

Mechanisms to promote inter-regional equity in the finance of the National Health
Service in Spain

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Abstract

Regional governments in Spain have considerable autonomy for the provision and financing of health care and other public services. The Act of 2001 set up redistributive transfers (fondo de suficiencia) between regions to ensure that at least a minimum level of basic common services could be provided to each citizen, weighted for need. This article develops an economic model of the financing of public services in Spain and examines whether this system of redistribution has continued to maintain equity since its establishment, given variation in rates of economic and demographic growth between regions.

The results indicate that the system of transfers established in the Act of 2001 has not kept pace with changes in the distribution of population needs and economic activity in Spain. Assuming that need matched finance in all regions in 1999, we calculated the Gini coefficient in 2005 to be 0.018. However, this summary measure may obscure the magnitude of changes for individual regions. To maintain equity of health care provision in 2005 compared with 1999, transfers from the sufficiency fund would have to increase faster than national economic growth in Valencia, Canarias, Cataluña, La Rioja and Murcia, and increase slower than national economic growth in Cantabria, Aragón, Extremadura, Asturias, Castilla y León and Andalucía. Contributions to the sufficiency fund by Madrid and Baleares would need to reduce over time. These results are based on a very simple aggregate model of public finance. Further, more detailed work is needed to verify the findings, to construct a robust formula that reflects relative need for health-care services, and to clarify how the sufficiency fund will operate if rates of economic growth are negative.

Introduction

The system of public finance established in 2001 gives regional government considerable autonomy for the provision and policy making of most types of health care. Regional governments also have some autonomy over their sources of finance. From an economic perspective, a primary objective of decentralisation is to enable local communities to shape the financing and provision of local services closer to their preferences (Oates 1972). The theory of fiscal federalism suggests this ought to increase the efficiency of public services if, for example, local government has better information about local needs, opportunities and constraints than a remote central purchaser. However, there are several reasons why we might also expect decentralisation to be accompanied by increasing inequity between regions. Fiscal autonomy implies that regions have the power to set their own tax rates and/or use tax revenues raised from local citizens and businesses to provide local public services. Local governments experience wide variations in health needs and revenue sources, indeed, high health needs and small tax bases often coincide. If public services in each area were entirely financed from taxes raised by local governments then this might lead to wide variations in services and a flight of mobile citizens from disadvantaged areas (Levaggi and Smith 2005) or lead higher-income citizens to opt-out of public services into private provision, with the risk that political support for high-quality universal public services is undermined (Hall 1998). Consequently, one of the key objectives of central government in a decentralised system is to mitigate this geographical divergence by means of transfers from low-need, high income regions to high-need, low income regions. The aim is to balance the efficiency benefits of decentralisation against equity concerns, so that each region has sufficient autonomy to respond to local preferences and needs, but sufficient revenue to maintain some kind of minimum level of public services in each region. Furthermore, central government has a role to monitor and regulate this system of transfers over time, to ensure that system continues to meet its objectives for efficiency and equity.

This article examines the mechanisms to promote inter-regional equity in the finance of health care services in Spain. Firstly, we describe the decentralised system established in 2001. Second, we develop a theoretical model of the financing and demand for

public services. Thirdly, we examine the empirical evidence to determine whether equity has been maintained over time (*suficiencia dinámica*).

The system for financing public services in Spain

Responsibility for providing health care, social services and education has been devolved to the autonomous regions of Spain (*comunidades autónomas*) since 2001 (Law 21/2001 of 27 December). 15 of these regions are financed under a system known as the common regime (*régimen común*), which is the focus of this article. The remaining 2 regions (País Vasco and Navarra) are funded by a special and separate system (*régimen foral*).

Basically, the two main sources of finance of regional governments are taxes and transfers from central government (Table 1), although regional governments also have some discretion to borrow. Taxes can be categorised into autonomous revenues (*ingresos propios*), devolved revenues (*ingresos cedidos*) and shared revenues (*tributos compartidos*). Autonomous sources are those tax bases over which the Constitution of Spain grants regional governments the discretion to choose any tax rate, administer collection of revenues and keeps the proceeds in full. Devolved sources are those tax bases over which the central government decides the tax rate, but for which regional governments manage collection and keeps all the revenues. Exceptionally, collection of income tax is included in this category although it is administered centrally and regional governments have some discretion to impose an additional component over and above the national rate. Finally, shared sources are those which the central government sets the tax rate and manages collection, but has ceded a proportion of the proceeds to regional government.

Transfers from central to regional government can be conditional or unconditional. Unconditional grants are grants carrying only general provisions on the ways in which revenues are to be spent by recipient governments. Health funds with specific conditions, with which central government can influence health planning include the Temporary Disability Savings Program Fund, the Health Cohesion Fund, and funds to finance various capital projects. The shared revenues are considered unconditional

transfers, as central government has no discretion in their distribution. The other unconditional transfer is the so-called sufficiency fund (Fondo de Suficiencia). This transfer is the main mechanism that central government uses to promote inter-regional equity of financing and delivery of public services, and is the focus of this article.

The sufficiency fund.

The sufficiency fund is a series of transfers from high-income, low need regions to low-income, high need regions, managed by the central government. The relevant tax revenue of a region was re-calculated in a base year (1999) as if it were at a common rate for all regions. This is a so-called ‘standard rate’ or hypothetical rate (financiación normativa), rather than the actual rate (financiación efectiva) which for autonomous revenue may differ from region to region. This maintains the principle that regions have fiscal autonomy to set their own tax rates for autonomous revenues and spend the proceeds according to the preferences of their voters. The objective of the sufficiency fund redistribution is to ensure that regional governments have a level of funding, calculated at standard national tax rates, at least sufficient to meet a defined level of need, calculated according to a standard national formula. The sufficiency fund promotes a principle of vertical equity of financing between regions, that is, regions with higher tax revenues contribute more to the fund, and of horizontal equity of provision, that is, Spanish citizens are entitled to the same basic access to health-care depending on their need regardless of where they live (Van Doorslaer 2000; Hurley 2000).

The transfer was calculated for each region as the difference between the amount of funds required to meet these basic needs and the amount of funds available from tax revenues in the region, calculated at the standard rate in a base year, 1999 (see Table 2). It can take a positive or negative value, depending on whether the calculation of needs exceeded or fell short of standard-rate revenues in 1999. In the latter case, the transfer is from the region to the centre.

The total need for public services in each region is the sum of need for health-care, social services, and other services (mainly education). The focus of this article is on

health-care. A description of the needs formulas for other public services can be found in de la Fuente (2007).

The relative needs index D_i/D for health-care expenditure in region i can be represented as:

$$D_i / D = \alpha_{0i} + \alpha_1 P_i^P / P^P + \alpha_2 P_i^{65} / P^{65} + \alpha_3 I_i / I$$

where P_i^P is the population covered by the health system (población protegida), defined as the total population excluding civil servants and their families who are covered by a separate insurance system. P_i^{65} is the regional population over 65 years of age. I_i is the distance from the mainland of the two island regions (Balears and Canarias) and zero for other regions.

$$P^P = \sum P_i^P ; P^{65} = \sum P_i^{65} ; I = \sum I_i , \sum \alpha_{0i} = 0 ; D = \sum D_i$$

D represents the total expenditure that the central government has identified is required to meet a standard definition of need for health care for all Spanish citizens, in the base year 1999. In common with most other capitation systems, this quantity is a political decision by parliament or the executive. The needs formula is a mechanism for sharing this quantity between the regions in an equitable manner. The index D_i/D represents the share of total national health expenditure calculated for region i in the base year of 1999. The needs variables (eligible population, population over 65 and distance of island from mainland) in the 2001 finance formula do not appear to have been identified using an empirical model (Montero 2007). The value of the weights are $\alpha_1=0.75$, $\alpha_2=0.245$ and $\alpha_3=0.005$, and again there is no empirical study supporting these coefficients. Montero et al. used data from the Spanish Health Survey of 1999 to see if *post-hoc* empirical evidence supported these weights, and concluded that at the regional level of aggregation, an unweighted capitation per person gave similar results to the weighted capitation formulas that they tested (Montero 2007). However, in this article, we assume that the weights represented a fair (that is, equitable) political settlement in 1999, even if they are not supported by empirical data. The political settlement of 2001

also included some ad-hoc adjustments to the calculation of needs that were not supported by a capitation formula (de la Fuente). These are represented by the coefficient α_{0i} in the needs formula, and vary between regions. The health needs shown in Table 2 includes the shares from the capitation formula and these ad-hoc adjustments.

