990-2000.

aLife Expectancy, in years; Infant Mortality for every 1000 live births; Maternal Mortality for every 100 000 live births.
bEquivalent to Central Government Spending, measured as a percentage of GNP and grouped into 3 categories.

ving problems relating to the economy and society is not solely dependent on its size. Research into health may shed more light on currently undiscovered relationships between the dimensions of the state and social and health indicators and thereby help to resolve some of the political disagreements that still persist with respect to this question.

The present study has certain limitations such as the reduced time window and the fact that it did not take into account certain other variables that can influence the use of public resources, such as the payment of the external debt. Similarly, it was not possible at this stage of the study to consider the typology of the states considered: this is undoubtedly a factor that conditions their size and influences upon health and development. In order to establish a more precise relationship between public spending and health indicators, in the future, it will be necessary to consider a longer time period.

There is not sufficient data available for countries considered with reference to the basic indicators, nor for all the years considered. This is a consequence of a combination of poor recording and/or problems of availability, even when the data in question comes from official sources. This situation, which is particularly dramatic in the case of maternal mortality[44], could have had a certain affect upon the results obtained.

Furthermore, it cannot be ignored that studies based on national averages often mask many important regional and sub-regional disparities within coun-tries, particularly with regard to gender, ethnic group, social capital, social class, and income. These factors need to be studied in greater depth. Likewise, it is to be hoped that by breaking data down into still finer detail, for example internally by regions or sub-national regions, it should be possible to discover other kinds of relationships between government spending and health which perhaps remain hidden in the present study. The exclusion from this study of some countries from the former socialist bloc such as Cuba and Russia may have negatively influenced the results obtained, reducing the expected effect in favour of the hypothesis, as they are large states with, traditionally good health indicators.

In conclusion, the estimated correlations reflect an important influence of state size upon health, whether analysed independently or adjusted for other variables. In spite of the evident inter-relationships between government spending, pc GNP and the region, the multiple linear regression model showed the relationship between state size and health indicators. However, this conclusion needs to be verified by further social research and needs to be put to good use in order to enrich the current political and epidemiological debate.

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