For the base year, 1999, the sufficiency fund transfer to or from each region ensures that the needs of each region (as defined by the formula, plus some ad-hoc adjustments) are equal to the tax revenues (calculated at a standard rate) plus or minus the transfer. The principle that regions have fiscal autonomy was maintained by calculating tax revenues at standard rate. Regions are able to set autonomous tax rates to collect greater tax revenue and provide more services if they wish, without losing central government transfers. Devolved and autonomous regional fiscal powers meant that, in 1999, actual revenues exceeded 'standard' rate revenues by on average 4.4%, by 13.5% in Baleares and 17.8% in Canarias, islands which have been granted atypical fiscal rights (de la Fuente 2007).

A surprising aspect of the Spanish regional finance is that the transfer is increased at the same rate each year (*normas de evolución*) in all the regions with a positive transfer, regardless of the population or level of income or the changes in other sources of finance in that region. In this respect, the system is not strictly a capitation system, as the transfers are only related to the population in 1999, and not to subsequent years. The rate of increase of the transfer is set at the same rate as the average growth of national tax revenues for that year, known as the *Ingresos Tributarios del Estado* or ITE. For regions where the transfer is negative (Baleares and Madrid), the rate of 'increase' (that is, of the absolute value, ignoring the sign) is the minimum of the rate of growth of the national tax revenues and the growth in tax revenues for that region.

Additional funds (*asignaciones de nivelación*) are only considered in exceptional circumstances, that is, if the growth of either the number of school children or of the population covered by the health system in a region is more than three percentage points greater than the growth in the national rate. However, regional government should in these circumstances apply for additional transfers, and there is no specific budget set aside for this purpose, nor a guarantee that any transfer will be made. There

are no circumstances that would cause the transfer to be reduced in absolute size, either for regions with positive or negative transfers. Growth of GDP and tax revenues has been positive in all years since 2001 to 2007. It is not clear what would happen in a year of negative growth of taxes, for example, in a recession.

The design of this system means that finance available to each region will drift away over time from the normative equity principles established in the base year, that is, total revenue in each region will exceed or fall short of relative need as defined in 1999. The aim of this article is to investigate whether this has occurred for health services. In principle, one could recalculate the needs indices for each region for health care, education and other services in, say, 2005 using the same formulas as 1999, calculate all the tax revenues at the standard rate, and quantify whether the sufficiency fund exceeds these needs or falls short for each region. This would require examination of the needs formulas for all public services, and this is beyond the scope of this article. Instead, we propose a simpler method to examine inter-regional equity of provision of health services. We compare growth rates for each needs variable, the tax base and transfers in each region with the national average to see whether a region has maintained a position of relative equity, compared with its position in 1999.

This article will compare how equity in the funding of health services may have changed between regions between 1999 and 2005, by defining *relative* need according to the funding formula of the Finance Act of 2001. It does not draw any conclusions about whether the *absolute* level of funding for health services in Spain is efficient, that is, sufficient to meet the objectives of the public sector. Nor does it draw any conclusions about whether access to health services within regions is efficient or equitable. Capitation formulas are mechanisms for distributing a given amount of funding between the regions. Other mechanisms must be used to ensure that these funds are used appropriately (Levaggi R and Smith PC 2005).

In the following section we develop a theoretical model to provide a framework for the empirical analysis.

Theoretical model of health care finance

We develop a theoretical model of the health-care finance system established in Spain in 2001. This identifies the key variables in the system, the relationships between them, and how they may evolve over time. The model is used as the basis for the empirical analysis in the following sections.

Health needs formula

We amend slightly the relative health needs index D_i/D of region i compared with the formula used in the Finance Act of 2001:

$$\frac{D_i}{D} = \alpha_1 \frac{P_i}{P} + \alpha_2 \frac{P_i^{65}}{P^{65}} + \alpha_{0i}$$

We simplify the 2001 finance formula by ignoring the adjustment for the distance of islands from the mainland. Because this is constant, this should not affect how equity of finance between regions evolves over time which is the focus of this article. We assume $\alpha_1=0.75$ and $\alpha_2=0.25$.

We assume that the central government decides the total amount of funding for public services that is considered sufficient for needs (N), and will be redistributed between regions by the sufficiency fund. Table 2 showed that in 1999 this was set at 53.325€m and 41.2% was on health services. We assume that the share (h) of this total allocated to health ($D = hN$) and other public services ($O = (1-h)N$) remains constant over time.

$$N = D + O$$

$$D = hN$$

$$O = (1-h)N$$

Sources of finance

The sources of finance for public services to region i are taxes on the local population and transfers from central government. In order to calculate the transfer, the 2001 finance formula specifies that central government should recalculate the regional revenue as if it were at standard national tax rates. This quantity excludes autonomous revenues and devolved revenues where the regional government has departed from the standard rate.

In our simplified model, we assume the average and marginal standard tax rate for funding public services is τ , a constant, and that τ is the same for all regions and for central government receipts. The revenue of a region i to fund all public services is the sum of taxes on economic activity in the region that is not transferred to the centre ($b\tau Y_i$), plus transfers received from the centre (T_i).

$$S_i = b.\tau.Y_i + T_i$$

where

S_i is the regional revenue calculated at standard national rates

τ is the average proportion of national income required to provide a basic common level of public services (the 'tax rate' for public services)

b is the proportion of taxes used to fund public services that is raised by regional government, rather than central government

Y is the GNP of Spain in the base year (1999)

Y_i is the GNP of region i in the base year, so $Y = \sum Y_i$

T_i is the transfer to region i (positive or negative) from central government

If the central government is operating a balanced budget for transfers to regions, then for the I regions, the sum of transfers to the regions from the sufficiency fund equals the tax revenues received by the centre that are not ceded or devolved to the regions:

$$\sum T_i = (1-b).\tau.\sum Y_i = (1-b)\tau Y$$

Aggregating S_i over all regions

$$\sum S_i = b.\tau.\sum Y_i + \sum T_i$$

Substituting

$$S = \sum S_i = b.\tau.\sum Y_i + (1-b).\tau.\sum Y_i = \tau Y$$

The proportion of total revenue for public services that a region i receives is

$$S_i/S = (b\tau Y_i + T_i)/S = bY_i/Y + T_i/\tau Y$$

Equilibrium conditions

For fiscal equilibrium, expenditure on public services is funded from tax revenue

$$N = (1/h)D = (1/h)\sum D_i = \sum S_i = S = \tau Y$$

Implying

$$D = hS \quad \text{(equilibrium condition)}$$

where h is the proportion of national public service expenditure allocated to health care

In the base-year (year 0), budget N_i is assigned by central government to public service needs in each region, and transfers T_i are set such that

$$N_i = (1/h_i)D_i = S_i \text{ for all regions } i \text{ in year 0 (equity between regions in base year).}$$

Where h_i is the proportion of funding dedicated to health services in each region

We assume, rather than demonstrate, that the allocations S_i , N_i and D_i in the base year were acceptable politically and consequently equitable. This assumption is normative, in the sense that as the regions agreed to the funding and needs allocation in the base year, then all regions ought by implication to believe the funding formula equitably represents the relative level of need in that region. Further work should be undertaken to devise a funding formula that adequately represents need according to more objective criteria.

Variable b plays no role in determining the central government's calculation of the normative need N_i for public service expenditure in region i in the base year. If $b=0$,

then all tax is collected by the central government and then distributed by the central government to the regions. In this case, $N_i = S_i = T_i$ in all periods and $\sum T_i = \tau Y = N$. This could represent the finance of a centralised system such as the English health authorities, where regions do not collect any independent tax revenues. If $b=1$, then all tax revenues are devolved or ceded to regions. However, in the base year the regions are obliged to share these revenues such that regions whose tax revenues exceed needs transfer funds to those whose needs exceed revenues, so that in the base year:

$$T_i = N_i - \tau Y_i \text{ and } \sum T_i = 0$$

However, we will see that in this system variable b does determine the growth in funds for public services in each region over time.

Dynamic equilibrium conditions

For the health care system as a whole to be in equilibrium, aggregate normative needs should equal aggregate available finance in each year, that is, $S = N$. On a national level, normative need is a political decision about the share of national income to allocate to public services. We assume this share of national income (τ in the model) is constant over the period. As this article is mainly concerned with the equity of funding of health services, we assume that the share of national normative funding (h in the model) allocated to health services is constant. We also assume that the proportion of public service funding allocated to healthcare in each region (h_i in the model) is constant over time, and therefore the ratio h/h_i is constant over time for all regions. If we accept funding as equitable in the base year, then

$$(h/h_i)D_i/D = S_i/S \text{ for all regions } i \text{ in year } 0.$$

With the passage of time, demographics and regional income will evolve, so that equity between regions is not necessarily sustained. We are concerned here with a relative definition of equity, so that each region is considered to maintain an equitable state, relative to other regions, if the change in the health need index is equal to the change in the ability of that region to fund need, either from increased tax revenue or increased transfers. Dynamic equity is maintained for a region if:

$$(d(D_i - h_i S_i) / D) / dt = 0$$

Implying

$$d(D_i/D - h_i S_i/hS)/dt = d(D_i/D)/dt - d(h_i S_i/hS)/dt = 0$$

Therefore

$$d(D_i/D)/dt = d(h_i S_i/hS)/dt \quad (\text{dynamic equity condition})$$

If this is true for all regions then the system is in a dynamic equilibrium with respect to equity, that is, if the growth in need for health care D_i in region i , relative to the national average demand D , is equal to the growth in ‘standard-rate’ revenue S_i for the government of region i , relative to national revenue.

Growth in demand and finance for health care

The growth in need for health-care in region i , relative to the national average growth in demand can be decomposed as (see Appendix for derivation)

$$d(D_i/D)/dt = \alpha_1(P_i/P) (\eta_i - \eta) + \alpha_2(P^{65}_i/P^{65}) (\eta^{65}_i - \eta^{65})$$

where

η is the growth rate of the total population

η^{65} is the growth rate of the over-65 population

The growth in finance for health-care in region i , relative to national average tax revenues, can be decomposed as

$$d(h_i S_i/hS)/dt = b (h_i Y_i/hY) (g_i - g) + (h_i T_i/D) (\psi_i - g)$$

g is the growth rate of national income (GDP)

ψ_i is the growth rate of the transfers to region i (a central policy decision)

Growth rate in transfers

The change in transfers is a policy decision. The current system increases transfers at the national rate of growth in tax (ITE) in every region with a positive transfer in 1999, and at the minimum of the regional ITE and the national ITE for the regions with negative transfers. The average growth rate in transfers from 1999 to 2005 was 6.809% per year for all regions with positive transfers, 6.809% for Madrid and 6.165% per year for Balears (the regions with negative transfers). In our simplified model we estimate the effect of this policy by setting $\psi_i - g = 0$ for all regions with positive transfers and Madrid, and $\psi_i - g = 6.165 - 6.809 = -0.644$ for Balears.

Absolute net change in unfunded need

In the current finance system, revenues for public spending in each region grow at an unequal rate, because regional governments are ceded a proportion b of the growth in tax revenues. A net gain for a region i is

$$d(D_i/D)/dt - d(h_i S_i/hS)/dt$$

$$= \alpha_1 (P_i/P) (\eta_i - \eta) + \alpha_2 (P_i^{65}/P^{65}) (\eta_i^{65} - \eta^{65}) - b (h_i Y_i/hY) (g_i - g) - (h_i T_i/D) (\psi_i - g)$$

We call the statistic $d(D_i/D)/dt - d(h_i S_i/hS)/dt$ the ‘net increase in unfunded health need’.

For ease of interpretation, we multiply this statistic by the total national health expenditure in 1999 as calculated by the funding formula, which was 23.579,6 €m.

A ‘positive’ net increase in unfunded need shows the region has less proportion of total national finance, relative to need, in 2005 than 1999. For example, say the needs formula in 1999 allocated 1.000€m of health care funding to region X, and the transfer was set so that the region could meet these needs from its standard tax base plus the transfer. If, say, the formula calculates $d(D_i/D)/dt$ is 3€m/year and, then this implies that X’s needs have increased by an average 3€m per year more than the national average over the period, measured at 1999 prices. However, if say, $d(h_i S_i/hS)/dt$ is 1€m/year, then tax and transfer funding to pay for this increased need has only increased by 1€m per year more than the national average, implying a net loss of

funding of 2€m per year relative to the allocation made in 1999. This is a ‘zero-sum’ analysis, that is, by definition the sum of net gains and net losses are zero across all regions¹.

Proportionate change in unfunded need

The net increase in unfunded health need is an absolute measure, and does not reflect the change in funding relative to the size of the region. We also calculate a relative statistic, which we call the ‘proportionate increase in unfunded need’ Ω . This is simply the mean annual net increase in unfunded need between 1999 and 2005 divided by the share of health need in that region in 1999:

$$\Omega = \frac{d(D_i/D)/dt - d(h_i S_i/hS)/dt}{D_i/D}$$

Equity neutral growth in transfers

We can also examine what the growth in transfers would have to be in each region to match growth in needs with growth in the local tax base, assuming a constant overall share of national income is spent on health services. We can call this the ‘equity-neutral’ ideal growth rate in transfers. This model only considers the funding of health services, and assumes that funding of other services remains in equilibrium. Of course, in practice this is unlikely to be the case, because changes in population and other variables will affect demand for other public services as well as healthcare.

$$\psi_i - g = (hN/(h_i T_i)) \{ \alpha_1 (P_i/P) (\eta_i - \eta) + \alpha_2 (P^{65}_i/P^{65}) (\eta^{65}_i - \eta^{65}) - b (h_i Y_i/hY) (g_i - g) \}$$

We calculate the change in the relative needs index D_i/D and the relative funding index S_i/S for each region for the period 1999 to 2005. This is the latest date that data on regional GDP were available. All data on rates of increase in population (INE 2006c; INE 2006e) and GNP (INE 2006d) were available online from Instituto Nacional de Estadística (www.ine.es, accessed 31 January 2008). For comparative purposes, we include all the regions and the autonomous cities of Ceuta and Melilla in this analysis,

¹ As noted above, the formula for growth of D_i/D does not constrain these proportions to lie between 0 and 1. This introduces a small error in the formula and the sum of net gains and losses is not exactly equal to 1. Further work aims to correct this error.

applying the same need weights to growth of population and the same average rates of tax over the period 1999-2005, although Pais Vasco, Navarra, Ceuta and Melilla are not part of the common finance system and do not in fact make or receive transfers as part of the sufficiency fund.

Gini coefficient

We calculate the Gini coefficient as a summary measure of inequality between regions. The Gini coefficient takes a value between 0 and 1, where 0 represents a situation where every region receives funding exactly matching weighted need, and 1 represents an extreme of inequality, where one region receives all the funding. By our definition, the Gini coefficient for inter-regional equity of health-care finance in 1999 was zero. Therefore we calculate the average change in the Gini coefficient for Spain for the period 1999-2005.

Results

Results: Descriptive statistics

Table 3 shows the average growth rates of the population covered by public health care was 1,648% per year, the growth rate of the elderly (over 65s) population was 1,405% per year and the growth rate of GDP in each region from 1999 to 2005 at market prices was 7,848% per year. Figure 1 shows these rates in comparison to the national average.

The growth rates in population and GDP for each region shown in Figure 1 are useful descriptive statistics but do not show how the change in the finance available to each region matches the overall change in needs. For this reason, we calculate a weighted needs and finance index using the model developed in the previous section.

The proportion of taxes used to fund public services that is devolved to regional government, rather than raised by central government, is variable b in the model. We can calculate b from the data in Table 2.

$$\sum T_i = (1-b) \tau Y$$

Rearranging

$$b = 1 - \sum T_i / \tau Y$$

Table 2 shows that in 1999, the total transfers divided by the total tax revenue at the standard rate was $\sum T / \tau Y = 17066 \text{ €m} / 53325 \text{ €m} = 0,320$.

$$\text{Therefore } b = 1 - 0,320 = 0,680$$

National GDP in 1999 at market prices was 565.419 €m. This implies the average share of national income considered adequate to provide basic and common public services by regional government was

$$\tau = D / Y = 53325 / 565419 = 9,43\%$$

Of this, the share of national income funding a basic and common level of health care was $26579,6 / 565419 = 4,17\%$.

Results: Absolute net change in unfunded need

Figure 2 shows the change in weighted needs for health care services, the change in public finance (taxes and transfers) and the net decrease in unfunded need for each region, compared with the national average, at 1999 market prices. The net increase in unfunded need per year is the vertical sum of the change in the needs index and the change in the finance index. Regions are ranked in order of the net increase in unfunded need.

We can categorise the regions into 4 groups depending on the size of the net change in the unfunded need. Need for health care has increased in Valencia, Madrid, Canarias, Cataluña, Baleares and Murcia, with a greater increase in the needs-weighted population than the national average since 1999. However, growth in GDP (and therefore it is assumed the regional tax base) has been equal to or greater than national average in these regions. Overall, there has been an increase in unfunded health care need per year in these regions of between 2.6€m (Murcia) and 16.8€m (Valencia).

Group 2 are La Rioja, Ceuta and Melilla, Castilla-La-Mancha, and Navarra. Changes in need or GDP in these regions have had little effect on the share of national funding they should receive. We include regions in this category if the positive or negative annual change in net unfunded need is less than greater than 1.2€m per year². Regions may be in this category either because growth in income has matched growth in needs (Castilla La Mancha), or because both income and needs have grown at national average rates (Navarra), or because the regions are small (Ceuta and Melilla, Rioja), and so changes in their unfunded needs do not have much effect on the share of national funding they should receive. Group 3 are Cantabria, Aragón, País Vasco, Extremadura, Galicia, Asturias, and Castilla-y-León. These regions have experienced a relative decrease in need, as the need-weighted populations have grown less fast than the average, although GDP has also grown relatively more slowly in these regions than average. Overall,

² The value of 1.2€m (equal to 0.005% of health expenditure in 1999) is arbitrary. Further work may try to identify a threshold test.

these regions have a net gain in funding of between 1.7€m/year (Cantabria) to 9.9€m (Castilla y Leon), relative to other regions. Finally, group 4 is a single region, Andalucía, where needs-weighted population has grown slower than the average, while GDP has grown faster than average, leading to a net increase in funding for health-care services from 1999 to 2005 of 23.3€m/year compared with other regions.

Results: Percentage change in unfunded need

The previous analysis showed equity gains and losses for each region, but did not take account that regions in Spain are very unequal in size. Figure 3 shows the mean percentage change in unfunded need, as a proportion of expenditure on healthcare in that region in 1999.

Figure 3 shows that Melilla, Canarias, Baleares, Rioja and Valencia have experienced a net loss of funding of between 0.5 and 1.5% per year between 1999 and 2005, while Cantabria, Andalucia, Castilla y León, Extremadura and Asturias have gained in funding by more than 0.5% per year over this period.

Results: Equity-neutral growth in transfers

We also calculate what the growth rate in the transfer would have to be in each region if the change in revenue were to keep up with the change in needs, relative to the national average (Table 4 and Figure 4). Valencia, Canarias, Cataluña, La Rioja and Murcia would require an increase in transfers, over the national rate of economic growth or national ITE, to maintain the same relative equity position for health-care funding in 2005 as 1999. Madrid and Baleares make net payments into the sufficiency fund. These payments would have to have been lower than the rate of economic growth by 3.88% and 5.55% per year respectively to offset the increase in needs-weighted population in those regions. In Castilla-la-Mancha, the increase in needs-weighted population roughly matches the increase in GDP. Transfers should be less than the rate of economic growth in the remaining regions to match the change in needs with the change in GDP and maintain equity compared with 1999.

Results: Gini coefficient

Table 5 shows the proportions of weighted need and public finance for each region calculated in the model. Relative need for health-care is calculated in the base year 1999 using the needs formula in the Finance Act 2001 for all regions as if they were part of the common finance system.

Figure 5 shows the Lorenz curve based on this data. The horizontal axis shows cumulative proportion of weighted need, where regions are ranked by the net change in unfinanced need between 1999 and 2005. This is equivalent to the cumulative column d in Table 5. The vertical axis shows the cumulative proportion of total public finance, equivalent to the cumulative column e in Table 5.

The Gini coefficient is defined as twice the area between the curves in Figure 5. The Gini coefficient for inter-regional equality of health care finance was defined to be exactly zero in 1999, and was calculated to be 0.0183 in 2005.

Discussion

The finance agreement of 2001 established a mechanism for inter-regional transfers for the equitable funding of public services. This agreement allowed transfers to increase at a rate equal to the growth in national tax revenues, but did not allow for transfers to be adjusted in response to changes in needs variables such as population growth, other than in exceptional circumstances.

This article has examined the variation in growth of need for health care services, and the growth of sources of funding for those services, for each region of Spain over the period 1999-2005. We define the position of each region as unchanged, relative to its peers, if the change in funding, relative to the national rate of growth, kept pace with the change in needs, relative to the national rate of growth.

The results show that, in general, regions where needs have increased, relative to the national average, have also experienced relatively *faster* growth in GDP. Similarly,

regions where needs-weighted population have increased slower than national average have also experienced relatively *slower* growth in GDP. This might be expected as a growing population is likely to generate increased economic activity. An exception is Andalucía, where needs-weighted population has increased slower than national average but GDP growth has been relatively faster.

These results indicate that the system of transfers established in the Finance Act of 2001 has not kept pace with changes in the distribution of population needs and economic activity in Spain. Assuming that needs matched finance (Gini equal to 0) in each region in 1999, the Gini coefficient in 2005 was 0.018. This represents a modest overall change in inequality between regions. Nevertheless, the Gini coefficient may obscure the effect on individual regions. Unfunded need has been growing by more than 0.5% per year in Canarias, Baleares, Canarias, Baleares, Rioja and Valencia, while Cantabria, Andalucía, Castilla y León, Extremadura and Asturias have gained net funding by more than 0.5% per year over this period. To maintain equity of health care provision in 2005 compared with 1999, transfers from the sufficiency fund would have to increase in Valencia, Canarias, Cataluña, La Rioja and Murcia, and reduce in Cantabria, Aragón, Extremadura, Asturias, Castilla y León and Andalucía. Madrid and Baleares would need to contribute a declining amount to the sufficiency fund.

This analysis has been based on a highly simplified model of public finance in Spain, and is therefore subject to several important limitations. Firstly, we assume that the proportion of tax revenues ceded to regions (in the model, variable b), and the marginal and average 'standard' tax rate (variable τ), are constant across all regions and time. This implies that the growth in taxes is equal to the growth in GDP. In fact, national tax revenues increased by an average of 6,809% per year, while GDP at market prices increased by an average of 7,848% between 1999 and 2005 (de la Fuente 2007, MEH 2007, INE 2008). A more realistic model would take account of differences between regions in the growth of each of the sources of tax revenue (for example, employment income taxes and sales taxes) and the marginal rates applying to each source.

Second, we do not take account of the other public services, mainly education and social services, provided by regional government, or more precisely, we assume that the

share of public finance directed at each public service (variable h/h_i) is constant over time. Need for other public services might grow at different rates to the need for healthcare in each region. The focus of this article was on inter-regional equity in the provision of health services, and a more complete model should consider the position of the public sector as a whole.

Third, we assume that the agreement set into law in 2001 was equitable. There are several reasons to question this assumption. The needs formula for health services only included three predictive variables: the population covered by social insurance, the population aged over 65 years, and the distance of the Balearic and Canary island archipelagos from the mainland. The weights were not based on any published empirical study. As well as the needs formula, the system included a number of ad-hoc adjustments which were political decisions rather than based on an objective definition of need. Resource allocation formulas in most other countries include a wider set of variables and are based on empirical data, and updated regularly (Rice and Smith 1999).

The agreement of 2001 did allow for discretionary additional transfers from the state to regions in special circumstances, termed 'asignaciones de nivelación' (La Ley 21/2001, de 27 de diciembre). Regional governments whose population covered by the health system increased by more than three percentage points above the national growth rate could apply for additional funds, but no guarantee was made that such funds would be available nor was any budget identified. The period from 2002 to 2005 was deemed a 'bedding-in' period (años de vigilancia) and the government made additional guarantees that the annual growth in health funding would be at least as great as the growth in GDP. In this study, we have suggested a formula that includes other needs and finance variables that might be used to ensure the transfers maintained inter-regional equity of health care provision. This formula is still consistent with the aim that regions should have financial autonomy, as regions would still be able to set their own tax rates for relevant revenue sources and spend the revenues on public services. The formula is also revenue-neutral for the central government, that is, it calculates the distribution of transfers between regions rather than the overall tax rate. The agreement of 2001 did not make any allowance for regions with positive transfers to receive lower transfers, nor for regions which make net transfers into the fund to reduce the size of their contribution. The period from 2001 to 2007 coincided with a period of

considerable economic growth and growth in expenditure on public services in Spain, which to some extent may have cushioned demand by the regions for central funding and allowed fiscal flexibility. The agreement of 2001 has not yet been tested in a period of negative growth. This is likely to become an urgent economic and political problem. A transparent and robust empirical funding formula may inform the debate and help legitimise any agreement reached.

The financing of public services in Spain is currently being revised. The debate is mainly focused on the degree of financial autonomy and competencies that should be decentralised, and whether this should differ between regions. These arguments are mainly of a political nature, continuing a process that began in the transition to democracy in Spain in the late 1970s and early 1980s (Molero 2001). Less attention has been focused on the economic arguments justifying decentralisation, and consequently, there is still very little empirical evidence on the implications of decentralisation for efficiency or equity in the delivery of health and other public services (Zabalza 2006). There is therefore a need for reliable data and economic analysis to inform the debate. Furthermore, regardless of the political settlement reached, some kind of redistribution from higher income, low need regions to lower income, high need regions will continue. There is therefore also an urgent need to identify variables predictive of the need for public services to redistribute funds between regions on an objective and transparent basis.

The lack of objective weights in the funding formula in Spain is sometimes attributed to lack of data (Zabalza 2006). Smith and Rice (1999) recommend that variables in a resource allocation formula should be universally recorded across all regions, consistent, verifiable, not subject to manipulation, free from perverse incentives, and consistent with confidentiality requirements. However, in principle, some suitable primary data sources are available. The residence, age and sex of every individual in Spain is recorded in the Patron Municipal and published annually by the Instituto Nacional de Estadística (INE), and therefore in principle age and sex could be variables in a regional resource allocation formula, and updated annually. Data is collected by the INE on the use of inpatient services by residence, age and gender, and this data could be used to construct empirical weights. Table 6 shows hospital admissions per 100.000

residents in 2006 by age and sex, summarised from the publicly available data online (INE 2006a). While this data is unadjusted for other factors, it shows that both people over 65 and children under 1 year are the heaviest users of hospital services, and that the very elderly are much more likely to use hospital services than those aged 65 to 74 years. This data is available at hospital level and could be used to estimate the use of hospital services. Data is also available on pharmaceutical expenditure (MSC 2005) and expenditure on primary care services. The INE conducts a complete population census every 10 years, and makes predictions of trends in key variables between census dates. This suggests at least that a funding model could be explored to predict need for each of these components of health-care. Rice and Smith (1999) suggest that age and sex usually only explain less than 1% of the variation in expenditure on health care between individuals. Ideally, these sources would be linked together to create a dataset of health-care utilisation rates with other demand side variables, reflecting 'legitimate need', and supply-side variables, to adjust for unmet need. It is usually recommended that the unit of analysis is a small-area (eg municipal) level, rather than aggregated at provincial or regional level, to avoid biases due to omitted variables (Sutton 2002).

The INE commissions large-scale national social surveys of health, demography, economic status, and use of health-care every 3 years or so, which may also provide a basis for predicting need for health care. Surveys are not normally used as sources of primary data for weighted capitation purposes, because data might be inconsistently recorded across areas or time periods, or subject to manipulation (Rice et al 1999). Preliminary work has been undertaken on a model of health care use in Spain using INE health survey data from 1999 (Montero 2007). Given the objectivity, size and scope of the social surveys in Spain, further work could review whether survey data can be integrated with census data in a model to predict need for health care.

Appendix

Change in a ratio over time

Note that, for any ratio v/u , the change in the ratio over time is the initial ratio multiplied by the difference in the percentage change in the numerator and denominator.

$$d(v/u) / dt = (v/u)[(dv/v)/dt - (du/u)/dt]$$

In this case, $D_i = v$ and $D = \sum D_i = u$. This model is an approximation as it does not constrain the proportions D_i/D to lie between 0 and 1. A further extension of the model may correct this, so that $0 \leq D_i/D \leq 1$ for all i .

Exponential growth formula

The growth of the needs factors (eligible population and population aged over 65) and GNP between 1999 and 2005 was estimated by the exponential growth formula

$$x(t) = x(0) \exp(k t)$$

where

$x(t)$ is the value of the variable in 2005

$x(0)$ is the value in the base year 1999

k is the continuously compounded growth rate

Rearranging

$$k = \log (x(t) / x(0)) / t$$

Tables and figures

Table 1. Sources of finance of regional government in Spain

		Capacity to set own rates	Proportion of revenue ceded to regional government
Autonomous revenues	Autonomous sources	Yes	100%
	Rates	Yes	100%
	Recharges on state taxes	Yes	100%
	Tariffs from public services	Yes	100%
	Wealth tax	Yes	100%
	Regional borrowing	Yes	100%
Devolved revenues	Regional component of income tax	Partial	33%
	<i>Devolved sources</i>		
	Inheritance tax	Yes	100%
	Stamp and document duties	Yes	100%
	State taxes on gambling	Yes	100%
	Transport taxes	Yes	100%
Retail sales of certain fuels	Yes	100%	
Unconditional transfers	<i>Shared sources</i>		
	Regional component of sales taxes	No	35%
	Alcohol	No	40%
	Fuel	No	40%
	Tobacco	No	40%
	Electricity	No	100%
	<i>Unconditional fund</i>		
+ / - Sufficiency Fund Transfer			
Conditional Transfers	<i>Condiciona funds</i>		
	Inter-territorial compensation		
	Assistance and subsidies from European Union		
	Capital grants		
	Subsidies from financial intermediaries		

Source: Sánchez Maldonado et al 2005

Table 2. Calculation of needs for public services, revenues and sufficiency fund in the base year of 1999. Source: de la Fuente 2007

	Health needs (formula)	Social services needs (formula)	Other needs (formula)	Total needs (formula)	%	Tax revenues at standard rate	Sufficiency fund	Sufficiency fund as % of needs formula
Andalucia	4445.7	125.6	5684.7	10256	19,2%	5344	4912	47.9%
Aragon	816.9	37.9	1045.2	1900	3,6%	1270	630	33.2%
Asturias	750.6	27.7	866.7	1645	3,1%	1010	635	38.6%
Baleares	521.8	16.1	559.1	1097	2,1%	1259	-162	-14.8%
Canarias	1044.4	23.5	1399.1	2467	4,6%	716	1751	71.0%
Cantabria	402.9	13.1	437	853	1,6%	501	352	41.3%
Castilla la Mancha	1104.4	47.4	1500.2	2652	5,0%	1286	1366	51.5%
Castilla y Leon	1624	82.5	2256.5	3963	7,4%	2191	1772	44.7%
Cataluna	4013.9	129.3	4521.8	8665	16,2%	7609	1056	12.2%
Extremadura	698.3	27.4	1063.3	1789	3,4%	662	1127	63.0%
Galicia	1752	65.8	2378.2	4196	7,9%	2149	2047	48.8%
Madrid	3019.6	91.1	3320.3	6431	12,1%	7114	-683	-10.6%
Murcia	680.7	19.8	836.5	1537	2,9%	892	645	42.0%
Rioja	204.4	10.8	244.8	460	0,9%	270	190	41.3%
Valencia	2500	80.5	2833.5	5414	10,2%	3986	1428	26.4%
Total	23579.6	798.5	28946.9	53325	100%	36259	17066	32.0%

Table 3. Change in needs and source of finance from 1999 to 2005 for the 17 regions plus the 2 autonomous cities of Ceuta and Melilla. Elaboration: authors

Region	Proportion of total in region in 1999			Growth rate (% per year) from 1999 to 2005			Weighted change in needs and finance per year (€million)♣		
	Eligible pop	Aged > 65 years	GDP	Eligible pop.	Aged > 65 years	GDP	Increase in health need	Increase in public finance	Net increase in unfunded health need
Valencia	0.102	0.099	0.096	2.475	2.000	7.950	18.4	1.6	16.8
Madrid	0.124	0.112	0.172	2.755	1.930	8.370	27.7	15.3	12.5
Canarias	0.042	0.029	0.041	2.788	3.377	7.792	11.8	-0.3	12.1
Cataluña	0.159	0.159	0.187	2.073	1.206	7.906	10.0	1.8	8.2
Baleares	0.021	0.018	0.025	3.114	1.453	8.041	5.4	0.8	4.6
Murcia	0.028	0.024	0.023	2.975	2.034	9.122	7.4	4.8	2.6
Rioja (La)	0.007	0.008	0.008	2.180	1.333	7.340	0.6	-0.6	1.2
Melilla	0.001	0.001	0.002	2.889	1.803	7.400	0.3	-0.1	0.4
Castilla-La M	0.043	0.051	0.035	1.620	0.733	7.395	-2.2	-2.3	0.1
Navarra	0.014	0.014	0.017	1.722	1.073	7.951	-0.3	-0.2	-0.1
Ceuta	0.002	0.001	0.002	0.516	1.313	7.124	-0.1	0.3	-0.4
Cantabria	0.013	0.015	0.013	1.085	0.944	7.835	-1.7	0.0	-1.7
Aragón	0.029	0.038	0.031	1.234	0.426	7.617	-4.3	-1.1	-3.2
Extremadura	0.026	0.029	0.017	0.137	0.686	7.223	-13.0	-7.6	-5.3
Galicia	0.068	0.081	0.055	0.254	1.279	6.648	-8.3	-1.5	-6.8
Asturias	0.028	0.034	0.022	-0.101	0.517	7.107	-17.3	-9.9	-7.4
Castilla y León	0.061	0.081	0.058	0.170	0.632	6.729	-10.3	-2.8	-7.6
País Vasco	0.054	0.052	0.064	0.252	1.514	7.106	-19.6	-9.7	-9.9
Andalucía	0.180	0.154	0.133	1.273	1.607	8.479	-10.1	13.2	-23.3
ESPAÑA	1,000	1,000	0,999	1,648	1,405	7,848			

♣ The sum of the changes should sum to zero in these columns. They do not sum to zero because the model does not constrain the proportions to be between 0 and 1

♦ Data for GNP in Ceuta and Melilla were not available in 1999. Data for year 2000-2005 were used instead to calculate average growth in GNP per year

Table 4. Calculation of rate of growth in transfer from the sufficiency fund required to match the increase in needs in each region with the increase in tax revenues (the ‘equity neutral’ ideal rate of growth of transfer). Elaboration: authors

	Column a	Column b	Column c	Column d	Column e
Region	Proportion of health care in public expenditure in 1999	Sufficiency fund transfer T_i in 1999	Total health need in 1999 divided by $T_i = D / T_i$	Annual net increase in unfunded health need as % of D	Equity-neutral growth rate of T_i (% per year) = Col a x c x d
Valencia	0.462	1428	16.5	0.071	2.55
Madrid	0.470	-683	-34.5	0.053	-3.88
Canarias	0.423	1751	13.5	0.051	1.64
Cataluña	0.463	1056	22.3	0.035	1.68
Baleares	0.476	-162	-145.6	0.019	-5.95
Murcia	0.443	645	36.6	0.011	0.90
Rioja (La)	0.444	190	124.1	0.005	1.43
Castilla-La M	0.410	1772	13.3	0.001	0.02
Cantabria	0.472	352	67.0	-0.007	-1.02
Aragón	0.430	630	37.4	-0.014	-1.18
Extremadura	0.390	1127	20.9	-0.029	-1.54
Galicia	0.418	2047	11.5	-0.031	-0.86
Asturias	0.456	635	37.1	-0.032	-2.61
Castilla y León	0.416	1366	17.3	-0.042	-1.74
Andalucía	0.433	4912	4.8	-0.099	-1.09

Note: D represents health care needs in 1999, estimated to be 23579,6€m (de la Fuente 2007)

Table 5. Change in the proportion of total need and total public finance for each region 1999-2005. Elaboration: authors

	Column a	Column b	Column c	Column d	Column e
Region	Weighted need in 1999	Change in need per year	Change in public finance per year	Weighted need in 2005	Public finance in 2005
Valencia	0.10144	0.00078	0.00007	0.10613	0.10186
Madrid	0.12099	0.00118	0.00065	0.12805	0.12488
Canarias	0.03857	0.00050	-0.00001	0.04156	0.03848
Cataluña	0.15860	0.00043	0.00008	0.16116	0.15907
Baleares	0.02007	0.00023	0.00006	0.02145	0.02041
Murcia	0.02676	0.00031	0.00020	0.02864	0.02798
Rioja (La)	0.00688	0.00003	-0.00003	0.00703	0.00673
Melilla	0.00109	0.00001	0.00000	0.00116	0.00106
Castilla-La M	0.04493	-0.00009	-0.00010	0.04436	0.04433
Ceuta	0.00144	-0.00001	-0.00001	0.00136	0.00139
Navarra	0.01390	0.00000	0.00001	0.01387	0.01397
Cantabria	0.01367	-0.00007	0.00000	0.01323	0.01367
Aragón	0.03130	-0.00018	-0.00005	0.03020	0.03101
País Vasco	0.05352	-0.00055	-0.00032	0.05022	0.05158
Extremadura	0.02721	-0.00035	-0.00006	0.02509	0.02682
Galicia	0.07101	-0.00073	-0.00042	0.06660	0.06848
Asturias	0.02919	-0.00044	-0.00012	0.02657	0.02849
Castilla y León	0.06598	-0.00083	-0.00041	0.06098	0.06350
Andalucía	0.17346	-0.00043	0.00056	0.17089	0.17682
Total	1	0	0	1	1

Table 6. Hospital admissions per 100.000 residents in 2006 by age and sex.

	Both sexes	Men	Women	Weight relative to national average (both sexes)
All ages	10.724	10.096	11.335	1,00
Less than 1 year	37.862	41.199	34.314	3,53
from 1 to 4 years	7.217	8.192	6.183	0,67
from 5 to 14 years	3.293	3.722	2.839	0,31
from 15 to 24 years	5.272	4.023	6.586	0,49
from 25 to 34 years	9.108	4.149	14.407	0,85
from 35 to 44 years	7.621	5.663	9.647	0,71
from 45 to 54 years	7.905	8.512	7.305	0,74
from 55 to 64 years	12.018	14.330	9.836	1,12
from 65 to 74 years	18.878	23.283	15.130	1,76
from 75 to 84 years	27.433	34.194	22.781	2,56
from 85 to 89 years	34.232	41.251	30.762	3,19
from 90 to 94 years	37.578	44.521	34.909	3,50
from 95 years	35.273	42.609	32.864	3,29

Source: INE, Encuesta de morbilidad hospitalaria 2006a

Figure 1. Growth rates of eligible population, elderly population and GDP in each region compared with the national average, 1999-2005. Elaboration: Authors

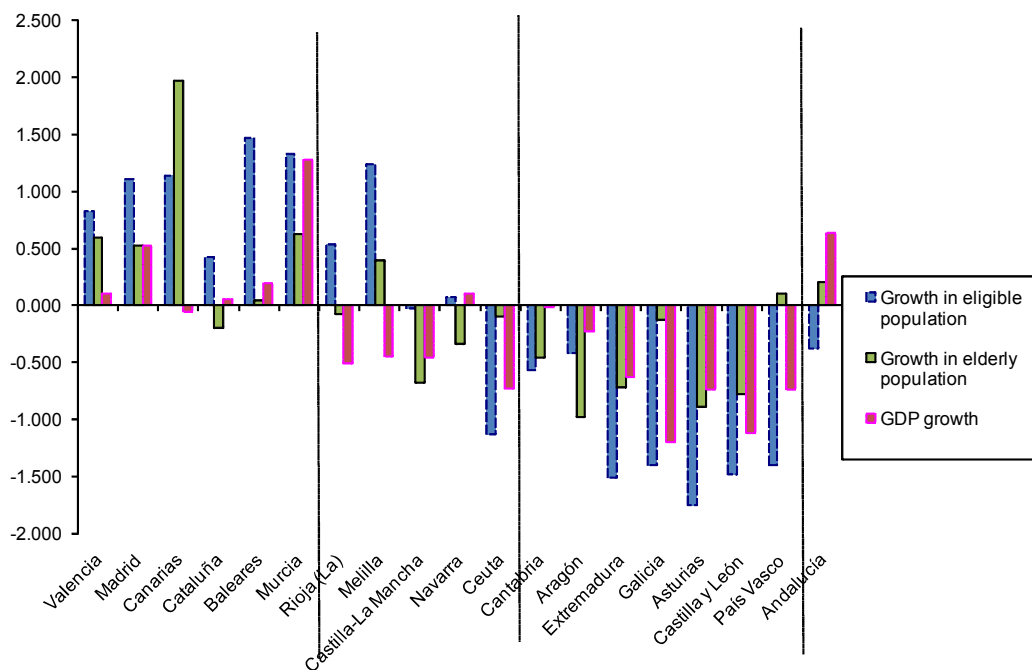
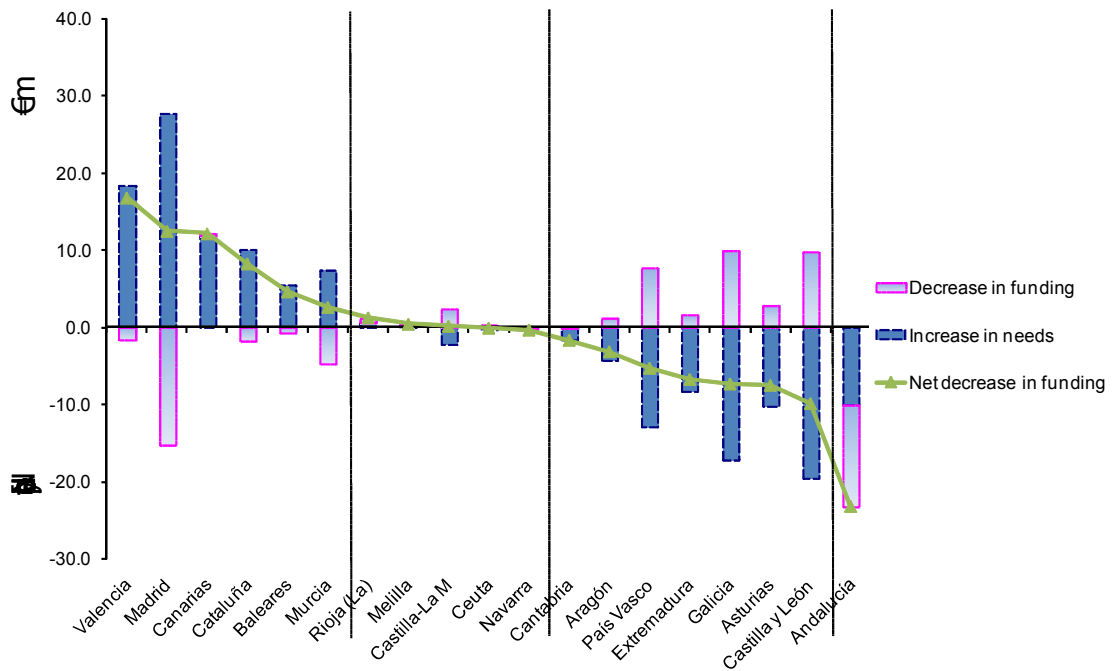
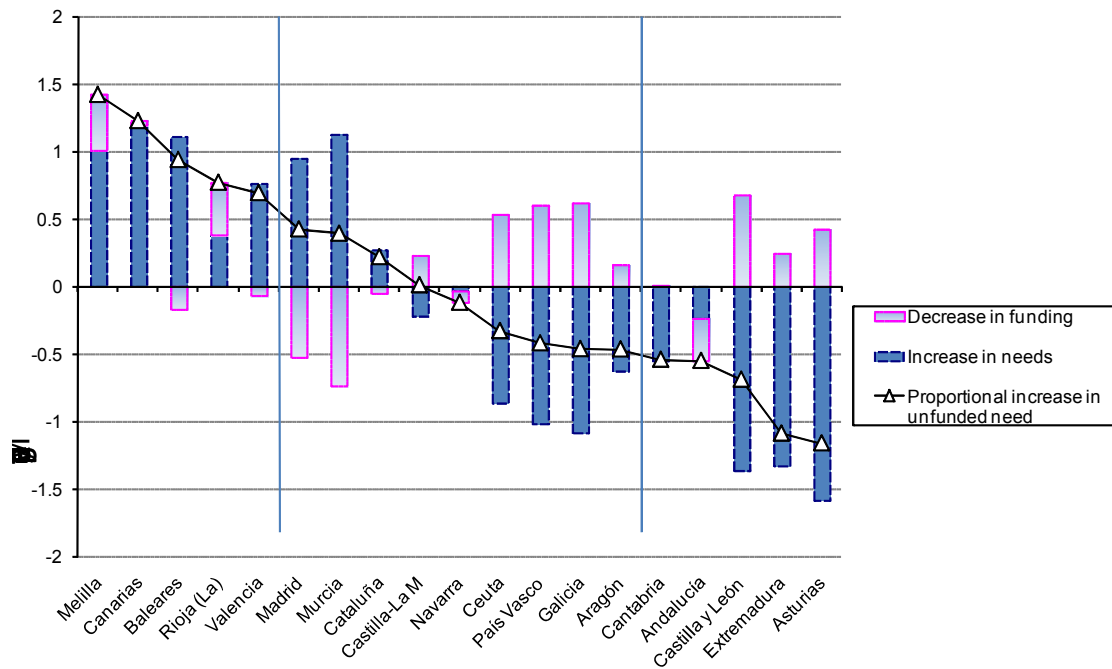


Figure 2 Mean annual change in normative needs and finance from 1999 to 2005 by region (€m per year at 1999 prices). Elaboration: authors



Note to Figure. A 'positive' net increase in unfunded need shows the region has a lower proportion of total national healthcare finance, relative to need, in 2005 than 1999.

Figure 3. Mean percentage change in unfunded need per year by region, 1999-2005, as a proportion of expenditure in 1999. Elaboration: authors



Note to Figure. The percentage change increase in unfunded need shows the mean annual increase in unfunded need between 1999 and 2005 as a percentage of the region's budgeted health expenditure in 1999

Figure 4. Mean annual percentage growth in transfers, over the rate of economic growth, that would be required to maintain each region in a position of relative equity of health-care finance in 2005 compared with 1999. Elaboration: authors

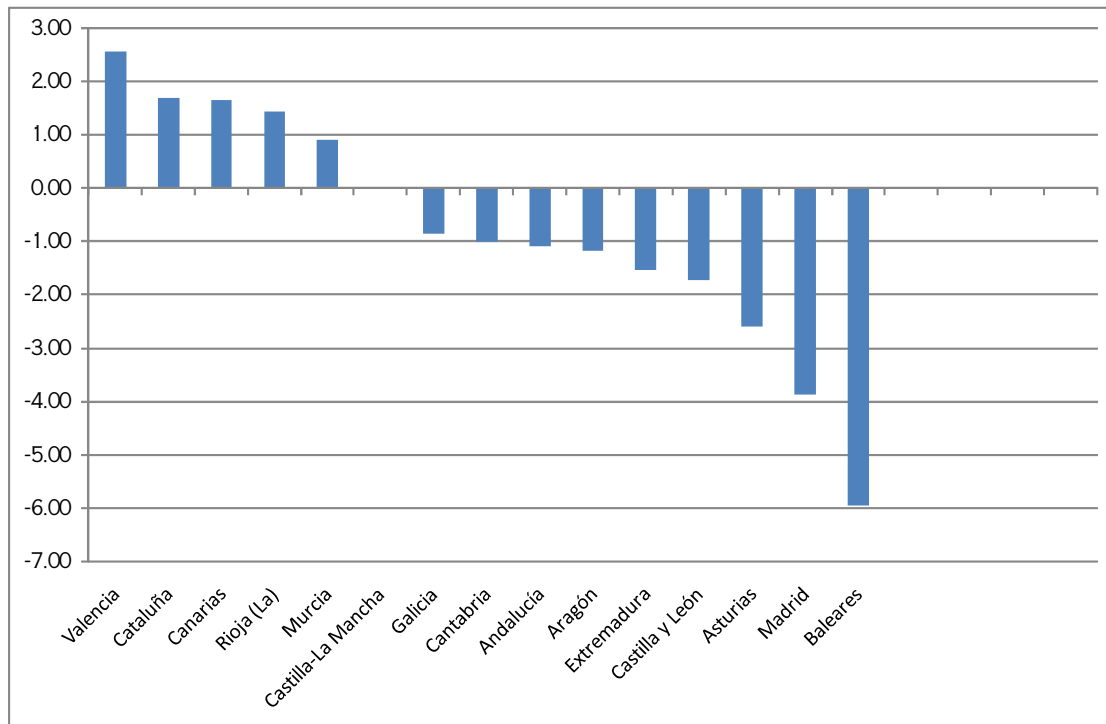
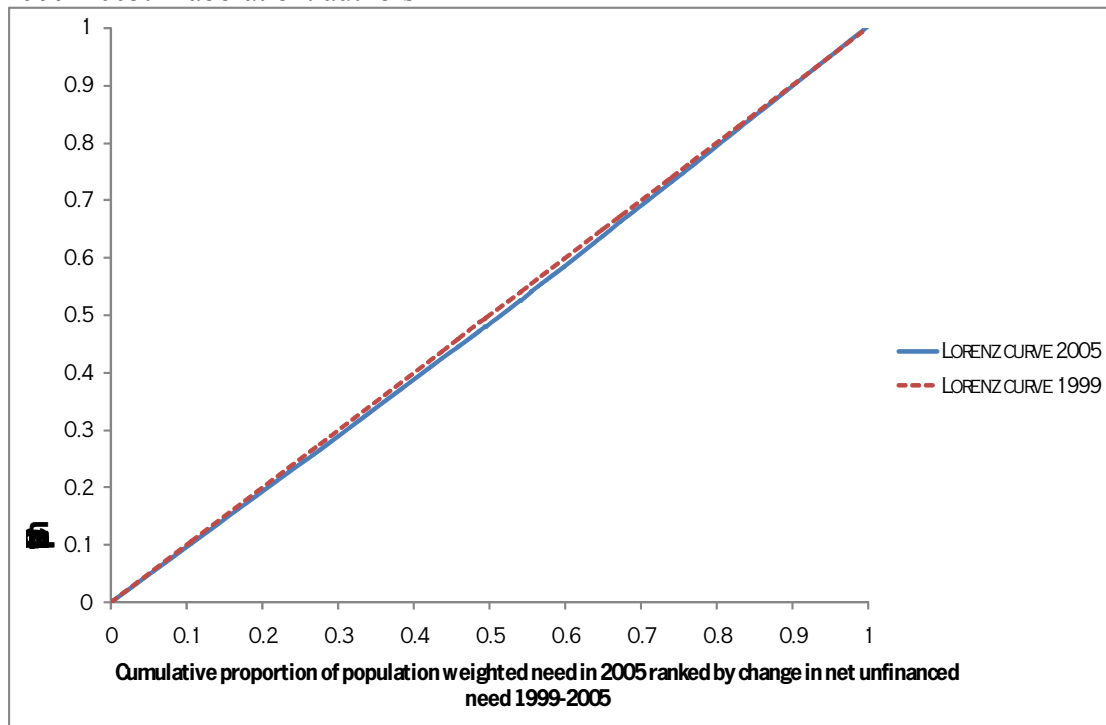


Figure 5. Lorenz curve: Change in inter-regional equity of health-care finance 1999-2005. Elaboration: authors



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